Cross-border Exposure characterisation for Risk Assessment in Chemical Incidents (CERACI)

Final report

National Institute for Public Health and the Environment
Ministry of Health, Welfare and Sport

Health Protection Agency

NOFER INSTITUTE OF OCCUPATIONAL MEDICINE

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Sole responsibility for this report lies with the authors: the National Institute for Public Health and the Environment (RIVM), the Health Protection Agency (HPA) and the Nofer Institute of Occupational Medicine (NIOM). Neither the European Commission, nor the authors, nor any person acting on their behalf is responsible for the use which might be made of this information.

This report is a collation of the information made available via literature reviews, expert feedback and project surveys and workshops, within the resources available to the project. It does not represent the position of the European Commission, the National Institute for Public Health and the Environment, the Health Protection Agency or the Nofer Institute of Occupational Medicine.

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Task E (final report) contributors & tasks

HPA: task manager.

HPA: integrate all information and guidance developed in the previous tasks into a final report.

RIVM (with sub-contractors) and NIOM: support the HPA with its review and on reporting and defining conclusions.

All partners and collaborators: review draft reports.

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Contents

Glossary of acronyms and terms

Acronym	Meaning
ADMLC	UK Atmospheric Dispersion Modelling Liaison Committee
AEGLs	Acute Exposure Guideline Levels
ALOHA	Areal Locations of Hazardous Atmospheres
APELL	UNEP Awareness and Preparedness for Emergencies at Local Level
APPORT	Le programme d'Aide à la Préparation des Plans Opérationnels des Risques Transfrontaliers (Programme for Assistance in Preparation of Operational Plans for Transboundary Risk)
ARGUS	EC general rapid alert system
ARIA	Analysis, Research and Information on Accidents
ASHT	Alerting System for Chemical Health Threats
ASHTII	Alerting System for Chemical Health Threats Phase II
ATSDR	US Agency for Toxic Substances and Disease Registry
BIICL	British Institute of International and Comparative Law
BSEC	Organisation of the Black Sea Economic Cooperation
BUSF	Bomberos Unidos sin Fronteras (United Fire-fighters Without Borders)
CAA	Civil Aviation Authority
CAMEO	Computer-Aided Management of Emergency Operations
CARIMEC	Chemical & radiation inventory of public health measures & medical countermeasures
CARRA-NET	Chemical and Radiation Risk Assessment Network
CASCADE	Chemicals as contaminants in the food chain: a Network of Excellence for research, risk assessment and education
CBRN	Chemical, Biological, Radiological and Nuclear
CBRNE	Chemical, Biological, Radiological, Nuclear and high- yield Explosives
CDC	US Centers for Disease Control
CEAM	US EPA Center for Exposure Assessment Modeling
CECIS	Common Emergency Communication and Information System
CEFIC	Conseil Européen des Fédérations de l'Industrie Chimique (European Chemical Industry Council)
CEI	Central European Initiative
CERACI	Cross-border Exposure characterisation for Risk Assessment in Chemical Incidents
CHEMET	UK Met Office Chemical Meteorology model output
CIE TOOLKIT	Public Health Response to Chemical Incident Emergencies Toolkit
CIRCA	Communication and Information Resource Centre Administrator
CIVILARCH	Civil Protection Against Chemical Releases in Rivers
CMEPC	Civil Military Emergency Preparedness Council
CMEPC SEE	Civil Military Emergency Planning Council for South Eastern Europe
COST	European Cooperation in Science and Technology
DCPEP	Norwegian Department for Civil Protection and Emergency Planning
DEMA	Danish Emergency Management Agency
DFID	UK Department for International Development
DG ECHO	Directorate General for Humanitarian Aid and Civil Protection

Acronym	Meaning
DG SANCO	Directorate General for Health and Consumers
DG SANCO HSC	DG SANCO Health Security Committee
DIADEM	Distributed Information Acquisition and Decision Making for Environmental Management
DIM	Detection, Identification and Monitoring Equipment
DPPI SEE	Disaster Prevention and Preparedness Initiative for South Eastern EU countries
EACCC	European Aviation Crisis Co-ordination Cell
EAM	Environmental Assessment Module
EAPCCT	European Association of Poisons Centres and Clinical Toxicologists
EC	European Commission
ECE	Economic Commission for Europe
ECEH	WHO European Centre for Environment and Health
ECURIE	European Community Urgent Radiological Information Exchange
EFCA	European Fisheries Control Agency
EFFIS	European Forest Fire Information System
EIG	Economic Interest Group
EIONET	European Environment Information and Observation Network
eMARS	Major Accident Reporting System.
EM-DAT	Emergency Events Database
ENDS	Environment Intelligence for Professionals report
ENSEMBLE	Platform for model evaluation and ENSEMBLE analysis of atmospheric chemistry transport and dispersion models - Reconciling National Forecasts of Atmospheric Dispersion
ERA	European Research Area
ERA-ENVHEALTH	European Research Area – Environment and Health
ERB	Estonian Rescue Board
ERDF	European Regional Development Fund
ETC/ACC	European Topic Centre on Air and Climate Change
EU	European Union
EUMETNET	European National Meteorological Service
EUPHA	European Public Health Association
EURDEP	European Radiological Data Exchange Platform
EUROCONTROL	European air traffic controllers
EUROPA	Council of Europe
EWRS	Early Warning and Response System
FEA	Federal Environmental Agency
GDACS	Global Disaster Alert and Coordination System
GHSI	Global Health Security Initiative
GIS	Geographical Information Systems
GMES	Global Monitoring for Environment and Security
GSCT	Development of Generic Scenarios, alerting system and training modules relating to release of Chemicals by Terrorists (DG SANCO project)
HARMO	Harmonisation within Atmospheric Dispersion Modelling for Regulatory Purposes
HAZMAT	Fire Service Hazardous Materials

Acronym	Meaning
HAZMED	UK Ambulance Service Hazardous Medicine (paramedics with chemical training)
HEIMTSA	Health and environment integrated methodology and toolbox for scenario assessment
HPA	Health Protection Agency
HPA WHO CC	Health Protection Agency World Health Organisation Collaborating Centre
IAEM	International Association of Emergency Managers
IAN	UNECE Industrial Accident Notification System
IANPHI	The International Association of National Public Health Institutes
ICAO	International Civil Aviation Organization
ICAWEB	RIVM Integrale Crisis Advies Website (Integrated Crisis Advice Website)
ICE	Intervention in Chemical Transport Emergencies
ICT	Information Communication Technology
IEHIAS	Integrated Environmental Health Impact Assessment System
iEMS	International Congresses on Environmental Modelling and Software
IFRC	International Federation of Red Cross and Red Crescent
IHP	International Humanitarian Partnership
IHR	International Health Regulations
IKSR	International Commission for the Protection of the Rhine
IM +GIS EG	Information Management and Geographical Information System Expert Group
IMPEL	European Union Network for the Implementation and Enforcement of Environmental Law
INTARESE	Integrated Assessment of Health Risks of Environmental Stressors in Europe
iNTegRisk	Early Recognition, Monitoring and Integrated Management of Emerging, New Technology Related, Risks
INTERREG	Innovation and Environment Regions of Europe Sharing Solutions
JRC	EC Joint Research Centre
MAEG	Monitoring and Assessment Expert Group
MAHB	Major Accidents Hazards Bureau
MASH	Mass casualties and Health Care following the release of toxic chemicals or radioactive material
MCA	UK Maritime and Coastguard Agency
Met Office	UK Meteorological Office
METHANE	**M** Major Incident declared (or hospitals to standby) **E** Exact location **T** Type of incident - brief details of types and numbers of vehicles, buildings, aircraft, etc, involved **H** Hazards, present and potential **A** Access and egress **N** Numbers and types of casualties **E** Emergency Services present and required
MIC	DG ECHO Monitoring and Information Centre
MODFLOW	3D Finite-Difference Groundwater Flow Model
MS	Member State
MSDS	Material Safety Data Sheets

Acronym	Meaning
NAME	Numerical Atmospheric-dispersion Modelling Environment
NATO	North Atlantic Treaty Organisation
NATO CEPC	NATO Civil Emergency Planning Civil Protection Committee
NERIS	European Platform on Preparedness for Nuclear and Radiological Emergency Response and Recovery
NFPs	National Focal Points
NGO	Non-Governmental Organisation
NIOM	Nofer Institute of Occupational Medicine
N-MFA	Dutch Ministry of Foreign Affairs
NORMAN	Network of Reference Laboratories for Monitoring of Emerging Environmental Pollutants
OCHA	UN Office for the Coordination of Humanitarian Affairs
OECD	Organisation for Economic Co-operation and Development
OFCM	Office of the Federal Coordinator for Meteorology
OPPT	US EPA Office of Pollution Prevention and Toxics
PCs	Poisons Centres
PHAST	Process Hazard Analysis Software Tool
PID	Photo Ionisation Detection
RAS	Rapid Alert System
RAS BICHAT	Rapid Alerting System for Biological and Chemical Attack
RAS CHEM	Rapid Alerting System for Chemical Health Threats
RASFF	Rapid Alerting System for Food and Feed
REC	Regional Environmental Centre
RISK ASSETs	Risk Assessment and Management - European Training Programme
RIVM	Netherlands National Institute for Public Health and the Environment
RODOS	Real-time Online Decision Support System for nuclear emergency management
SAFER	Services and Applications For Emergency Response
SAMU	Service d'Aide Médicale Urgente (Emergency Medical Service)
Seveso	Council Directive 96/82/EC on the control of major-accident hazards
SEE	South Eastern Europe
SLAM	Standardisation of Laboratory Analytical Methods
TFEU	Treaty on the Functioning of the European Union
THL	National Institute for Health and Welfare
UK	United Kingdom
UN	United Nations
UNDAC	United Nations Disaster Assessment and Coordination
UNECE	United Nations Economic Committee for Europe
UNEP	United Nations Environment Programme
UNISDR	United Nations International Strategy for Disaster Reduction
US EPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VAAC	Volcanic Ash Advisory Centre
WHO	World Health Organisation
WWF	Worldwide Fund for Nature

Acronym	Meaning
ZEMA	Zentrale Melde und Auswertestelle für Ereignisse in verfahrenstechnischen Anlagen (Central Reporting and Evaluation Office for incidents and disturbances in process plants)

1 Executive summary

This is the final report to the European Commission Directorate General for Humanitarian Aid and Civil Protection (DG ECHO) of the Cross-border Exposure characterisation for Risk Assessment in Chemical Incidents (CERACI) project (hereafter referred to as 'the project' or 'CERACI'). CERACI's objectives are to strengthen public health risk assessment during the acute phase of chemical incidents by improving exposure assessment and to facilitate cooperation across administrative boundaries by improving interoperability of exposure assessment guidelines, tools and practices.

This final report (CERACI's Task E) brings together three earlier reports (Tasks B-D), which are included in full as appendices[1]. Through a literature and project review, Task B investigated exposure assessment capability, capacity and organisation in Member States. Task C gathered and analysed more detailed information about individual Member States, obtained through a web-based survey and telephone interviews of individuals involved in exposure assessment. The findings of Tasks B and C were tested by delegates at two international workshops as part of Task D. Using exercise incident scenarios, the workshops identified and explored good practices and gaps across the EU in exposure assessment in cross-border chemical incidents, which were termed 'unmet needs'. Sharing good practices was deemed a fruitful exercise, enabling delegates to learn from each other and to identify possible gaps in their own country's approach to exposure assessment. Furthermore, delegates discussed the concept of local, national and international networks of experts in exposure assessment and agreed that there was a need for cross-European coordination of work in this area.

CERACI has addressed the following questions:

- How have Member States organised exposure assessment for health risk assessment during acute chemical incidents?
- Which Member States have organised collaboration and interoperability on exposure assessment, nationally and across borders?
- Which good practices - technical or organisational - can be (further) developed?
- Will harmonisation and collaboration improve Member States' capabilities and capacities to respond to acute chemical incidents?

How have Member States organised exposure assessment for health risk assessment during acute chemical incidents?

At its outset, the project anticipated that substantial differences in exposure assessment capability and practice were likely to exist between Member States – this view has been confirmed by the project findings. CERACI describes the organisation in each Member State in detail (Task B), and has compiled and categorised good practices in exposure assessment across Member States in order to present a framework and guidelines for

[1] Note that Task A, "Project personnel appointment and working strategy formulation", related to the management of the project; therefore there is no associated report.

exposure assessment organisation and practice (Section 4.1). Member States have organised their exposure assessment functions in different ways and organisations have differing roles: for example, in some countries environmental monitoring is carried out at the scene by fire services, in others it is undertaken by environmental organisations. Different methodologies and standards are used. The time needed to respond, and the capabilities of the equipment and software used, varies. Many different organisations and people are involved in exposure assessment, and they do not always communicate effectively with one another. It is of fundamental importance that those who undertake exposure assessment are linked not only with each other, but also with those who undertake risk assessment, both within Member States, and between Member States. These are often people within different organisations, and their liaison during incident response may not be commonplace or formalised.

Communication is a particular issue in the cross-border context, both during incident response and as part of emergency preparedness: Member States are focussed inwards and good practices tend to remain within a country. There is limited exchange of good practices between countries because experts are rarely connected across borders and there are few opportunities for networking and sharing of expert knowledge. CERACI proposes the initiation of a European 'network of experts' to drive cross-border emergency preparedness for exposure assessment in chemical incidents.

Which Member States have organised collaboration and interoperability on exposure assessment, nationally and across borders?

Mutual aid in exposure assessment can be comprised of physical resources, such as on-scene environmental monitoring, and remote capabilities, such as computer dispersion modelling. By paying specific attention to exposure assessment as part of a wider programme of emergency preparedness for chemical incidents, these physical and remote capabilities for exposure assessment and communication within and between Member States, can, and should, be improved. The Member States with the best national collaborations in exposure assessment are characterised by well-developed working relationships between the organisations that are responsible for exposure assessment and a good understanding of each other's roles and responsibilities, underpinned by formal and informal agreements for working together.

Collaboration across borders is most likely to exist when Member States have a shared interest, such as an industrial area along a border or a river that passes through more than one country. CERACI has identified Member States that have such agreements in place (Task B). This report has considered the facilitation of mutual aid during cross-border incidents via cross-EU mutual aid mechanisms, and it discusses capabilities for mutual aid across the EU and presents a number of examples of mutual aid in practice (Section 4.4). Cross-European support in exposure assessment is available via the EU, but, for the majority of cross-border incidents, Member States are most likely to utilise mutual aid from neighbouring countries at the local responder level.

Multilateral conventions exist for rivers such as the Rhine and Danube, and these high-level legal agreements can facilitate emergency preparedness and response. There is, however, no standardised approach to such agreements, and the level of detail paid to exposure assessment can be small. Many legal agreements between Member States lack the detail that is required by exposure and risk assessors in terms of procedures for carrying out environmental monitoring and modelling, how this information will be shared and how a commonly accepted risk assessment will be produced in the event of an incident. As part of emergency preparedness work, it is important that this detail is specified by plans and procedures, and that exposure and risk assessors in different Member States work together at an operational level to agree it.

Which good practices - technical or organisational - can be (further) developed?

In many cases, changes to working practices and better use of resources can optimise the response to incidents, both within Member States and across their borders. Good practices in emergency preparedness, exposure assessment and cross-border collaboration are presented as part of a framework for exposure assessment guidelines in Section 4.1.

Exposure assessment provides information that forms the basis for health risk assessment during acute chemical incidents, but the expectations of exposure assessors and risk assessors differ. For example, during an incident a risk assessor requires information to inform and refine their risk assessment, and they may demand a dispersion model output that is rapidly produced and which compares predicted exposure to health standards. A dispersion modeller may be more focussed on developing a model that is mathematically sound and has predictions that are consistent with field experiment and wind-tunnel data.

Furthermore, exposure assessment is cross-disciplinary: it is carried out by a diverse range of professions responsible for functions such as field and laboratory sampling and analysis, computer modelling to predict chemical dispersion, and the collection and mapping of complaints and reports of symptoms experienced by people who have been exposed to a toxic chemical. CERACI bridges these professional and organisational gaps, and strengthens public health risk assessment during the acute phase of chemical incidents, by providing an assessment methodology and guidance that European Union (EU) Member States, and organisations within them, can use to assess and improve exposure assessment. Effective exposure and risk assessment, in turn, leads to faster decision-making, risk communication and interventions to protect the public during crisis situations.

<u>Self-assessment tool</u>

Using the information gathered throughout the project tasks, CERACI proposes the development of an assessment tool that can be used by Member States, and organisations within them, to display capabilities in exposure assessment. This allows users to visualise and understand capabilities and the communication between the disparate groups involved in exposure and risk assessment during the acute phase of chemical incidents (Section 4.2), both within and between Member States. This methodology can be used to assess and visualise:

- Exposure assessment at local, regional, national and international levels;

- Exposure assessment capabilities of individual organisations;
- Cross-border exposure assessment within and between Member States;
- Functions of exposure assessment at an overview level (e.g. monitoring) or further broken down by media (e.g. monitoring of air).

Good practices

CERACI characterises effective exposure assessment as where both exposure and risk assessors in Member States consider exposure assessment outputs during an incident to be 'timely and adequate'. Adoption of good practices identified by the project can help to deliver a timely and adequate response to national and international chemical incidents. Each exposure assessment function, its inputs, and its outputs are linked to a number of generic and specific good practices. Improvement can be achieved by using the self-assessment methodology to identify areas where improvement is possible, then selecting and implementing applicable good practices in emergency preparedness and response from those listed in Section 4.1. These can be customised to meet a Member State or organisation's particular needs. Good practices that can improve cross-border response range from the development of shared plans and procedures to the provision of joint response units, which operate across Member States' borders.

Training and exercising

Training and exercising forms a vital part of emergency preparedness efforts, and is another means of improving cross-border collaboration. Effort can be directed at testing and improving the overall response to an emergency or at specific functions of exposure assessment or communication during incident response. CERACI recommends the testing of specific functions of exposure assessment. Guidance on how to do this is provided in Section 4.3.

Will harmonisation and collaboration improve Member States' capabilities and capacities to respond to acute chemical incidents?

Individual Member States cannot consider their responses to acute chemical incidents in isolation, because such incidents do not respect borders: chemical releases have the potential to cross borders and affect public health in more than one country or administrative area. Member States should share information and resources during such incidents. It is important that they do this in a way that expedites, rather than hampers, an effective response in each country.

Each Member State has developed its own approach and, because there are different approaches, this can hamper the response to cross-border incidents. There is extensive expertise and knowledge within Member States, but the potential for sharing and applying this across Europe as part of emergency preparedness effort is not met. Effective incident response is reliant on good emergency preparedness. As part of European emergency preparedness, Member States should share lessons learned in chemical incident response: by reviewing incidents in other countries Member States can improve their own preparedness for similar events.

Harmonisation and collaboration will improve Member States' capabilities and capacities. A shared approach to exposure and risk assessment, and common standards, leads to an effective response to cross-border incidents. It remains important for roles and responsibilities to be understood on both sides of a border and this requires contact between responders as part of emergency preparedness work, such as networking and joint training and exercising.

<u>A network of experts</u>

Existing networks of experts provide a means of reaching specialists within the different functions of exposure assessment, and they are an important route to sharing good practices, developing standardised approaches to functions and building national and international comparability. Such networks may transcend borders and can also be used to improve emergency preparedness. However, there is no clear map of these networks or a clear connection between their members and emergency preparedness leads. A coordinated chemical incident emergency preparedness programme, engaging these specialist networks, requires clear direction and leadership at the local, national and international levels. Section 4.5 discusses the potential role and structure of a strategic-level cross-European CERACI network, coordinating emergency preparedness in exposure assessment for acute chemical incidents and linking to national and local preparedness and response structures and networks of experts in exposure assessment.

There is no one existing European forum or working group that addresses chemical incident emergency preparedness *in its entirety*, although there are a number of groups with related interests. Similarly, whilst this report describes the various mechanisms for sharing information and collaborating between Member States during incidents, there is no one system that is specific to chemical incidents and available to meet the current needs of exposure and risk assessors at local and national levels. This report explores how future work in this area might best be coordinated (Section 4.6): networks of experts, supported by platforms for networking and information exchange, are fundamental to the organisation and coordination of emergency preparedness work. CERACI recommends that existing networks are mapped more extensively and that an overarching coordinating body, led by risk assessors, is created to coordinate European emergency preparedness for chemical incidents.

How to progress this work

CERACI's work is directly relevant to international, national and local chemical incident emergency preparedness. CERACI's priority recommendations are for the formation of a cross-European network to coordinate chemical incident emergency preparedness and, as part of emergency preparedness work, for an ongoing dynamic process of assessing and improving exposure and risk assessment using CERACI's self-assessment methodology. These priority recommendations are described in more detail below.

CERACI's wider recommendations (Section 4.6) fall into five main areas of future work:

- the adoption of a holistic approach to emergency preparedness for chemical incidents;

- the coordination of chemical incident emergency preparedness at EU and Member State level;
- the provision of resources to support chemical incident emergency preparedness;
- the facilitation of emergency preparedness in border areas; and
- the facilitation of mutual aid.

CERACI recommends that DG ECHO develops and propagates the CERACI self-assessment methodology as an accessible web-tool, using it to focus chemical incident emergency preparedness and training and exercising. This offers direct benefits for emergency preparedness at the organisational, Member State, and European levels (Section 4.2.4.1). Associated benefits from its use are the creation of a directory of Member State experts in exposure and risk assessment, the mapping of networks of experts and development and extension of the good practices found by CERACI.

Emergency preparedness structures and work programmes are required to achieve further improvement in exposure assessment. EU-wide cooperation and improvement of mutual aid in exposure assessment, both in terms of remote collaboration and the provision of physical resources, ideally requires a dedicated forum at European level to coordinate chemical incident emergency preparedness and encourage harmonisation, standardisation and interoperability between Member States. CERACI suggests a network structure that connects public health risk assessors with exposure assessors' networks. This is required to translate risk assessors' information needs for risk assessment into technical requirements, standards, and working practices for exposure assessment.

Proposed objectives for a European network of experts:

- Improve exposure assessment as part of a programme of chemical incident emergency preparedness via national forums led by risk assessors;
- Develop, propagate and coordinate self-assessment using the methodology developed by CERACI;
- Map international and national networks of experts in exposure and risk assessment;
- Collate and signpost relevant international and Member State resources, guidance and training materials;
- Collate and provide lessons learned from cross-border chemical incidents and joint training and exercising events;
- Support and implement shared harmonisation and cross-border initiatives, training, exercising and research.

This is aligned with the objectives of both DG ECHO (with its remit in civil protection emergency preparedness) and the Directorate General for Health and Consumers (DG SANCO, with its remit in health risk assessment).

The Commission has adopted a proposal for a "Decision of the European Parliament and of the Council on serious cross-border threats to health" to better protect EU citizens against serious cross-border threats to health [2]. This initiative seeks to improve preparedness across the EU and to strengthen the capacity to coordinate response to health emergencies.

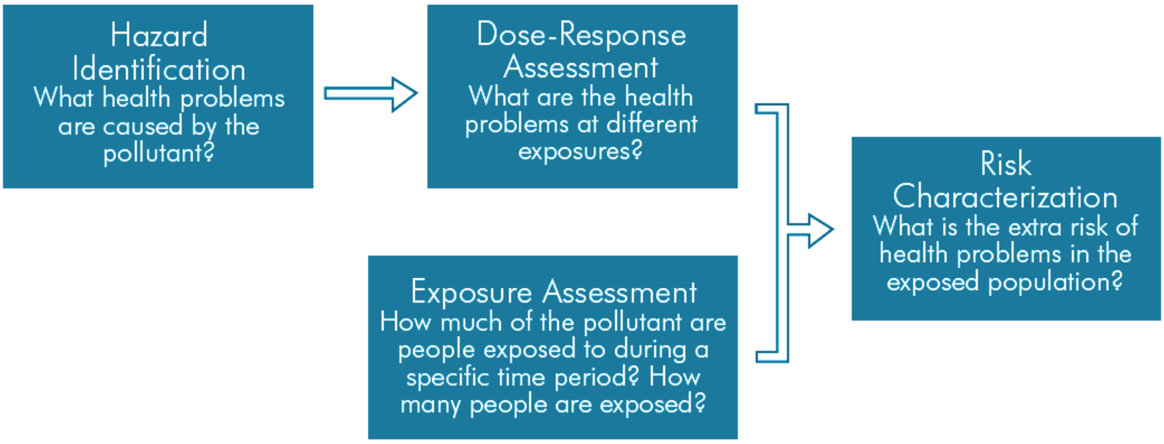
The proposal will facilitate Member States' compliance with the International Health Regulations, which require reporting and communication regarding significant chemical incidents. As part of the proposal, the Commission undertook a gap analysis [3] to assess how far existing systems covered the monitoring of threats to health, their notification, and risk assessment and crisis management capacities and structures, from the public health perspective. This gap analysis revealed that the existing structures and mechanisms at EU level do not address these threats sufficiently as far as public health is concerned. During chemical events, cross-border public health emergencies are managed case-by-case on an ad hoc basis. The proposal seeks to strengthen the links between public health risk assessors during incident response, and it formalises the DG SANCO Health Security Committee (HSC).

This proposal has potential implications for a future European approach to chemical incident preparedness and response. Therefore further dialogue between DG ECHO and DG SANCO is recommended regarding the outcomes of CERACI, as the HSC may have an interest in the future chemical incident emergency preparedness initiatives proposed by the project.

2 Introduction

Exposure assessment is part of an interconnected four-step risk assessment process, presented in Figures 1 and 2 below, that is commonly understood by risk assessors. This process is described by the World Health Organisation (WHO) [4], with some definitions referring to “hazard characterisation” rather than “dose-response assessment” [1]. Exposure assessment forms the basis for health risk assessment during acute chemical incidents. Risk assessment informs risk management and risk communication (e.g. advice to the public to reduce the burden of disease); therefore, exposure assessment is important to subsequent risk management and risk communication efforts. From a public health perspective, the priorities are to protect people from harm and ensure treatment is provided to those potentially exposed or at risk. During cross-border incidents it is important to be aware of the similarities and differences in approaches to exposure assessment between Member States.

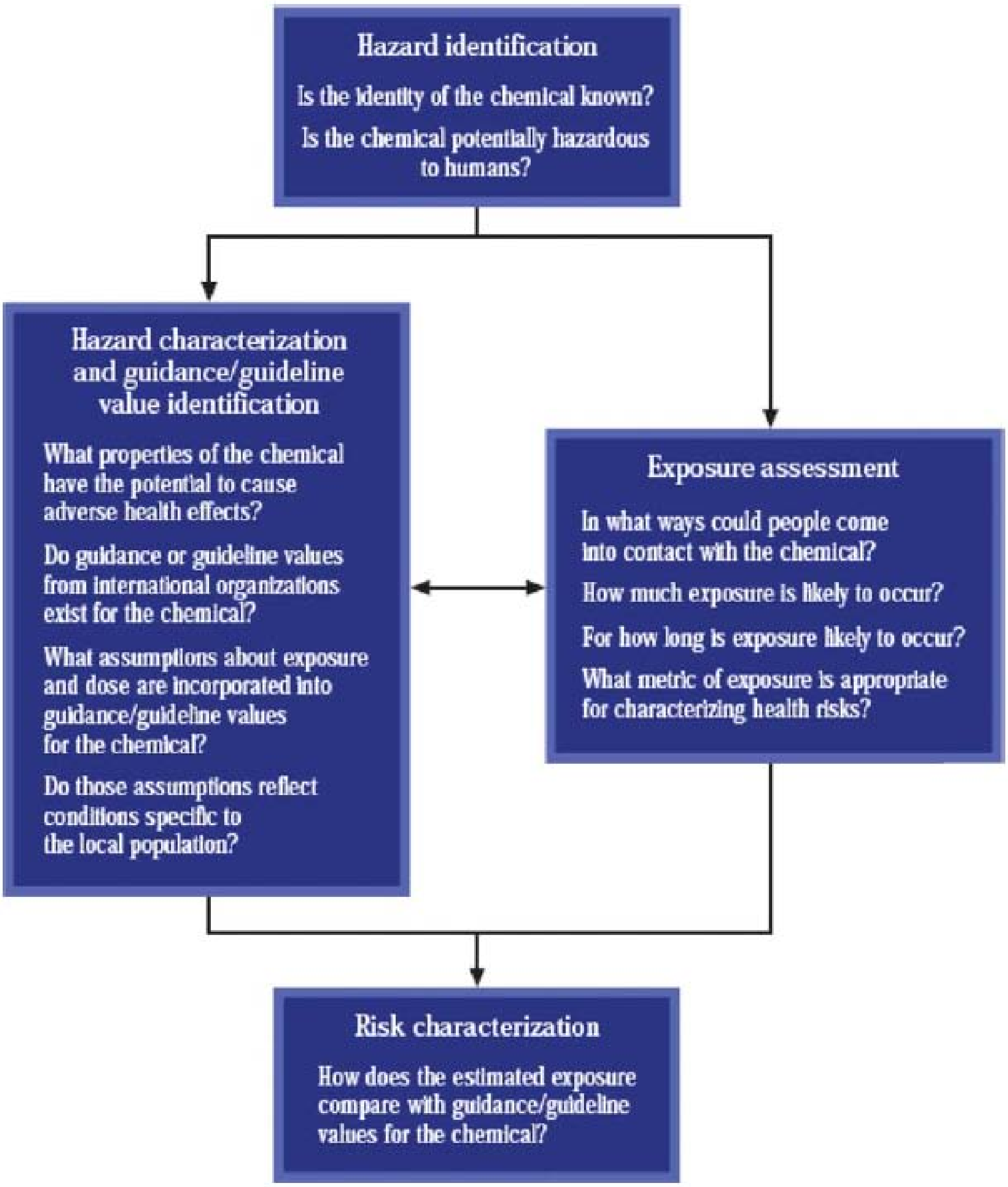
Figure 1. The 4-step risk assessment process [4])



CERACI aims to strengthen public health risk assessment during the acute phase of chemical incidents by improving exposure assessment. It also aims to facilitate cooperation across administrative boundaries by improving interoperability of exposure assessment guidelines, tools and practices. This report considers the following questions:

- How have Member States organised exposure assessment for health risk assessment during acute chemical incidents? (Detailed in Tasks B-D, Appendices 2-3, summarised in Task E Section 4.1)
- Which Member States have organised collaboration and interoperability on exposure assessment, nationally and across borders? (Detailed in Tasks B-D, Appendices 2-3, summarised in Task E Section 4.4)
- Which good practices - technical or organisational - can be (further) developed? (Task E Section 4.1)
- Will harmonisation and collaboration improve Member States’ capabilities and capacities to respond to acute chemical incidents? (Task E Sections 4.3 & 4.5)

Figure 2. Generic road map for chemical risk assessment [1]



2.1 Final report (Task E) objectives & deliverables

This final report (Task E) follows three earlier reports (Tasks B-D), which are summarised in Chapter 3 and are included in full as appendices to this document (Appendices 2-4). Through a literature and project review, Task B investigated exposure monitoring capability, capacity and organisation in Member States. Task C gathered and analysed more detailed information about individual Member States, obtained through a web-based survey and telephone interviews of individuals involved in exposure assessment. The findings of Tasks B and C were tested by delegates at two international workshops as part of Task D. Using exercise incident scenarios, Task D explored and developed good practices and unmet needs in exposure assessment across the EU. Delegates discussed the concept of local, national, and international ‘networks of experts’ in exposure assessment and agreed that there seemed to be a need for cross-European coordination of work in this area.

The CERACI Project Strategy identifies the aims of Task E as:

- “Developing a framework for a set of guidelines, training and exercise package to improve the human and environmental exposure assessment to hazardous airborne chemicals during chemical incidents.
- Assessing capabilities in the EU to provide mutual aid.
- Presenting lessons learned and the way forward.”

The CERACI Project Strategy identifies the deliverables of Task E as:

- “A final network of experts as a starting point for an operational and knowledge exchange platform.
- A framework for a set of guidelines, and a training and exercise package to improve environmental modelling and monitoring in chemical incidents.
- A report on lessons learned from the workshops and the way forward.
- A report assessing capabilities in the EU to provide mutual aid during incidents involving hazardous airborne chemicals.”

This Task E report collates and summarises the information and guidance developed by previous tasks – the information presented in this report is a synthesis of information from Tasks B-D, further informed by an additional review of information sources referenced by past task reports and workshop delegates. Several contacts, working at national and European level in the fields of chemical emergency preparedness, were contacted in order to elicit their views regarding the European coordination of mutual aid and the role of networks of experts (this is discussed in Section 4.5).

3 Earlier reports (Tasks B-D)

In order to present lessons learned and the way forward, it is first important to recap the work undertaken during Tasks B-D. These earlier task reports are included as appendices to this report (Appendices 2-4).

3.1 Task B – literature review

This first evaluation report presented a preliminary understanding of exposure monitoring capability, capacity and organisation in Member States.

European Commission projects were identified that are relevant to exposure assessment in chemical incidents. A range of EU initiatives, arrangements and cross-border agreements are presented within the Task B report (Appendix 2).

A review of targeted literature sources identified organisations and agencies involved in exposure assessment and risk characterisation across Member States. Whilst the literature review collected a significant amount of information about organisations' capabilities, sufficient resolution to detail information exchange between the various responsible bodies during chemical incidents was unavailable for the majority of Member States. The results of Task B informed the design of the Task C survey questionnaire, which examined organisational experience of chemical incident response in more detail.

3.2 Task C – web-based survey

Task C comprised a web-based survey (based on the results of Task B) and follow-up telephone interviews of representatives of government environmental and health protection institutions, fire and rescue services and research institutes from different Member States

The Task C report (Appendix 3) presents summaries of web and interview questionnaires, together with detailed results for individual Member States. Quantitative and qualitative analysis of responses was undertaken to identify good practices and critical success and failure factors for environmental modelling and monitoring for risk assessment during chemical incidents.

3.3 Task D – workshops with tabletop exercises

This report presented the outcomes of two international workshops (Appendix 4). Exercises using chemical incident scenarios were used to elicit good practices, unmet needs and success factors for exposure assessment, with a particular focus on cross-border incidents. European experts in different functions of exposure assessment shared their experiences.

The workshop delegates endorsed and added to the good practices identified by Tasks B and C. Many good practices related to general aspects of exposure assessment (e.g. information exchange and collaboration); there was less focus on technical aspects, which may have been due to the diverse backgrounds of the delegates. The report gives an overview of good practices, gaps (unmet needs) and success factors for both the preparedness and response phases of a chemical incident.

The concept of a framework for a ‘network of experts’ was also discussed in the workshops. Delegates considered that there was a clear need for a network of experts for exposure assessment and envisioned its focus ranging from emergency preparedness to emergency response. The report presents an initial exploration of the potential organisation, coordination and resourcing of such a network and presents an initial list of related existing networks of experts.

4 Final report deliverables

This chapter is split into six sequential sections:

- **4.1 Framework for exposure assessment guidelines**

This section explains, in general terms, how exposure assessment and communication should be organised and what the requirements of exposure assessment are. Referencing good practices and different approaches found by the project that are currently used within the EU, it then considers emergency preparedness; general emergency response; the specific functions of exposure assessment (observation, monitoring, dispersion modelling, and mapping); risk assessment; and cross-border emergency response. Requirements, outcomes, barriers, good practices, and unmet needs are presented for each of these areas, together with signposting of relevant resources and publications.

- **4.2 Self-assessment tool**

The framework for exposure assessment guidelines leads to a section describing a self-assessment tool that can be used to apply the exposure assessment guidelines and good practices developed by CERACI. The tool can be used to visualise and understand Member States' and organisations' capabilities in exposure assessment and the communication between the disparate groups involved in exposure and risk assessment during the acute phase of chemical incidents. The tool can be used specifically for cross-border interactions, as well as those that occur solely within a country. Member States can use the self-assessment tool to focus their emergency preparedness work in the area of exposure assessment.

After an organisation or Member State has carried out a self-assessment, they might wish to improve certain areas of their preparedness and response. CERACI characterises effective exposure assessment as where both exposure and risk assessors in Member States consider exposure assessment outputs during an incident to be 'timely and adequate'. The tool indicates where inputs, functions, and outputs may not be timely or adequate. This may necessitate changes to working practices to secure improvements, such as the adoption of applicable good practices described in Section 4.1: these include generic emergency preparedness and response actions, and actions that are specific to each of the different functions of exposure assessment during a response.

Other options to secure improvement include training and exercising (described in a section on a framework for exposure assessment training and exercising – Section 4.1), raising awareness of mechanisms for assistance (described in a section on mutual aid in exposure assessment – Section 4.4), or establishing links for networking and knowledge exchange (described in a section on a framework for networks of experts – Section 4.5).

- **4.3 Framework for exposure assessment training and exercising**

Training and exercising is a vital part of emergency preparedness work. Effort can be directed at testing and improving the overall response to an emergency, or at specific functions of exposure assessment or communication. This section presents good practices and explains how training and exercising should be organised and what existing material can assist when developing training and exercises specifically for exposure assessment. Similarly to Section 4.1, it then considers emergency preparedness; general emergency response; the specific functions of exposure assessment (observation, monitoring, dispersion modelling, and mapping); risk assessment; and cross-border emergency response. For each of these areas, the section discusses what needs to be trained, what needs to be tested and how it should be tested. Resources and relevant publications are signposted, and the section considers how training and exercising can be supported and resourced.

- **4.4 Mutual aid in exposure assessment**

This section discusses what is required for Member States to be able to offer and receive mutual aid in exposure assessment. It summarises the theoretical capabilities of Member States to provide mutual aid and describes actual examples in practice: this develops the information gathered by Tasks B-D. Cross-EU mutual aid mechanisms and the drivers for the provision of mutual aid are discussed, and recommendations are made regarding the facilitation of mutual aid.

- **4.5 Framework for network of experts**

Networks of experts can exist at local, regional, national, and international levels and exist across borders. Technical networks provide a clear means to influence and develop standardised approaches to exposure assessment functions and build national and international comparability. Networks also provide a means of linking different specialists within the different functions of exposure assessment. This section discusses existing networks of experts, building on an initial list of networks produced by Task D, and explains how such networks can be used to improve emergency preparedness and response. A coordinated emergency preparedness programme requires clear direction and leadership at the local, national and international levels, and the potential role and structure of a strategic-level European network to steer exposure assessment emergency preparedness is discussed.

- **4.6 CERACI lessons learned and the way forward**

This section summarises European and international-level potential gaps (unmet needs) in exposure assessment during acute chemical incidents. It sets out separate recommendations to the EU and to Member States. These recommendations consolidate those made elsewhere in this report (regarding exposure assessment guidelines, mutual aid, and networks of experts). They fall into five main areas of future work: the adoption of a holistic approach to emergency preparedness for chemical incidents; the coordination of chemical incident emergency preparedness at EU and Member State level; the provision of resources to support chemical incident emergency preparedness; the facilitation of emergency preparedness in border areas and the facilitation of mutual aid.

4.1 Framework for exposure assessment guidelines

The Project Strategy requires Task E to deliver a "*Framework for a set of guidelines, and a training and exercise package to improve environmental modelling and monitoring in chemical incidents.*"

This section sets out guidance regarding the organisation of exposure assessment and its outcomes. It identifies useful resources for organisations that are involved in exposure assessment, leading to a self-assessment tool that can be used to focus organisations' and Member States' future development of exposure assessment capability and collaboration within countries and across borders (see Section 4.2).

4.1.1 Organising exposure assessment

The WHO [1] observes that "exposure assessment is used to determine whether people are in contact with a potentially hazardous chemical and, if so, to how much, by what route, through what media and for how long. Risk characterisation is dependent upon the route (oral, inhalation, or dermal) and duration (short-term, medium-term, long-term) of exposure. When combined with information on hazard characterisation or a guidance or guideline value, exposure information is used to characterise health risks."

At its simplest, exposure assessment is informed by on-scene observations of things such as the distance of people from a source, an airborne plume's direction, the exposure duration, and any adverse health effects. Ideally, this basic exposure assessment is further informed by more sophisticated approaches such as monitoring and modelling; these enhance, rather than replace, information from the scene.

Organisational roles in exposure assessment may involve:

- Undertaking at-scene observations of exposure effects in humans and/or the environment;
- Employing Geographical Information Systems (GIS) to locate vulnerable populations and facilities;
- Detecting or quantifying a chemical release using field monitoring or laboratory analysis; and
- Estimating chemical dispersion and exposure concentration using computer modelling software.

Exposure assessment falls between disciplines. There is no such job title as a professional 'exposure assessor'. Exposure assessment tends to be undertaken as part of other roles and may be seen by those carrying it out as an adjunct to their primary tasks. The same may be said of risk assessment. For the purposes of this report, the terms 'exposure assessor' and 'risk assessor' are used to describe those carrying out these functions. The roles may be performed by personal from a wide variety of professional backgrounds: they may be emergency service personnel, civil servants, healthcare workers or other professional groups. This is further described in Figure 3 below.

Figure 3. CERACI terms: 'exposure assessors' and 'risk assessors'

Term	Explanation
Exposure assessor	A person responsible for undertaking one, or more, functions of exposure assessment e.g. on-scene observations, field monitoring, laboratory analysis, modelling, and mapping.
Exposure assessment	The undertaking of one, or more functions of exposure assessment e.g. on-scene observations, field monitoring, laboratory analysis, modelling, and mapping.
Risk assessor	A person responsible for conducting a public health risk assessment.
Risk assessment	The undertaking of a public health risk assessment.

Each Member State has its own unique organisational structure. DG ECHO's Vademecum gives a general overview of the measures taken at Member State and EU level to deal with disasters [5]. During acute chemical incidents, different organisations are responsible for undertaking, or contributing towards, exposure assessment and risk characterisation. This is unavoidable. Their resources in exposure assessment tend to be related to their wider responsibilities: for example, emergency services must attend the scene of incidents whilst ensuring the health and safety of their staff and therefore often utilise monitoring and modelling resources; environmental organisations commonly employ monitoring and modelling during their day-to-day work; while meteorological organisations have a natural affinity for dispersion modelling of airborne substances. Resources that are not primarily intended for exposure assessment during chemical incidents may, nonetheless, be effectively applied during such incidents too; this may involve organisations that do not ordinarily provide an emergency response function (e.g. meteorological organisations with modelling capabilities ordinarily used for weather forecasting or sensor networks linked to the monitoring of ambient air quality).

Earlier CERACI reports identified anecdotal reports of communication problems between military and civil organisations in cases where the military had a role in exposure assessment; however, this was not unique and issues with information sharing also existed between civil organisations. Communication problems are likely to be exacerbated in cross-border incidents, especially when there are different protocols and languages on either side of the border. For effective exposure assessment during an incident, and collaboration in exposure assessment, other than the capability to effectively undertake exposure assessment in the first place, *the key requirement is for effective sharing of information*, irrespective of the organisations or borders involved.

Information sharing is identified in all predecessor reports as a key requirement for exposure assessment to be able to inform risk assessment. Exposure assessors and risk assessors are often different people, in different organisations. Exposure assessment must be organised in such a way as to ensure that risk assessors swiftly receive the information required to inform their risk assessment(s) during an incident. The risk assessor is responsible for interpreting the data, then informing decision-making and subsequent actions. During incidents which could impact across borders, risk assessors on both sides of the border should share their risk assessments and ensure that health messages are communicated in a coordinated and consistent manner.

A WHO toolkit for chemical hazards [1] proposes the type of information needed for successful exposure assessment. It considers the criteria required for undertaking appropriate exposure assessments and presents a generic road map for use in the exposure assessment process, as well as flagging other international sources of guidance on exposure assessment. This, and other guidance in this area [6-7], tends to focus on exposure assessment and risk assessment in a broader context that is not specific to acute chemical incidents, as the scope of these documents includes consideration of chronic environmental issues. Nevertheless, their content is relevant and information related to specific functions of exposure assessment is signposted in subsequent sections of this report.

The WHO recommends an organisational structure that includes public health professionals at the various administrative levels [4], recognising that organisations and responsibilities will depend on what is most suitable for any given country. It is not possible, nor practical, to recommend any one organisational structure that is best for exposure assessment. Nonetheless, CERACI has compiled a number of exposure assessment requirements (listed and detailed in Section 4.1.2 and subsequent sections below) that are fundamental to effective exposure assessment. However they are organised, the different functions of exposure assessment should meet these requirements.

4.1.2 Requirements of exposure assessment

The nature and quality of information collected during chemical incidents varies significantly, depending on available resources, organisational practices and the techniques employed. Timely public health risk assessment is dependent on the identification, quantification and characterisation of a chemical release in the early stages of an incident, and on the provision of this information to risk assessors in a readily interpretable format.

The essential outcomes of effective emergency response are that exposure assessment inputs, functions, and outputs are all 'timely and adequate'. This is the simplest way of breaking down and understanding these complex response functions and their interactions. It underpins the way in which these guidelines are set out, and the way in which CERACI's self-assessment tool can be used to visualise how communication and exposure assessment functions work during incidents. Adopting the good practices within this document can help to deliver a timely and adequate response; the ultimate arbiters of whether a response is indeed 'timely and adequate' should be exposure assessors and risk assessors themselves, an approach that incorporates this principle is outlined in Section 4.2.

Because risk assessment is the primary driver for exposure assessment, functions and outputs must be tailored to the needs of risk assessors. The hallmark of effective exposure assessment is a seamless integration with risk assessment, where the risk assessor agrees that the information that they are provided with is 'timely and adequate'.

Although the scope of the CERACI project is focussed on exposure assessment, risk assessment considerations are integral to these guidelines.

Likewise, whilst CERACI is focussed on what happens during the response phase of chemical incidents, the importance of emergency preparedness in delivering an effective emergency response cannot be understated. Emergency preparedness for exposure assessment during incident response is discussed first in a separate section within these guidelines.

The following sections (4.1.3-4.1.10) collate the good practices, key success factors, barriers, and EU-level gaps (unmet needs) that have been found by CERACI and presented by previous task reports. For each function of exposure assessment, its requisite outcomes are described in general terms. In some cases further, more specific, descriptions are given in order to give a fuller explanation of what is needed. The Task D report presents good practices in each functional group of exposure assessment and discusses communication requirements for collaboration. Applying these good practices is a way by which Member States can achieve these outcomes.

In order to do this, each good practice has been tabulated and categorised to show which outcomes it can help to meet. Practices may take place in the preparedness phase or response phase of incidents, or both. They may contribute to preparedness aims, response aims, cross-border aims, or all three. They may be generic good practices that apply to every function of exposure assessment, or they may be very specific and apply to only one function. The good practices should not be seen as a prescriptive list, merely as different ways of achieving the outcomes that constitute effective exposure assessment. The practical use of this framework is discussed further in Section 4.2, which presents the concept of a self-assessment tool.

4.1.3 Emergency preparedness

The WHO [4] explains the importance of emergency preparedness:

"The time taken during an incident to locate equipment and infrastructure, coordinate the actions of the various stakeholders, establish links between agencies and emergency services, establish a response plan and gather general information about the pollutant(s) and the facility responsible for the incident will be time lost towards minimising the extent and consequences of a chemical incident.

Hence, these tasks should be accomplished prior to the incident, in order to ensure that immediate efforts can readily be focused on the response to the incident. Therefore the incident response system should be designed, the roles, responsibilities and competencies attributed, personnel selected, trained and exercised, in the planning and preparedness stage."

The requirements for, outcomes of, and good practices in emergency preparedness for chemical incidents are almost wholly generic. As such, they are applicable to **all** of the different functions of exposure assessment in incident response (discussed in Sections

4.1.4-4.1.9) and apply implicitly to cross-border incidents (discussed in Section 4.1.10). To avoid duplication, good practices in emergency preparedness are collated in this first section rather than being repeated again in later sections.

4.1.3.1 Requirements of emergency preparedness

CERACI's basic requirement of emergency preparedness is that:

All stakeholders and resources must be prepared and ready to respond effectively[2]

4.1.3.2 Outcomes of emergency preparedness

CERACI's Emergency preparedness outcomes are:

Incident response stakeholders are engaged in emergency preparedness work

Exposure assessment capabilities are maximised

The multi-agency response to incidents is optimised (e.g. information flow is efficient)

- Organisational structures are understood by responders
- Roles and responsibilities are understood by responders
- Procedures and standards are understood by responders
- Geographical differences are understood by responders
- Resources are understood by responders
- There is familiarity between counterparts
- There are links between counterparts
- Any differences in resources and approaches are understood and accounted for by responders
- There is mutual trust between responders

[3]

4.1.3.3 Barriers to emergency preparedness

CERACI has identified a number of common barriers to effective emergency preparedness:

- A lack of national, regional or local focus on emergency preparedness for chemical incidents
- Insufficient inclusion or engagement of all of the organisations and agencies involved in incident response
- A narrow focus in training and exercising (e.g. not multi-agency or focussed only on emergency services)
- A lack of national guidance and standard-setting for emergency preparedness
- Differences in guidelines and standards for developing local emergency plans

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[2] Within Section 4.1, 'Requirements' are presented in emphasised text.

[3] Within Section 4.1, 'Outcomes' are presented in emphasised text. The tables in the 'Good practices' sections indicate which of these outcomes they can help to meet.

- A lack of integration between chemical emergency plans and other existing plans
- Insufficient resourcing of organisations to be able to fully engage in emergency preparedness work

4.1.3.4 Good practices in emergency preparedness

Good practices in emergency preparedness identified by CERACI are listed in Table 1. The categorisation of these good practices in the table relates them to the outcomes described above, showing which outcomes they can help to meet. Emergency response outcomes are split by input, function, and output, the rationale behind this is described further in Section 4.2. Many of these good practices help to meet aims for the response and cross-border phases of incidents and where this is the case it is also indicated.

There are a number of key practices that are of primary importance. These are:

- **Interagency training at local, regional, national, and international level**

  This includes the training of responders to undertake functions of exposure assessment and to communicate effectively with one another. Training helps to build capabilities and maximise resources.

- **Interagency exercising at local, regional, national, and international level**

  Exercising is particularly important in establishing and maintaining contact between the disparate responders involved in exposure assessment. A detailed example of an international cross-border exercise to facilitate mutual aid between Poland and the Czech Republic is discussed in Section 4.4.5.2.3.3.

- **Including public health risk assessors (e.g. in events organised by first responders)**

  It is vitally important to bridge the gap between exposure assessors and risk assessors: this can be done by including public health risk assessors in multi-agency training and exercising for response.

- **Setting up infrastructure, organisational structures and resources for an effective response**

  Member States should ensure that their organisations are properly resourced to undertake exposure assessment and communicate with one another and that roles and responsibilities are clearly specified before incidents occur.

- **Having agreed approaches before incidents occur (official protocols and procedures)**

  These range from formal high-level agreements on international collaboration between neighbouring Member States to local and regional-level agreements, specifying more detailed procedures and protocols. Such protocols must address alerting and notification, sustained communication and ensure that exposure assessment is undertaken to agreed standards that informs risk assessment.

- **Preparing and sharing preparedness information (e.g. emergency response plans, pre-prepared information)**

  The development of shared tools, standards, procedures and manuals for exposure and risk assessors is of great benefit. It is important that links and contacts are in place before incidents occur. The sharing of information within emergency preparedness also encompasses incident debriefs and information shared via journals and professional groups.

- **Preparing plans for incident response**

  Plans should be developed and shared between responders: they should be focussed on areas of highest risk and reiterate response, communication, and decision-making mechanisms. The approach mandated for industrial installations subject to the Seveso Directive [8] is a useful model.

Table 1. Good practices in emergency preparedness

Good practices identified by CERACI are categorised to show which outcomes they can help to meet: these are listed in the top row. Practices may contribute to preparedness aims, response aims, or cross-border aims, or all three. Key practices are marked by ***bold*** *text.*

		Emergency preparedness												Emergency response			Cross-border		
Area	**Good practice**	Engages stakeholders in emergency preparedness	Maximises exposure assessment capabilities (resources)	Optimises the multi-agency response to incidents	Organisational structures are understood	Roles & responsibilities are understood	Procedures & standards are understood	Geographical differences are understood	Resources are understood	There is familiarity between counterparts	There are links between counterparts	Differences are understood	There is mutual trust between responders	Timely and adequate input	Timely and adequate function	Timely and adequate output	Cross-border communication and sharing	Sharing informs cross-border assessment and action	Consistent cross-border risk management and communication
All functions	**Interagency training at local, regional, national, and international level**	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Mapping	Training of emergency service first responders to undertake rapid mapping	X	X												X				
Modelling	Training of emergency service first responders to undertake rapid modelling	X	X												X				
Monitoring	Training of emergency service first responders to undertake rapid monitoring	X	X												X				
Observation	Training of emergency service first responders to undertake exposure assessment using toxidromes	X	X												X	X			
All functions	Training of exposure assessors (scientists) to communicate with risk assessors and public (laymen)	X		X												X			
All functions	Training of risk assessors to communicate with risk communicators and decision-makers	X		X															

Area	Good practice	Emergency preparedness												Emergency response			Cross-border		
		Engages stakeholders in emergency preparedness	Maximises exposure assessment capabilities (resources)	Optimises the multi-agency response to incidents	Organisational structures are understood	Roles & responsibilities are understood	Procedures & standards are understood	Geographical differences are understood	Resources are understood	There is familiarity between counterparts	There are links between counterparts	Differences are understood	There is mutual trust between responders	Timely and adequate input	Timely and adequate function	Timely and adequate output	Cross-border communication and sharing	Sharing informs cross-border assessment and action	Consistent cross-border risk management and communication
All functions	Training of multi-lingual liaison officers capable of interpreting public health, science, and emergency response communications	X		X								X					X	X	X
All functions	**Interagency exercising at local, regional, national, and international level**	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
All functions	Targeting training and exercising at communication (between responders)	X	X	X		X		X		X	X	X	X	X		X			
All functions	Targeting training and exercising at specific functions of exposure assessment (& at people rather than organisations)	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			
Risk assessment	**Including public health risk assessors (e.g. in events organised by first responders)**	X		X	X	X	X	X	X	X	X	X	X			X			X
All functions	Trialling harmonisation efforts using training and exercising events	X		X	X	X	X	X	X	X	X	X	X					X	X
All functions	Accounting for language differences in training and exercising material	X		X													X	X	X
All functions	Including cross border incident aspects and focus in exercises and training	X	X	X	X	X	X	X	X	X	X	X	X				X	X	X

Area	Good practice	Emergency preparedness												Emergency response			Cross-border		
		Engages stakeholders in emergency preparedness	Maximises exposure assessment capabilities (resources)	Optimises the multi-agency response to incidents	Organisational structures are understood	Roles & responsibilities are understood	Procedures & standards are understood	Geographical differences are understood	Resources are understood	There is familiarity between counterparts	There are links between counterparts	Differences are understood	There is mutual trust between responders	Timely and adequate input	Timely and adequate function	Timely and adequate output	Cross-border communication and sharing	Sharing informs cross-border assessment and action	Consistent cross-border risk management and communication
All functions	Exchanging experts between organisations (e.g. via DG ECHO's expert exchange programme [9])	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
All functions	**Setting up infrastructure, organisational structures and resources for an effective response**	X	X	X	X	X		X	X					X	X	X			
All functions	Clearly specifying each institution's responsibilities in exposure assessment (e.g. legal acts in force)			X		X													
All functions	Having coterminus areas of geographical responsibility between organisations (where possible)			X	X			X											
All functions	Minimising steps in incident response structures (e.g. streamlining the number of organisations and people involved in response (insofar as is possible))	X		X										X		X			
All functions	Providing 24/7 response capabilities (e.g. out of hours and weekend arrangements) - also for cross-border incidents	X	X	X							X			X	X	X	X		
All functions	Setting up emergency management centres and focal points (single points of contact & management)	X		X	X	X					X			X		X	X		

Area	Good practice	Emergency preparedness												Emergency response			Cross-border		
		Engages stakeholders in emergency preparedness	Maximises exposure assessment capabilities (resources)	Optimises the multi-agency response to incidents	Organisational structures are understood	Roles & responsibilities are understood	Procedures & standards are understood	Geographical differences are understood	Resources are understood	There is familiarity between counterparts	There are links between counterparts	Differences are understood	There is mutual trust between responders	Timely and adequate input	Timely and adequate function	Timely and adequate output	Cross-border communication and sharing	Sharing informs cross-border assessment and action	Consistent cross-border risk management and communication
All functions	Setting up fixed sensor networks (e.g. for water bodies and air quality)	X	X												X	X			
Modelling	Providing a national service for modelling for local responders without their own capabilities		X												X				
Modelling	Being able to model all applicable media (air, water, food, soil)		X												X	X			
Monitoring	Being able to monitor all applicable media (air, water, food, soil)		X												X	X			
Monitoring	Being able to sample for common suites of chemicals (e.g. products of combustion)		X												X	X			
Monitoring	Being able to sample for persistent chemicals		X												X	X			
All functions	Developing & using dedicated web-based multi-agency systems to share information	X	X	X			X		X	X	X	X	X	X		X	X		X
All functions	**Having agreed approaches before incidents occur (official protocols and procedures)**	X		X		X	X				X	X	X	X	X	X			
All functions	**Having in place formal high-level agreements on international collaboration between neighbours (e.g. bilateral agreements)**	X															X		

Area	Good practice	Emergency preparedness												Emergency response			Cross-border		
		Engages stakeholders in emergency preparedness	Maximises exposure assessment capabilities (resources)	Optimises the multi-agency response to incidents	Organisational structures are understood	Roles & responsibilities are understood	Procedures & standards are understood	Geographical differences are understood	Resources are understood	There is familiarity between counterparts	There are links between counterparts	Differences are understood	There is mutual trust between responders	Timely and adequate input	Timely and adequate function	Timely and adequate output	Cross-border communication and sharing	Sharing informs cross-border assessment and action	Consistent cross-border risk management and communication
All functions	**Having in place local and regional-level agreements, specifying more detailed procedures and protocols**	X		X	X	X	X	X	X	X	X	X	X	X		X	X		
All functions	Agreeing local, regional, national, and international alerting mechanisms (including automatic cascades)	X		X		X	X	X			X	X	X	X		X	X		
All functions	Agreeing cross-border alerting mechanisms for the first stages of cross-border incidents	X		X		X	X	X			X	X	X	X		X	X		
All functions	Linking fixed sensor networks to alerting mechanisms	X		X			X							X		X			
All functions	Agreeing systematic procedures for obtaining, communicating and sharing information between stakeholders (and standards e.g. timeliness)	X		X		X	X				X	X	X	X		X			
All functions	Having formal agreements from first responders to provide early information to exposure and public health risk assessors	X		X		X	X				X		X	X		X			
All functions	Agreeing information and datasets to be collected by responders in the event of incidents (e.g. monitoring data to be collected by Fire Service)	X		X		X	X				X		X		X	X			

Area	Good practice	Emergency preparedness												Emergency response			Cross-border		
		Engages stakeholders in emergency preparedness	Maximises exposure assessment capabilities (resources)	Optimises the multi-agency response to incidents	Organisational structures are understood	Roles & responsibilities are understood	Procedures & standards are understood	Geographical differences are understood	Resources are understood	There is familiarity between counterparts	There are links between counterparts	Differences are understood	There is mutual trust between responders	Timely and adequate input	Timely and adequate function	Timely and adequate output	Cross-border communication and sharing	Sharing informs cross-border assessment and action	Consistent cross-border risk management and communication
All functions	Agreeing information to be provided to exposure assessors (e.g. source term inputs)	X		X		X	X				X		X	X					
All functions	Specifying detailed approaches to exposure assessment (e.g. monitoring and modelling)	X		X		X	X	X	X		X	X	X	X	X	X			
All functions	Harmonising and standardising approaches to exposure assessment	X		X		X	X		X	X	X	X	X		X				
All functions	Agreeing the purpose use, and interpretation of exposure assessment outputs between exposure assessors and risk assessors	X	X	X		X	X				X		X			X			
All functions	Agreeing consistent approaches to cross-border information exchange and risk communication on both sides of the border	X		X		X	X	X		X	X	X	X				X		X
Risk assessment	Agreeing risk assessors' approaches to communication and decision-making if contradictory inputs are received during incidents	X		X			X				X	X							X
All functions	Using a Member State's own language in written materials or otherwise accounting for language differences	X		X	X	X	X	X	X			X					X	X	X

Area	Good practice	Emergency preparedness												Emergency response			Cross-border		
		Engages stakeholders in emergency preparedness	Maximises exposure assessment capabilities (resources)	Optimises the multi-agency response to incidents	Organisational structures are understood	Roles & responsibilities are understood	Procedures & standards are understood	Geographical differences are understood	Resources are understood	There is familiarity between counterparts	There are links between counterparts	Differences are understood	There is mutual trust between responders	Timely and adequate input	Timely and adequate function	Timely and adequate output	Cross-border communication and sharing	Sharing informs cross-border assessment and action	Consistent cross-border risk management and communication
All functions	Agreeing detailed treaties to facilitate the movement of equipment and personnel over borders	X	X	X			X									X	X		
All functions	Exempting shared resources from cross-border taxes and customs duties	X	X	X			X									X	X		
All functions	Ensuring compatibility of exposure and risk assessment outputs (between stakeholders)	X		X			X					X	X			X		X	
All functions	**Preparing and sharing preparedness information (e.g. emergency response plans, pre-prepared information)**	X		X	X	X	X	X	X	X	X	X	X	X		X			X
All functions	Developing shared tools, standards, procedures and manuals for exposure and risk assessors	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
All functions	Sharing responders' contact details between responders (including cross-border)	X		X						X	X						X		
All functions	Recognising common cross-border risks and receptors (e.g. rivers, clusters of industrial installations) and sharing related plans	X		X				X			X	X	X				X		X
All functions	Multi-agency debriefing after incidents occur	X		X	X	X	X	X	X	X	X	X	X						

Area	Good practice	Emergency preparedness												Emergency response			Cross-border		
		Engages stakeholders in emergency preparedness	Maximises exposure assessment capabilities (resources)	Optimises the multi-agency response to incidents	Organisational structures are understood	Roles & responsibilities are understood	Procedures & standards are understood	Geographical differences are understood	Resources are understood	There is familiarity between counterparts	There are links between counterparts	Differences are understood	There is mutual trust between responders	Timely and adequate input	Timely and adequate function	Timely and adequate output	Cross-border communication and sharing	Sharing informs cross-border assessment and action	Consistent cross-border risk management and communication
All functions	Using existing expert networks to propagate preparedness work (e.g. EAPCCT, ICE [10])	X		X	X	X	X	X	X	X	X	X	X				X		
All functions	Developing shared databases on incidents, exercises and lessons learned	X		X	X	X	X	X	X	X	X	X	X				X	X	X
All functions	Collating and sharing incident reports at EU level (e.g. Seveso site accident reports)	X		X		X		X	X			X							
All functions	Publication of incident reports and initiatives in collaborative emergency preparedness (e.g. in English-language journals)	X		X	X	X	X	X	X	X	X	X	X						
All functions	Implementing common research programmes	X	X										X	X	X	X	X	X	X
All functions	**Preparing plans for incident response**	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
All functions	Prioritising high-risk areas in emergency plans	X		X				X											
All functions	Preparing plans for specific sites or areas where incidents have the potential to lead to cross-border impacts	X		X	X	X	X	X	X	X	X	X	X				X	X	X
All functions	Pre-preparing exposure assessment outputs where possible (e.g. dispersion modelling for worst-case and typical scenarios for industrial sites)	X	X	X												X			

Area	Good practice	Emergency preparedness												Emergency response			Cross-border		
		Engages stakeholders in emergency preparedness	Maximises exposure assessment capabilities (resources)	Optimises the multi-agency response to incidents	Organisational structures are understood	Roles & responsibilities are understood	Procedures & standards are understood	Geographical differences are understood	Resources are understood	There is familiarity between counterparts	There are links between counterparts	Differences are understood	There is mutual trust between responders	Timely and adequate input	Timely and adequate function	Timely and adequate output	Cross-border communication and sharing	Sharing informs cross-border assessment and action	Consistent cross-border risk management and communication
All functions	Specifying response and decision-making mechanisms within plans (including exposure assessment and cross-border protocols and procedures)	X		X	X	X	X	X	X		X	X	X	X		X	X		X
All functions	Ensuring plans are short, simple, and transparent	X																	
All functions	Accounting for language differences in plans (e.g. for users and with regard to public messages)	X		X	X	X	X	X	X		X	X	X				X	X	X
All functions	Including multi-language FAQ and media statements in cross-border plans	X		X								X							X
All functions	Exercising of emergency response plans	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X

4.1.3.5 Unmet needs in emergency preparedness

A number of EU-level needs were identified by CERACI:

- A common European approach to exposure and risk assessment preparedness and response for chemical incidents
- An EU-level formal legal requirement for Member States' cooperation in exposure assessment for chemical incidents
- National formal legal requirements within Member States for cooperation in exposure assessment between responders (i.e. between exposure assessors and risk assessors)
- A common framework for semi-formal international collaboration between Member States (e.g. memoranda of understanding)
- A common prescriptive framework for mutual assistance in exposure assessment at the local level
- A database of EU Seveso site exercises and other chemical incident response exercises that can be used to exercise exposure assessment functions
- An EU "risk profile" map identifying cross-border areas with the highest risk of chemical incidents, to focus preparedness work
- Member States agreeing joint procedures for controlled burns in border areas (e.g. when the fire-fighting strategy is to let a fire ‘burn out’ in a controlled way rather than tackling it with active fire-fighting)
- A specific Seveso-type approach to preparedness and planning for cross-border areas where there are (non-Seveso) chemical threats
- Incident response plans which specify detailed approaches to exposure assessment, including cross-border
- An EU database of Member States' resources for exposure and risk assessment (e.g. monitoring capabilities, dispersion modelling capabilities, public health risk assessors) to aid information exchange and consistency
- An EU Crisis or Emergency Cooperation Centre for all stakeholders that need to share cross-border emergency preparedness information
- Awareness-raising of existing EU support mechanisms (e.g. DG ECHO’s Monitoring and Information Centre (MIC))
- Support for funding for joint emergency preparedness initiatives, such as those listed above

Gaps identified by CERACI (unmet needs) are discussed further in Section 4.6.

4.1.3.6 Emergency preparedness resources

The EU “Informed. Prepared. Together.” website is a gateway to resources, information, and practical tools for developing the ability of individuals, communities and organisations to be better prepared to cope with emergencies and disasters [11].

The WHO [4] discusses chemical incident emergency planning and preparedness in detail, outlining the information that should be made available to guide responses. This includes national databases of sites that store hazardous substances, chemical information, health sector capabilities and responder contact information, for each of which the WHO specifies what information is required. It also sets out how a chemical incident response plan should be prepared and provides links to plan templates. The WHO [4] also identifies a number of international tools for emergency preparedness: this information is restated below.

The United Nations Environment Programme (UNEP) has produced a number of publications as part of its programme for Awareness and Preparedness for Emergencies at Local Level (APELL) [12]. The APELL guidance provides a framework that enables local communities to prepare emergency response plans in co-operation with industry and other leading groups. This is a modular, flexible methodological international tool for preventing accidents and, failing this, it aims to minimise their impacts. This is achieved by assisting decision-makers and technical personnel to increase community awareness and to prepare coordinated response plans involving industry, government, and the local community, in the event that unexpected events should endanger life, property or the environment.

Another UNEP tool is the Framework for Chemical Accident Prevention. This framework offers guidance for governments wanting to develop, improve or review their chemical accidents prevention programme [13]. It brings together in-depth information on critical elements of a chemical accident prevention programme, based on international references and practical information addressed to national governments on how to develop such a programme.

More specifically, the guidance provides comprehensive information for establishing a chemical accident prevention programme by:

- describing the steps that are needed before developing and implementing laws, regulations, policies, guidance or other instruments which would make up an effective chemical accidents programme;
- setting out the possible elements of such instruments; and
- providing resource materials related to how these elements may be implemented, based on international initiatives and the experience of countries.

The guidance focuses on prevention and preparedness for accidents at “hazardous installations” which include places where hazardous substances are produced, processed, used, handled or stored in such quantities and under such conditions that a chemical accident could occur. The types of accidents addressed by the guidance would include any loss of containment, explosion, or fire involving chemicals which pose a hazard to human health or the environment.

The Organisation for Economic Co-operation and Development (OECD) has introduced Guiding Principles for Chemical Accident Prevention, Preparedness and Response [14] with sections on prevention, emergency preparedness/mitigation, emergency response, follow-up of incidents and some special issues. For each of the target groups, industry (including management and labour), public authorities, communities and other stakeholders, specific guidance is provided for each stage of the disaster cycle. The guidance stresses the importance of preparedness and bilateral agreements and collaboration between countries.

Focussed on health and public health capabilities, the WHO has also produced a toolkit for assessing health-system capacity for crisis management [15]. Several assessments have been carried out for existing countries (e.g. within the EU, England and Poland). These assessments examine legal and institutional frameworks for emergency management and information management systems for emergency preparedness and response. They summarise health workforce development (including training), and their consideration of service delivery provides a wider overview of incident response, including non-health civil protection and response. It contains information relevant to chemical incident response (such as details regarding specialist emergency service capabilities and organisations with a role in providing advice during chemical incidents). Emergency preparedness for mass events (such as international sporting events) has driven the development of this toolkit. Its implementation is a relatively recent development, having developed since 2007, and it is likely to support the preparedness activities in Member States that are mandated by the International Health Regulations [16]. Both the toolkit, and the assessments of health-system crisis preparedness that are being prepared by WHO member countries, are useful resources.

A US report examines public health emergency preparedness for incidents involving the release of chemical or radiological substances [17]. This report focuses on the roles of the public health service in emergency preparedness and its response to chemical and radiological incidents. The authors develop a functional framework for public health roles in such incidents by aligning the capabilities and roles of the public health service with the emergency preparedness and response activities that would be required for those incidents. Although it is intended for US organisations, the principles of public health functions in preparedness and response are applicable in the European context and this reference provides a useful overview of public health organisations' roles in chemical incident preparedness and response.

4.1.4 Emergency response (exposure assessment)

An initial requirement for exposure assessment is an understanding of the presence (or absence) of an agent and its concentrations and distribution [7]. Accurate and useful exposure assessment requires a detailed understanding both of the strengths and weaknesses of the exposure assessment techniques.

The preceding section (4.1.3) describes emergency preparedness, which naturally takes place before an incident occurs. The following sections (4.1.4-4.1.10) concern what should happen during the response phase of an incident i.e. response actions which take place after an incident has occurred.

There are a number of good practices that are applicable to all functions of exposure assessment during incident response. They are predominantly related to the sharing of information. These generic practices are listed below and are reiterated in later sections, where specific examples are given.

4.1.4.1 Requirements of emergency response

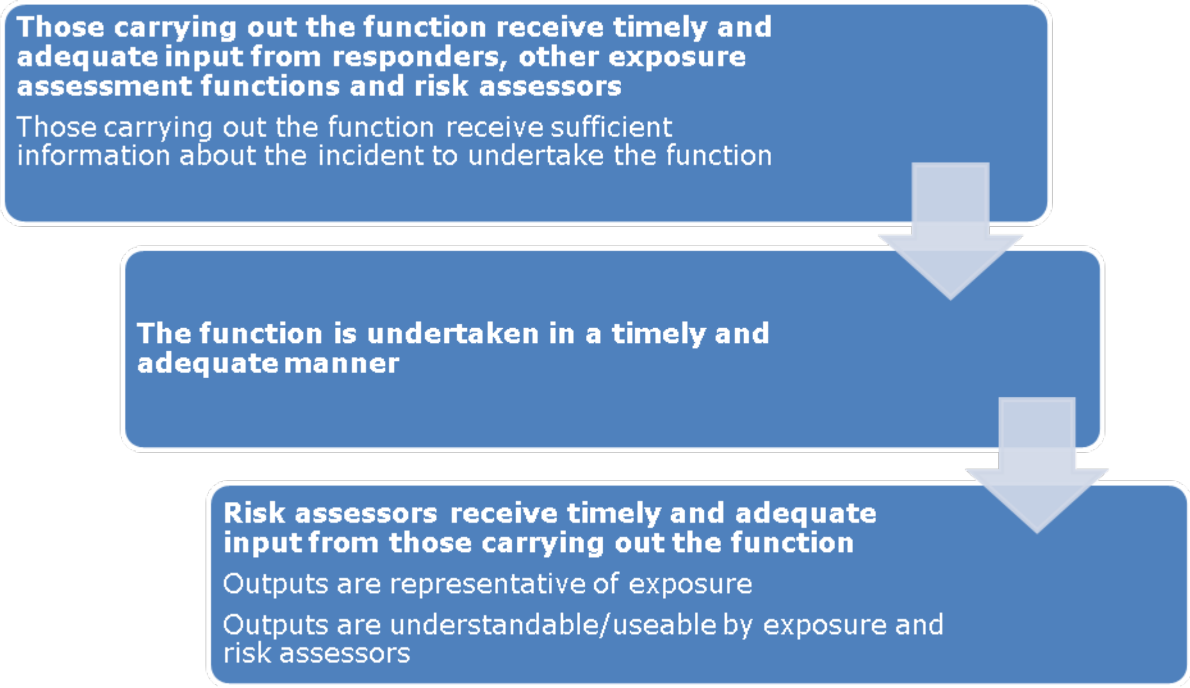
CERACI's basic requirements for all functions of exposure assessment (observation, monitoring, modelling and mapping) are that:

The function must exist

The function's outputs must inform risk assessment

4.1.4.2 Outcomes of emergency response

CERACI's three fundamental outcomes required for all functions of exposure assessment (observation, monitoring, modelling and mapping) are that:



4.1.4.3 Barriers to emergency response

CERACI has identified a number of common barriers that may apply to all functions of exposure assessment (observation, monitoring, modelling and mapping) during emergency response:

- The function is not carried out specifically for human health reasons (e.g. it may be focussed on ecological or environmental impacts)
- Inputs are insufficient, or estimates or judgements are made regarding some inputs
- There is no dedicated or 24/7 resource
- Organisational roles and responsibilities overlap, or are not clearly specified
- There is poor exchange of data and information
- Responders have limited "real-life" experience due to low numbers of incidents
- A lack of systematic procedures exist for data sharing between assessors
- Data collected for acute risk assessment may not be suitable for public health surveillance and follow-up (and vice versa)

4.1.4.4 Good practices in emergency response

Good practices in emergency response identified by CERACI are listed in Table 1. The categorisation of these good practices in the table relates them to the outcomes described above, showing which outcomes they can help to meet. Emergency response outcomes are split by input, function, and output, the rationale behind this is described further in Section 4.2.

These good practices focus on the response phase of incidents. They should be considered alongside the good practices identified in the section on emergency preparedness (4.1.3.4).

Some of these good practices help to meet aims for the emergency preparedness and cross-border response phases of incidents and where this is the case it is also indicated.

There are a number of key practices that are of primary importance. These are:

- **Immediately exchanging information between responders and sustaining this**

  This may require a lead agency or single point of contact to be established. The use of multi-agency meetings and emergency communications centres can facilitate communication during incidents, as can the use of existing networks. Earlier task reports identified that most Member States have dedicated emergency centres.

- **Using checklists and pre-prepared guidance to direct response and communication**

  Information to be collected by exposure assessors should be agreed before incidents occur, and information gathering and the production of outputs should proceed according to pre-agreed protocols, delivering pre-defined, expected outputs to risk assessors. For this to occur it is important that exposure assessors receive the information required to undertake their function.

- **Using outputs from other functions to refine outputs e.g. using monitoring and observation outputs to refine model outputs**

  Information should be exchanged between exposure assessors e.g. in order to produce useful maps then those undertaking monitoring and observations at the scene must provide information to those who are producing maps. For modelling, particularly, feedback of monitoring information is important in examining, validating and updating model outputs so that they can best inform risk assessors.

- **Tailoring output formats to risk assessors' requirements**

  It is important that exposure assessment delivers outputs that are understandable and useable by risk assessors (ideally this should be facilitated during the emergency preparedness phase). Active communication and feedback between exposure and risk assessors should occur during an incident to ensure that an adequate risk assessment can be carried out. All exposure assessment outputs should be setup to allow meaningful comparison with health-based standards and decision-making criteria.

Table 2. Good practices in emergency response

Good practices identified by CERACI are categorised to show which outcomes they can help to meet: these are listed in the top row. Practices may contribute to preparedness aims, response aims, or cross-border aims, or all three. Key practices are marked by **bold** *text.*

Area	Good practice	Emergency preparedness			Emergency response							Cross-border		
		Engages stakeholders in emergency preparedness	Maximises exposure assessment capabilities (resources)	Optimises the multi-agency response to incidents	Timely and adequate input	Receive sufficient information to undertake the function	Timely and adequate function	Timely and adequate output	Outputs are representative of exposure	Outputs are understandable & usable	Risk assessors receive sufficient information to undertake a risk assessment	Cross-border communication and sharing	Sharing informs cross-border assessment and action	Consistent cross-border risk management and communication
All functions	**Optimising communication**													
All functions	Using international frameworks for chemical incident alerting and notification (e.g. IHR [16], RASFF, RAS BICHAT, RAS CHEM)											X		
All functions	Alerting via automatic mechanisms				X			X				X		
All functions	**Immediately exchanging information between responders and sustaining this**				X	X								
All functions	Assigning one responder to be lead for information provision to others (e.g. single point of contact collects and provides information)				X			X						
All functions	Communicating via emergency management centres and focal points (single points of contact & management, both on-site and off-site)				X			X				X		
All functions	Using multi-agency face-to-face meetings to coordinate information exchange				X	X		X			X			
All functions	Use of networks of responders and advisors				X	X		X			X	X		

Area	Good practice	Emergency preparedness			Emergency response							Cross-border		
		Engages stakeholders in emergency preparedness	Maximises exposure assessment capabilities (resources)	Optimises the multi-agency response to incidents	Timely and adequate input	Receive sufficient information to undertake the function	Timely and adequate function	Timely and adequate output	Outputs are representative of exposure	Outputs are understandable & usable	Risk assessors receive sufficient information to undertake a risk assessment	Cross-border communication and sharing	Sharing informs cross-border assessment and action	Consistent cross-border risk management and communication
All functions	Using international networks of experts for chemical incident alerting, notification and information exchange (e.g. EUMETNET [18])				X			X				X		
All functions	Using of the Common Emergency Communication and Information System for information sharing between Member States' focal points				X			X				X		
All functions	Linking national focal points with local focal points within and between countries (i.e. coordinated local, national, and international response)											X		
All functions	Sharing of information between countries 24-7 (including non-EU states)				X			X				X		
All functions	Providing translation services capable of interpreting public health, science, and emergency response communications (e.g. multi-lingual liaison officers)			X	X			X				X	X	X
	Optimising inputs, functions and outputs													
All functions	Sharing emergency preparedness information (during the incident, as well as beforehand)				X	X		X			X		X	
All functions	**Using checklists and pre-prepared guidance to direct response and communication**				X	X	X	X	X	X	X	X	X	X

Area	Good practice	Emergency preparedness			Emergency response							Cross-border		
		Engages stakeholders in emergency preparedness	Maximises exposure assessment capabilities (resources)	Optimises the multi-agency response to incidents	Timely and adequate input	Receive sufficient information to undertake the function	Timely and adequate function	Timely and adequate output	Outputs are representative of exposure	Outputs are understandable & usable	Risk assessors receive sufficient information to undertake a risk assessment	Cross-border communication and sharing	Sharing informs cross-border assessment and action	Consistent cross-border risk management and communication
All functions	Using uniform approaches to information collection, exchange and terminology (e.g. METHANE [19])				X	X	X	X	X	X	X	X	X	X
All functions	Accessing 24/7 chemical incident advisory services (chemical expert advisors) early in incidents, during the first hour(s)				X	X	X	X						
All functions	Use of rapid information tools (e.g. Wireless Information System for Emergency Responders [20])				X	X	X	X			X			
All functions	Receiving input information that satisfies pre-agreed information requirements				X	X	X							
All functions	Sharing of exposure assessment inputs and outputs (e.g. complaints reporting shared with those undertaking monitoring and modelling)				X	X	X	X			X	X		
All functions	Using dedicated joint cross-border units for exposure assessment (e.g. EMRIC+ project: see Task D)											X	X	
All functions	Using common equipment and approaches											X	X	
All functions	Involving civilian and voluntary organisation resources (where appropriate)		X				X							

Area	Good practice	Emergency preparedness			Emergency response							Cross-border		
		Engages stakeholders in emergency preparedness	Maximises exposure assessment capabilities (resources)	Optimises the multi-agency response to incidents	Timely and adequate input	Receive sufficient information to undertake the function	Timely and adequate function	Timely and adequate output	Outputs are representative of exposure	Outputs are understandable & usable	Risk assessors receive sufficient information to undertake a risk assessment	Cross-border communication and sharing	Sharing informs cross-border assessment and action	Consistent cross-border risk management and communication
All functions	Basing approaches to exposure assessment on risk assessment requirements (e.g. standards used to determine levels of detection)							X		X	X			
All functions	Providing output information that satisfies a pre-agreed purpose, use and interpretation							X	X	X	X			
All functions	**Using outputs from other functions to refine outputs e.g. using monitoring and observation outputs to refine model outputs**				X	X	X	X	X					
All functions	**Tailoring output formats to risk assessors' requirements**							X	X	X	X			
All functions	Outputs incorporate comparison to, or can be readily compared to, health standards and decision-making criteria							X		X	X			
All functions	Providing notes on output interpretation (e.g. units used, conversion factors)							X		X				
All functions	Making risk assessors aware of any limitations in capabilities and outputs							X		X				
All functions	Accounting for the possible need to use outputs for follow-up health surveillance or studies							X		X	X			

Area	Good practice	Emergency preparedness			Emergency response							Cross-border		
		Engages stakeholders in emergency preparedness	Maximises exposure assessment capabilities (resources)	Optimises the multi-agency response to incidents	Timely and adequate input	Receive sufficient information to undertake the function	Timely and adequate function	Timely and adequate output	Outputs are representative of exposure	Outputs are understandable & usable	Risk assessors receive sufficient information to undertake a risk assessment	Cross-border communication and sharing	Sharing informs cross-border assessment and action	Consistent cross-border risk management and communication
All functions	Adjustment of outputs to account for different time zones												X	
All functions	Producing outputs that are compatible between Member States (e.g. same model, same units used)												X	
All functions	Producing outputs that are not limited to one Member State's geographical area (e.g. maps that cross borders)												X	

4.1.4.5 Unmet needs in emergency response

One EU-level need was identified by CERACI:

- A rapid-response EU-wide callout service (on the ground within less than two days) for Member States requiring support

Gaps identified by CERACI (unmet needs) are discussed further in Section 4.6.

4.1.4.6 Emergency response resources

The NATO Guidelines for first response to a CBRN incident [21] provide generic advice and guidance on procedures, capabilities and equipment required to implement an effective response; they are aimed at responses to terrorism but can also be applied to civil incidents. Constituting non-binding guidelines and minimum standards to facilitate and improve national responses and mutual assistance, they focus on developing a common understanding of the actions required during the initial response phase (during the first 20 minutes of an incident). The response guidelines are divided into four sections: information gathering, scene management, saving and protecting lives and additional support. Each section lists, in general terms, the procedures, capabilities and equipment required to implement an effective response. In addition, the Commission has produced a framework of essential tasks that EU civil protection modules should be capable of undertaking [22]: this includes monitoring and modelling capabilities for CBRN modules.

An overall view of the steps of emergency response is given by the WHO [4], and the importance of communication is discussed. The document outlines in detail how environmental assessment should be approached; further detail is provided in Australian health service guidance on health risk assessment [7] which presents a general environmental health risk assessment methodology applicable to a range of environmental health hazards. The focus is on chemical hazards in the first instance.

As a product of European-funded projects, a Platform for Exposure Assessment has been developed [23], which aggregates databases, modelling tools and information related to the field of exposure assessment. This is limited as it is not focussed on acute incident scenarios, but information regarding source attribution studies and an online exposure modelling tool are useful resources. External sources are provided in a searchable format: general exposure assessment guidance and a directory of tools, covering prediction of exposure from all media, are particularly useful [24].

Intervention in Chemical Transport Emergencies (ICE) is a co-operative programme, set up to provide in the event of an incident information, practical help and, if necessary and possible, appropriate equipment to the competent emergency authorities by the chemical industry in order to minimise any adverse effects [10]. National ICE schemes exist for many European countries and collaborate across borders; however, it is important to note that their focus is not necessarily on public health, and those at the scene who take advice through an ICE scheme should also seek input from public health professionals.

Information Communication Technology (ICT) systems can be used to collate and present incident information. They can be used by responders to quickly share information between different organisations; this can include exposure assessment information (e.g. monitoring and modelling outputs) and public communications. Task B identified a number of ICT projects that aimed to improve incident management through the development of decision support systems for responding organisations. ICAWEB (Integrale Crisis Advies Website) is one such system used for information exchange within the Netherlands [25]. Incident command systems and communication are discussed in detail by the WHO [4]. The potential of ICT systems to enhance cross-border collaboration is discussed in section 4.1.10.6), together with other examples of existing government-level and responder-level systems.

4.1.5 Observation

'Observers' are people at the scene and wider area affected by an incident who can provide useful information. Within this report, the term is used to describe those who have an active role in making observations that inform risk assessors. In this context, observers can include first responders who gather information at the scene of an incident, medical professionals treating patients affected by chemical exposure, poisons specialists providing advice on clinical management, local agencies receiving complaints from members of the public, news agencies reporting on the incident, and even members of the public uploading photos and videos to social media.

The WHO [4] discusses methods for detecting chemical incidents. These include identifying chemical incidents from notifications by the public or person(s) responsible for a chemical release. There are several methods that can assist with detection of chemical incidents, including training in the recognition of chemical incidents for public health officials, medical professionals, first responders, and members of the community; population health surveillance; and environmental monitoring systems.

4.1.5.1 Requirements of observation

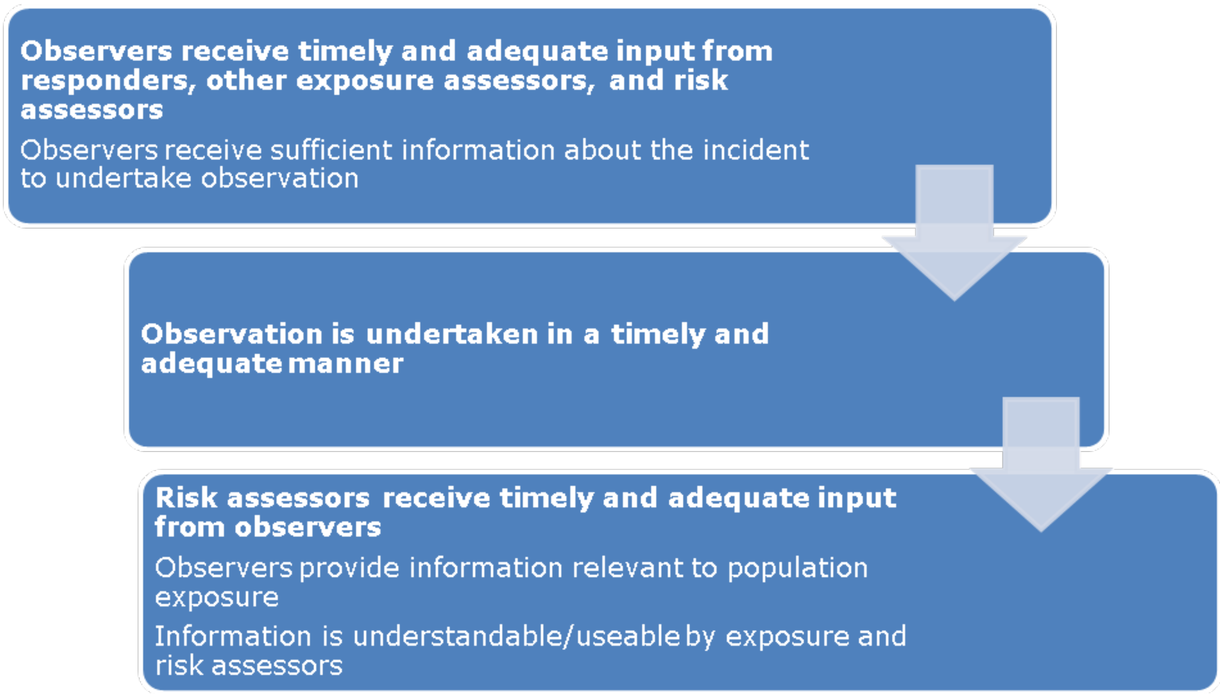
CERACI's basic requirements for an observation function are that:

Observers (e.g. responders) must exist

Observers' outputs must inform risk assessment

4.1.5.2 Outcomes of observation

CERACI's considers that, in order to inform risk assessment:



4.1.5.3 Barriers to observation

CERACI has identified a number of common barriers to effective observation during emergency response:

- The incident scene may be inaccessible because a hazard, such as a vapour or gas cloud has not dispersed (e.g. a source is still present)
- Depending on the chemical, observable health effects can be delayed for hours to days [4]
- Identification of a material on fire can prove very difficult
- Responders have no control or quality assurance over observation that is undertaken by news agencies or the public

4.1.5.4 Good practices in observation

Good practices in observation identified by CERACI are listed in Table 3. The categorisation of these good practices in the table relates them to the outcomes described above, showing which outcomes they can help to meet. Emergency response outcomes are split by input, function, and output, the rationale behind this is described further in Section 4.2.

These good practices focus on the response phase of incidents and are observation-specific additional good practices to those generic good practices in emergency response identified in Section 4.1.4.4. They should be considered alongside the good practices identified in the section on emergency preparedness (4.1.3.4).

Some of these good practices help to meet aims for the emergency preparedness and cross-border phases of incidents and where this is the case it is also indicated.

There are a number of key practices that are of primary importance. These are:

- **Optimising communication, inputs, functions and outputs**

  For observation, this involves the marshalling a number of disparate sources to provide and collate information, such as responders at the scene, poisons centres, and local health services.

- **Observers report the situation and prognosis at the scene**

  Risk assessors require a clear indication of the nature of an incident and its characteristics, ideally directly from the scene. The information provided should be pre-agreed with other responders at the emergency preparedness phase and should be adequate to characterise the incident and potential for exposure so that an initial risk assessment can be carried out: there is a wide scope in terms of information that can be usefully provided to inform a risk assessment.

  It is also important that risk assessors are provided with information from observation in the wider area of an incident:

  - **Risk assessors should receive local surveillance outputs (e.g. information from doctors, hospitals, and agencies who receive complaints)**
  - **Risk assessors should receive national surveillance outputs (e.g. information from poisons centre queries and calls to national telephone advice services)**

Table 3. Good practices in observation

*Good practices identified by CERACI are categorised to show which outcomes they can help to meet: these are listed in the top row. Practices may contribute to preparedness aims, response aims, or cross-border aims, or all three. Key practices are marked by **bold** text.*

Area	**Good practice**	Emergency preparedness			Emergency response							Cross-border		
		Engages stakeholders in emergency preparedness	Maximises exposure assessment capabilities (resources)	Optimises the multi-agency response to incidents	Timely and adequate input	Receive sufficient information to undertake the function	Timely and adequate function	Timely and adequate output	Outputs are representative of exposure	Outputs are understandable & usable	Risk assessors receive sufficient information to undertake a risk assessment	Cross-border communication and sharing	Sharing informs cross-border assessment and action	Consistent cross-border risk management and communication
	Optimising communication, inputs, functions and outputs													
Observation	Using poisons centres to detect events and report health symptoms (e.g. RAS-CHEM)		X				X	X	X	X	X			
Observation	Using specialist chemical-trained first responders (e.g. HAZMAT, HAZMED)		X		X	X	X	X			X			
Observation	**Observers report the situation and prognosis at the scene**						X	X	X					
Observation	Obtaining Material Safety Data Sheets (MSDS) for the chemical(s) concerned				X	X	X	X						
Observation	Describing the place of release (building, contained, open, uncontained)						X	X	X					
Observation	Describing the potentially exposed population (type of building(s), number of people, presence of sensitive receptors)						X	X	X					

Area	Good practice	Emergency preparedness			Emergency response							Cross-border		
		Engages stakeholders in emergency preparedness	Maximises exposure assessment capabilities (resources)	Optimises the multi-agency response to incidents	Timely and adequate input	Receive sufficient information to undertake the function	Timely and adequate function	Timely and adequate output	Outputs are representative of exposure	Outputs are understandable & usable	Risk assessors receive sufficient information to undertake a risk assessment	Cross-border communication and sharing	Sharing informs cross-border assessment and action	Consistent cross-border risk management and communication
Observation	Reporting the distance of receptors from the source of a release						X	X	X					
Observation	Describing other potential receptors of interest (crops, water)						X	X	X					
Observation	Describing the physical properties and behaviour of the source chemical(s)						X	X	X					
Observation	Describing the quantity of chemical(s) involved and/or released						X	X	X					
Observation	Describing meteorological conditions (weather)						X	X	X					
Observation	Describing plume direction and behaviour						X	X	X					
Observation	Observers report exposure information from the incident scene						X	X	X		X			
Observation	Observers report where a release is going and whom it is effecting						X	X	X	X				
Observation	Reporting health effects observed in members of the public or first responders						X	X	X		X			
Observation	Observers report interventions, their scale, and results (e.g. sheltering or evacuation)						X	X		X				

Area	Good practice	Emergency preparedness			Emergency response							Cross-border		
		Engages stakeholders in emergency preparedness	Maximises exposure assessment capabilities (resources)	Optimises the multi-agency response to incidents	Timely and adequate input	Receive sufficient information to undertake the function	Timely and adequate function	Timely and adequate output	Outputs are representative of exposure	Outputs are understandable & usable	Risk assessors receive sufficient information to undertake a risk assessment	Cross-border communication and sharing	Sharing informs cross-border assessment and action	Consistent cross-border risk management and communication
Observation	Observers using toxidromes to identify likely agents when reporting health effects in the initial stages of incidents						X	X	X	X	X			
Observation	Linking toxidrome reporting to information provision to hospitals						X	X	X	X				
Observation	Collecting exposure information from the wider area						X	X	X		X			
Observation	Collecting self-reported health effects (e.g. complaints, calls to government and health services)						X	X	X	X	X			
Observation	Risk assessors receiving direct reports of the situation at the scene							X			X			
Observation	Collation of observation reports from all stakeholders				X	X	X	X	X		X			
Observation	Risk assessors receiving complaint surveillance outputs (e.g. local government, responders)							X	X	X	X			
Observation	**Risk assessors receiving local health surveillance outputs (e.g. doctors, telephone services, hospitals)**							X	X	X	X			
Observation	**Risk assessors receiving national health surveillance outputs (e.g. poisons centre queries)**							X	X	X	X			

Area	Good practice	Emergency preparedness			Emergency response							Cross-border		
		Engages stakeholders in emergency preparedness	Maximises exposure assessment capabilities (resources)	Optimises the multi-agency response to incidents	Timely and adequate input	Receive sufficient information to undertake the function	Timely and adequate function	Timely and adequate output	Outputs are representative of exposure	Outputs are understandable & usable	Risk assessors receive sufficient information to undertake a risk assessment	Cross-border communication and sharing	Sharing informs cross-border assessment and action	Consistent cross-border risk management and communication
Observation	Using social media to gather exposure reports and incident information				X	X	X	X			X			
Observation	Interpreting media and public reports with care (due to potential inaccuracies)							X	X	X				

4.1.5.5 Unmet needs in observation

One EU-level need was identified by CERACI:

- Training of first responders at the scene in the use of toxidromes, so as to be able to provide better characterisation of chemical threats in the early stages of an incident

Gaps identified by CERACI (unmet needs) are discussed further in Section 4.6.

4.1.5.6 Observation resources

The WHO [4] discusses methods for detecting chemical incidents. This includes mention of chemical incident recognition training and a detailed review of health and surveillance and the information sources that may inform risk assessors.

There are various initiatives for the surveillance of social media to utilise information during incidents, such as the "Twitcident" project in the Netherlands [26].

4.1.6 Monitoring

Rapid environmental sampling may enable a determination of the media that have been contaminated, the level of contamination in the media, and the geographical distribution of contamination [4]. Whilst environmental sampling provides an indication of population exposure, direct measurements are the only way to establish unequivocally whether, and to what extent, individuals are exposed to specific environmental agents [6].

The importance of ongoing background monitoring to identify events and provide baseline data is described by the WHO [4], but CERACI is primarily concerned with environmental monitoring during the acute phase of an incident and that is the main focus of this section.

Environmental monitoring programmes should focus on evaluating the concentrations of chemical(s) released (as well as their potential decomposition products) in all of the environmental media that individuals could be exposed to. Specifically, potential contamination of air, water, soil and vegetation should be considered in areas surrounding the release site [4].

Environmental monitoring does not allow prediction of future exposure *per se*, but can provide information on current and past concentrations of a chemical, although this may require field or laboratory analysis. The following information from the iNTeg-Risk (Early Recognition, Monitoring and Integrated Management of Emerging, New Technology Related, Risks) project [27] provides a useful overview of monitoring during acute chemical incidents, from a risk assessors perspective:

"Environmental monitoring in the acute phase of a chemical incident is usually restricted to quick and simple direct reading techniques such as gas detection tubes, Photo Ionisation Detection (PID) and infrared spectroscopy. Under these circumstances the accuracy and validity of the environmental monitoring are limited due to the personnel involved, the available detection and analysis equipment and the time necessary to fit the personnel with appropriate protective equipment to enter the site or the downwind area. While air sampling could be performed quickly, and the analysis and interpretation performed post-hoc, this environmental monitoring strategy has not been applied frequently yet."

The iNTeg-Risk report also discusses the useful application of active sensor networks in acute incidents. These may exist around industrial sites, setup with the capacity to detect specific chemical releases, or they may be ambient air monitoring networks that are setup to monitor common air pollutants. Miniaturisation of sensor technology is making the use of low-cost personal sensors a more feasible option for the future.

4.1.6.1 Requirements of monitoring

CERACI's basic requirements for a monitoring function are that:

Monitoring resources must exist

Monitoring outputs must inform risk assessment

4.1.6.2 Outcomes of monitoring

CERACI considers that, in order to inform risk assessment:

Monitors receive timely and adequate input from responders, other exposure assessors, and risk assessors

Monitors receive sufficient information about the incident to undertake monitoring

Monitoring is undertaken in a timely and adequate manner

Risk assessors receive timely and adequate input from monitors

Outputs are representative of population exposure

Monitoring detects and quantifies the chemicals of interest with adequate sensitivity and frequency

The location and duration of monitoring reflects population exposure

Outputs are understandable/useable by risk assessors

When considering what constitutes "timely" following a sudden outdoor release of gas or vapour, the WHO [4] states that "the first environmental monitoring results will rarely come in before 30–45 minutes following the chemical release." For releases directly to water, soil, or food, the time taken to respond is usually longer: a matter of hours or longer.

4.1.6.3 Barriers to monitoring

CERACI has identified a number of common barriers to effective monitoring during emergency response:

- Following aerosol releases, the contaminated area outdoors can range over kilometres, depending on the type of the event (e.g. explosion), characteristics of the aerosol and environmental conditions [4]
- A common, but not insurmountable, limitation of environmental monitoring is its cost: it is often difficult to avoid high costs associated with environmental sampling [4]
- Sampling close to the source may not accurately represent the exposure of populations further away
- Fixed network locations may not be representative of exposure locations during incidents
- Many measurement techniques involve monitoring equipment that can be influenced by factors such as temperature and humidity (although correction for this may be possible)
- Comparability of field techniques and results varies between organisations
- There may be interferences from the media in which the pollutant is measured (e.g. other contaminants or other sources of the same contaminant)
- The lowest level of a certain contaminant that can reliably be quantified may still be above health criteria values
- Sampling / analysis may be unable to identify all chemicals of interest
- Inappropriate sample collection procedures may yield samples that are not representative of exposure
- Continuous monitoring may be unavailable and sampling results can vary over time
- The time required to deploy and monitor may preclude early risk assessment
- Restrictions on access may limit or prevent the deployment of monitoring resources
- Exposure measurements may not match the actual media, location and duration that represent the human exposure to the chemical of concern
- Lack of training and personal protective equipment to be able to sample in plumes may make sampling in contaminated areas impossible
- Monitoring may use semi-quantitative methodologies, such as detection tubes, that are less useful to risk assessors (as discussed in the Task C report)
- Monitoring may not be carried out after an incident, when this is still required by risk assessors
- Monitoring may not be carried out specifically for human health reasons (e.g. ecological). As a result:
    - The sampling strategy may not be optimal
    - Instrumentation may not be optimal
    - The choice of determinands may not be optimal
    - The scale of analysis may not be optimal

4.1.6.4 Good practices in monitoring

Good practices in monitoring identified by CERACI are listed in Table 4. The categorisation of these good practices in the table relates them to the outcomes described above, showing which outcomes they can help to meet. Emergency response outcomes are split by input, function, and output, the rationale behind this is described further in Section 4.2.

These good practices focus on the response phase of incidents and are monitoring-specific additional good practices to those generic good practices in emergency response identified in Section 4.1.4.4. They should be considered alongside the good practices identified in the section on emergency preparedness (4.1.3.4).

Some of these good practices help to meet aims for the emergency preparedness and cross-border phases of incidents and where this is the case it is also indicated.

There are a number of key practices that are of primary importance. These are:

- **Optimising communication, inputs, functions and outputs**

  For monitoring, this involves early alerting and deployment and the provision of the initial information required to undertake modelling, such as the determinands of interest and monitoring locations.

- **Undertaking monitoring according to an agreed strategy (systematic response plan)**

  There are a range of options for monitoring and sampling and it is important that it is undertaken according to an agreed strategy. Quality assurance and explanation of uncertainty should be integral to a monitoring function. Outputs should be representative of exposure and be comparable to health standards used by risk assessors.

  Due to the time required to undertake monitoring and the limited time available for risk assessment and decision-making in an incident, a good practice approach is:

  - **Undertaking semi-quantitative or quantitative monitoring in the first hour of the incident (e.g. via the emergency services at the scene)**
  - **Deploying more advanced monitoring capabilities to the scene early in the incident (within several hours)**

Table 4. Good practices in monitoring

Good practices identified by CERACI are categorised to show which outcomes they can help to meet: these are listed in the top row. Practices may contribute to preparedness aims, response aims, or cross-border aims, or all three. Key practices are marked by ***bold*** *text.*

		Emergency preparedness			Emergency response							Cross-border		
Area	**Good practice**	Engages stakeholders in emergency preparedness	Maximises exposure assessment capabilities (resources)	Optimises the multi-agency response to incidents	Timely and adequate input	Receive sufficient information to undertake the function	Timely and adequate function	Timely and adequate output	Outputs are representative of exposure	Outputs are understandable & usable	Risk assessors receive sufficient information to undertake a risk assessment	Cross-border communication and sharing	Sharing informs cross-border assessment and action	Consistent cross-border risk management and communication
	Optimising communication, inputs, functions and outputs													
Monitoring	Detection, alerting and notification takes place in the 'golden hour'						X	X			X			
Monitoring	Using fixed networks to collect monitoring information		X				X	X			X			
Monitoring	Using any available ad-hoc resources (e.g. at industrial sites)		X				X	X			X			
Monitoring	**Undertaking monitoring according to an agreed strategy (systematic response plan)**						X	X	X	X	X			
Monitoring	Analysing all the samples at the time of collection for the full range of contaminants that might be encountered						X	X			X			
Monitoring	If cost is an issue - minimising costs through careful sampling strategy design						X							
Monitoring	If cost is an issue - minimising costs by only analysing samples for those contaminants that are of interest						X							

Area	Good practice	Emergency preparedness			Emergency response							Cross-border		
		Engages stakeholders in emergency preparedness	Maximises exposure assessment capabilities (resources)	Optimises the multi-agency response to incidents	Timely and adequate input	Receive sufficient information to undertake the function	Timely and adequate function	Timely and adequate output	Outputs are representative of exposure	Outputs are understandable & usable	Risk assessors receive sufficient information to undertake a risk assessment	Cross-border communication and sharing	Sharing informs cross-border assessment and action	Consistent cross-border risk management and communication
Monitoring	Monitors know the media in which monitoring is required				X	X								
Monitoring	Monitors know the aims and objectives of monitoring				X	X								
Monitoring	Monitors know the locations on which monitoring should focus				X	X								
Monitoring	Monitors know of any incident-specific constraints or requirements				X	X								
Monitoring	Deploying mobile monitoring resources to the area of an incident		X				X	X			X			
Monitoring	Deploying rapid-response monitoring resources in urban areas (e.g. the use of "electronic noses" in Rotterdam, described in Task D)						X	X			X			
Monitoring	**Undertaking semi-quantitative or quantitative monitoring in the first hour of the incident (via emergency services)**						X	X			X			
Monitoring	Sharing data from monitoring undertaken at the scene of an incident for emergency services' occupational purposes with public health risk assessors						X	X		X	X			
Monitoring	**Deploying more advanced monitoring capabilities early in the incident (within several hours)**						X	X	X		X			

Area	Good practice	Emergency preparedness			Emergency response							Cross-border		
		Engages stakeholders in emergency preparedness	Maximises exposure assessment capabilities (resources)	Optimises the multi-agency response to incidents	Timely and adequate input	Receive sufficient information to undertake the function	Timely and adequate function	Timely and adequate output	Outputs are representative of exposure	Outputs are understandable & usable	Risk assessors receive sufficient information to undertake a risk assessment	Cross-border communication and sharing	Sharing informs cross-border assessment and action	Consistent cross-border risk management and communication
Monitoring	Using monitoring methodologies that assess air quality rapidly and continuously						X	X			X			
Monitoring	Collecting quantitative data in preference to qualitative information						X	X	X	X				
Monitoring	Mobile monitoring units crossing borders if required to offer mutual aid											X		
Monitoring	Calling-in commercial contractors to fill gaps in capability (e.g. asbestos monitoring)						X	X			X			
Monitoring	The location and duration of monitoring reflects population exposure						X	X	X		X			
Monitoring	Undertaking monitoring at the sites of sensitive receptors (i.e. people & sheltering areas)						X	X	X	X	X			
Monitoring	Monitoring detects and quantifies the chemicals of interest with adequate sensitivity						X	X	X					
Monitoring	Providing rapid-response laboratory sampling and analysis (e.g. mobile laboratories)		X				X	X			X			
Monitoring	Mobile laboratories crossing borders if required to offer mutual aid											X		
Monitoring	Accessing a national laboratory network for sampling and analysis support		X		X	X	X							

Area	Good practice	Emergency preparedness			Emergency response							Cross-border		
		Engages stakeholders in emergency preparedness	Maximises exposure assessment capabilities (resources)	Optimises the multi-agency response to incidents	Timely and adequate input	Receive sufficient information to undertake the function	Timely and adequate function	Timely and adequate output	Outputs are representative of exposure	Outputs are understandable & usable	Risk assessors receive sufficient information to undertake a risk assessment	Cross-border communication and sharing	Sharing informs cross-border assessment and action	Consistent cross-border risk management and communication
Monitoring	Where analysis is conducted involving separation steps, keeping the time between each consecutive analysis as short as possible to allow a representative exposure profile to be assessed						X	X						
Monitoring	Accessing "reach-back" scientific expertise when monitoring is undertaken by non-specialists on-scene				X	X	X							
Monitoring	Using accepted and standardised approaches to monitoring and laboratory analysis (e.g. accredited methodologies)						X	X	X	X	X			
Monitoring	Quality control procedures to reduce sampling errors (e.g. blanks and duplicate samples)						X	X	X					
Monitoring	Undertaking repeated environmental monitoring						X	X	X					
Monitoring	Monitoring in conjunction with modelling				X	X	X	X	X					
Monitoring	Collecting monitoring results that are comparable to short-term and long-term exposure standards							X		X	X			
Monitoring	High frequency of provision of data (real-time or near real-time)						X	X	X		X			
Monitoring	Providing explanation of accuracy, precision, and levels of detection to risk assessors to aid interpretation							X		X	X			

Area	Good practice	Emergency preparedness			Emergency response							Cross-border		
		Engages stakeholders in emergency preparedness	Maximises exposure assessment capabilities (resources)	Optimises the multi-agency response to incidents	Timely and adequate input	Receive sufficient information to undertake the function	Timely and adequate function	Timely and adequate output	Outputs are representative of exposure	Outputs are understandable & usable	Risk assessors receive sufficient information to undertake a risk assessment	Cross-border communication and sharing	Sharing informs cross-border assessment and action	Consistent cross-border risk management and communication
Monitoring	Carrying out monitoring both during and after an incident						X	X	X					

4.1.6.5 Unmet needs in monitoring

A number of EU-level needs were identified by CERACI:

- Commonly agreed sets of standards and procedures for monitoring during incidents
- An ability to detect “difficult” chemical types, such as those with toxic effects at levels below current levels of detection or those for which robust field and analytical methods of detection do not yet exist
- Adaption of EURDEP [28] for international exchange of chemical incident monitoring data (in addition to radiological data), or use of a comparable international system for data exchange
- An accepted approach to the monitoring of chemical mixtures

Gaps identified by CERACI (unmet needs) are discussed further in Section 4.6.

4.1.6.6 Monitoring resources

The UNEP [6] discusses the measurement of human exposure to chemical contaminants in air, water, food and soil. This includes discussion of sampling methods and strategies, which is also well described in Australian guidance [7], together with further references and appendices which deal with each media (air, water, land, food).

The WHO [4] provides a short discussion of the aims of standard operating protocols for monitoring and the information that they should contain. It details approaches to environmental assessment and explores barriers to undertaking monitoring, discussing how cost considerations may be addressed through changes to sampling approaches.

Quality assurance in sampling is discussed in detail by existing literature [6-7]: this covers quality assurance and quality control for sample measurement and method selection and validation. Standardisation of Laboratory Analytical Methods (SLAM) is a current EU-funded CBRN that is reviewing the needs for European standardisation of CBRN analysis and suggesting a road map for its implementation. The project is anticipated to provide guidelines on sampling and analytical procedures for CBRN releases [29].

The Integrated Assessment of Health Risks of Environmental Stressors in Europe (INTERASE) project includes pertinent reviews of monitoring and modelling data-sources [30]. However, these are not specific to acute chemical incidents. European and international information sources are listed and gaps are discussed. Of particular relevance are the reviews of climate and meteorology, air, water, chemicals, emissions, and exposure factors. Air and water data sources are related to routine data collection and reporting, and useful information is provided regarding national focal points and quality assurance protocols. The water chapter includes an overview of a limited number of Member States’ national water databases and explains how national water quality monitoring results are collected.

4.1.7 Dispersion modelling

The iNTeg-Risk project states that the “single most important advantage of exposure models over exposure measurements is that exposure models can be used to predict future exposure and to estimate exposure where measurements are lacking, if there is sufficient information...” [27]. Models, which are mathematical abstractions of physical reality, may obviate the need for extensive monitoring programmes by providing estimates of population exposures (and doses) that are based on a smaller number of representative measurements [6].

Environmental modelling may enable a determination of the media that have been contaminated, the level of contamination in the media, and the geographical distribution of contamination. Modelling can also be used to identify the populations likely to have been exposed [4].

This section focuses primarily on emissions to air, which are the predominant focus in the majority of acute chemical incident release scenarios. In general, pollutant concentrations in outdoor air are directly proportional to emission strength and inversely proportional to dispersion. The physical relationship (e.g. lateral and vertical distance) between sources and receptors (e.g. vulnerable populations) is also an important factor. Meteorological parameters have an overwhelming influence on the dispersion of contaminants in the lower atmosphere. Among them, wind parameters (direction, velocity, and turbulence) and thermal properties (stability) are the most important [6]. The physicochemical properties of chemicals are also important in determining their dispersion: gas pockets are possible, particularly after the release of a heavy gas [4].

A number of different approaches are available for predicting atmospheric dispersion of material. These range from simple parametric methods to advanced dispersion models and sophisticated methods based on fast data-access to detailed pre-computed solutions [31].

CERACI’s findings corroborate those of iNTeg-Risk [27], which found that crude, non-expensive and fast methods are often used for fast exposure estimates during incidents, with more sophisticated methods that demand more time, information and resources being used in the later stages of ongoing incidents.

4.1.7.1 Requirements of dispersion modelling

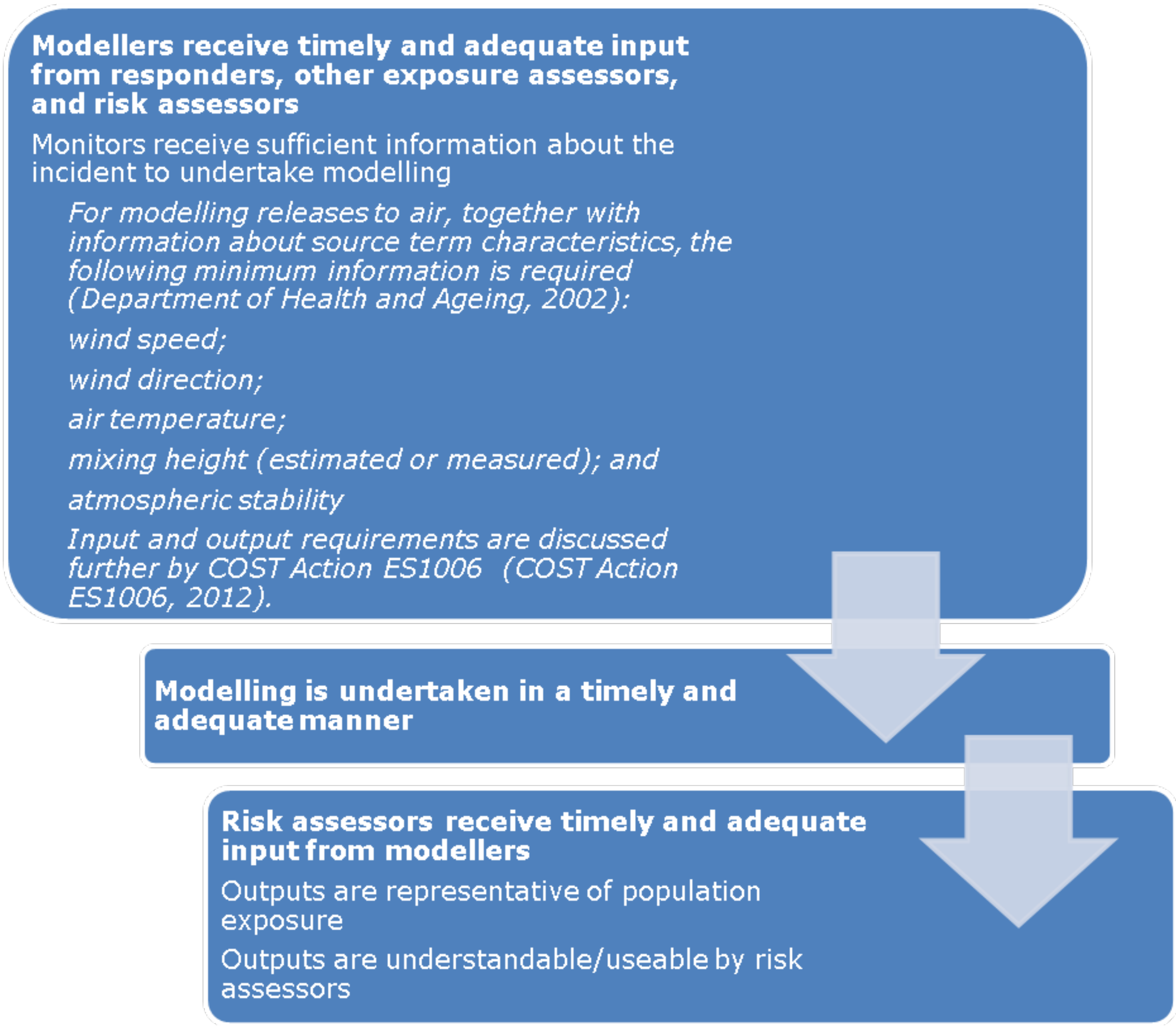
CERACI’s basic requirements for a modelling function are that:

Modelling resources must exist

Modelling outputs must inform risk assessment

4.1.7.2 Outcomes of dispersion modelling

CERACI considers that, in order to inform risk assessment:



4.1.7.3 Barriers to dispersion modelling

CERACI has identified a number of common barriers to effective modelling during emergency response:

- Specialised training and practice is required before people are able to use models
- Responders use many different models, so a variety of different answers can be given to emergency response personnel, depending on the model used [31]
- There are often difficulties obtaining source term information and other information to input into models to be able to produce a timely output
- Many models are general models which may be too simplistic for handling complex situations such as dispersion around hills or buildings (an issue that is considered in detail by COST Action ES1006 [31])
- Models may be unable to account for dense gases, topography, plume buoyancy, deposition, and other factors
- Models require time to run that may not be available during the early stages of an incident when decisions must be made
- Models may not be able to provide outputs of sufficient resolution (e.g. mesoscale models may be unsuitable for local-scale predictions, which again is an issue that is considered in detail by COST Action ES1006 [31])

4.1.7.4 Good practices in dispersion modelling

Good practices in modelling identified by CERACI are listed in Table 5. The categorisation of these good practices in the table relates them to the outcomes described above, showing which outcomes they can help to meet. Emergency response outcomes are split by input, function, and output, the rationale behind this is described further in Section 4.2.

These good practices focus on the response phase of incidents and are modelling-specific additional good practices to those generic good practices in emergency response identified in Section 4.1.4.4. They should be considered alongside the good practices identified in the section on emergency preparedness (4.1.3.4).

Some of these good practices help to meet aims for the emergency preparedness and cross-border phases of incidents and where this is the case it is also indicated.

There are a number of key practices that are of primary importance. These are:

- **Optimising communication, inputs, functions and outputs**

  For modelling, this involves the provision of the source term and environmental information required to undertake modelling, such as, for air, meteorological information and information about the release flux. Models themselves must account for chemical and physical factors that act to affect dispersion and, consequently, exposure. Outputs should be representative of exposure and be comparable to health standards used by risk assessors. It is important to refine model outputs based on information gathered from the scene about chemical behaviour and health effects and on data collected by field monitoring.

  Due to the time required to undertake modelling and the limited time available for risk assessment and decision-making in an incident, a good practice approach is:

  - **Using rapid models to provide timely outputs in the initial stages of an incident (i.e. produced within minutes)**
  - **Carrying out more complex (slower) modelling in the subsequent stages of an incident when more processing time is available**

Table 5. Good practices in modelling

*Good practices identified by CERACI are categorised to show which outcomes they can help to meet: these are listed in the top row. Practices may contribute to preparedness aims, response aims, or cross-border aims, or all three. Key practices are marked by **bold** text.*

		Emergency preparedness			Emergency response							Cross-border		
Area	**Good practice**	Engages stakeholders in emergency preparedness	Maximises exposure assessment capabilities (resources)	Optimises the multi-agency response to incidents	Timely and adequate input	Receive sufficient information to undertake the function	Timely and adequate function	Timely and adequate output	Outputs are representative of exposure	Outputs are understandable & usable	Risk assessors receive sufficient information to undertake a risk assessment	Cross-border communication and sharing	Sharing informs cross-border assessment and action	Consistent cross-border risk management and communication
	Optimising communication, inputs, functions and outputs													
Modelling	Using model output produced as part of emergency preparedness and planning	X	X				X	X			X			
Modelling	For air: providing all responders with ready access to basic plume direction meteorological predictions (e.g. wind direction)		X		X	X	X	X			X			
Modelling	For air: providing dispersion modellers with ready access to meteorological information, expertise and resources		X		X	X	X							
Modelling	Receiving information regarding the source term				X	X								
Modelling	Using plausible assumptions for missing or limited source-term data		X		X	X	X	X			X			
Modelling	Modellers know the media in which modelling is required				X	X								
Modelling	Modellers know the aims and objectives of modelling				X	X								

Area	Good practice	Emergency preparedness			Emergency response							Cross-border		
		Engages stakeholders in emergency preparedness	Maximises exposure assessment capabilities (resources)	Optimises the multi-agency response to incidents	Timely and adequate input	Receive sufficient information to undertake the function	Timely and adequate function	Timely and adequate output	Outputs are representative of exposure	Outputs are understandable & usable	Risk assessors receive sufficient information to undertake a risk assessment	Cross-border communication and sharing	Sharing informs cross-border assessment and action	Consistent cross-border risk management and communication
Modelling	Modellers know the locations on which modelling should focus				X	X								
Modelling	Modellers know of any incident-specific constraints or requirements				X	X								
Modelling	Modellers know the substance(s) released into a given media or involved in a fire				X	X								
Modelling	Modellers know the rate of release				X	X								
Modelling	Modellers know the location (including height) of release				X	X								
Modelling	Modellers know the likely duration of release				X	X								
Modelling	For air: modellers have meteorological information (e.g. wind speed, direction, and effect of weather)				X	X								
Modelling	Modellers have topographical information				X	X								
Modelling	Sharing information using existing modelling platforms (e.g. ENSEMBLE)				X	X	X	X			X	X		
Modelling	Modelling all applicable media (air, water, food, soil)						X	X	X		X			
Modelling	Modelling predicts exposure to the chemical(s) of interest						X	X						

Area	Good practice	Emergency preparedness			Emergency response							Cross-border		
		Engages stakeholders in emergency preparedness	Maximises exposure assessment capabilities (resources)	Optimises the multi-agency response to incidents	Timely and adequate input	Receive sufficient information to undertake the function	Timely and adequate function	Timely and adequate output	Outputs are representative of exposure	Outputs are understandable & usable	Risk assessors receive sufficient information to undertake a risk assessment	Cross-border communication and sharing	Sharing informs cross-border assessment and action	Consistent cross-border risk management and communication
Modelling	**Using rapid models to provide timely outputs in the initial stages of an incident (i.e. produced within minutes)**						X	X			X			
Modelling	For air: using local-scale dispersion models for local effects						X	X			X			
Modelling	For air: using mesoscale dispersion models for longer range effects						X	X			X			
Modelling	Modelling accurately predicts the concentration and duration of exposures at population locations						X	X	X	X	X			
Modelling	Modelling accounts for reactivity and chemical interactions that affect exposure concentrations						X	X	X					
Modelling	Modelling predicts exposure over a range of potentially applicable time periods (exposure periods)						X	X	X	X	X			
Modelling	For air: model accounts for topography						X	X	X					
Modelling	For air: model accounts for complex environments (e.g. urban, aquatic)						X	X	X					
Modelling	Model accounts for dilution and reaction						X	X	X					
Modelling	Model accounts for chemical characteristics (e.g. for air: buoyancy, density)						X	X	X					
Modelling	For air: model accounts for deposition						X	X	X					

Area	Good practice	Emergency preparedness			Emergency response							Cross-border		
		Engages stakeholders in emergency preparedness	Maximises exposure assessment capabilities (resources)	Optimises the multi-agency response to incidents	Timely and adequate input	Receive sufficient information to undertake the function	Timely and adequate function	Timely and adequate output	Outputs are representative of exposure	Outputs are understandable & usable	Risk assessors receive sufficient information to undertake a risk assessment	Cross-border communication and sharing	Sharing informs cross-border assessment and action	Consistent cross-border risk management and communication
Modelling	Model accounts for human behaviour (e.g. sheltering)						X	X	X	X				
Modelling	Model identifies at-risk areas						X	X	X	X				
Modelling	Model describes uncertainties and implications for interpretation						X	X	X	X				
Modelling	Model describes both likely and worst-case scenarios						X	X	X	X				
Modelling	Refining models throughout the course of an incident						X	X	X					
Modelling	Back-calculating exposure predictions based on monitoring data				X	X	X	X	X	X				
Modelling	Refining model predictions based on reports of health effects and complaints (to indicate areas at risk concentration ranges)				X	X	X	X	X	X				
Modelling	**Carrying out more complex (slower) modelling in the later stages of an incident when more time is available**						X	X	X					
Modelling	Routing and collating local modelling outputs through a national organisation							X			X			
Modelling	Using model output issue as an alerting cascade mechanism (e.g. outputs are sent to an email list of responders)			X				X			X			

Area	Good practice	Emergency preparedness			Emergency response							Cross-border		
		Engages stakeholders in emergency preparedness	Maximises exposure assessment capabilities (resources)	Optimises the multi-agency response to incidents	Timely and adequate input	Receive sufficient information to undertake the function	Timely and adequate function	Timely and adequate output	Outputs are representative of exposure	Outputs are understandable & usable	Risk assessors receive sufficient information to undertake a risk assessment	Cross-border communication and sharing	Sharing informs cross-border assessment and action	Consistent cross-border risk management and communication
Modelling	Producing outputs that are compatible with common resources (e.g. Google Maps and Google Earth)						X	X		X			X	
Modelling	Providing outputs as mapping layers (e.g. compatible with GIS mapping systems)						X	X		X				
Modelling	Producing outputs that are harmonised between organisations and Member States						X	X		X			X	X

4.1.7.5 Unmet needs in dispersion modelling

A number of EU-level needs were identified by CERACI:

- Commonly agreed standards and procedures for modelling during incidents [32]
- Models that allow rapid predictions of exposure during incidents, based on typical information that is commonly available during such incidents [32]
- An application to facilitate sharing of modelling outputs using open-source applications like Google Maps and Google Earth (discussed in the Task D report)

Gaps identified by CERACI (unmet needs) are discussed further in Section 4.6.

4.1.7.6 Modelling resources

The INTERASE (Integrated Assessment of Health Risks of Environmental Stressors in Europe) project includes pertinent reviews of monitoring and modelling data-sources [30]. However, these are not specific to acute chemical incidents. European and international information sources are listed and gaps are discussed. Of particular relevance are the reviews of climate and meteorology, air, water, chemicals, emissions, and exposure factors. A list of the European national weather services members of the World Meteorological Organisation is presented together with an explanation of how data is collected and presented. The project website provides links to ongoing International Congresses on Environmental Modelling and Software (iEMSs) [33].

The Integrated Environmental Health Impact Assessment System (IEHIAS) lists release emission factors and scenarios and climate/meteorology data sources and provides limited information on air pollution models that may have both acute and chronic applications [34]. Other European projects such as HEIMTSA (Health and environment integrated methodology and toolbox for scenario assessment), review models for indoor and outdoor air for modelling outdoor (focussed on the global and regional scale) and indoor air pollution in a non-emergency context [35]. The HEIMTSA report includes a global assessment of the state of knowledge in this area and modelling tools and databases.

The UNEP [6] discusses general types of model (statistical, deterministic and practical, or combinations of statistical and deterministic models) single-medium and multi-media modelling. It is not focussed on dispersion modelling *per se*, although it goes on to consider models for outdoor air. It is most useful as an overview of the theoretical derivation and approach of modelling for health risk assessment.

At an introductory level, the Australian Department of Health and Ageing [7] provides simple summary tables that outline:

- Physicochemical properties of chemicals and properties of the atmospheric environment important in transport-fate calculations
- Exposure modelling parameters for point sources (input requirements/data needs and output requirements) – these can be modified to suit incident characteristics rather than industrial point source releases

A European Cooperation in Science and Technology (COST) Action has been undertaken which has developed a database of microscale and macroscale dispersion models [36]; a number of the referenced models can be employed to model acute chemical releases. One aim of the project was to identify the requirements for the unification of Meteorology (MetM) and Atmospheric Chemical Transport (CTM) modelling systems and to propose recommendations for a European strategy for integrated mesoscale modelling capability. The project identified a number of Member State meteorological institutions, contacts and the models used and being developed within these Member States. Two meta-databases were generated: the first is an inventory of mesoscale models [37], subsequently extended by other projects to include micro- and macroscale models, and the second is for model evaluation. Work on the second database, of experiments for validation of mesoscale models, is summarised in published journal articles [38].

ENSEMBLE is a web-based platform for the inter-comparison and evaluation of atmospheric chemistry transport and dispersion models [39]. It has primarily been used for large-scale longer-range incidents. The system was originally developed for the support in case of nuclear emergencies and has evolved over time into a service to any kind of atmospheric model. ENSEMBLE can be used for the inter-comparison and evaluation of models working at scales from local to global, and is capable of handling any number of variables and period of time. The system also allows users to perform on line ensemble analysis. Its objective is to provide effective communication procedures and software tools for reconciliation and harmonisation of disparate national atmospheric modelling predictions and assessments. Its also assists model developers to compare new models with existing ones using the same evaluation standards, cases studies and monitoring data. ENSEMBLE aims to facilitate coherent and harmonised European best estimate forecasts, including qualification of forecast uncertainty. Common agreements, communication protocols and alert procedures are being established for on-line model result exchange and uncertainty interpretation.

A European initiative exists for increased cooperation and standardisation of atmospheric dispersion models for regulatory purposes [40]. The initiative aims to pool and share experiences and to share good practices in modelling. Annual conferences are held, for which proceedings are available online, and the initiative has produced a paper giving practical advice on resources [41]. A central activity, closely related to the conferences, is the distribution of a “Model Validation Kit” for evaluation of atmospheric dispersion models [42]. The Kit is a practical tool intended to serve as a common frame of reference for model performance evaluation in a regulatory setting (dispersion from a single industrial point source, rather than for acute incidents). The initiative’s website also lists related activities and tools: these include collaborative websites and email discussion lists for modellers, together with links to modelling networks, datasets for modelling, databases of models, and tools for model intercomparison.

The iNTeg-Risk project [32] found that a large number of air dispersion models are used in Europe. Frequently used programs are ALOHA, PHAST and Effects. The WHO [4] describes predictive dispersion models that can be used to identify potentially affected populations during chemical incidents. More information about predictive and general purpose models can be obtained from the US EPA [43-44]. An extensive listing is provided by the Office of the Federal Coordinator for Meteorological Services and Supporting Research Directory of Atmospheric Transport and Diffusion Consequence Assessment Models [45] and by the European Topic Centre on Air and Climate Change (ETC/ACC), which has a database that can be searched for models which have specific application during chemical emergencies [46]. The UK Atmospheric Dispersion Modelling Liaison Committee (ADMLC) have published a number of technical reports useful to those working in the field [47], including "Guidelines for Short Range Dispersion Modelling of Releases to Atmosphere from Industrial Sources".

COST Action ES10006 [31] deals specifically with the use of local-scale models during acute incidents. The modelling process and input and output requirements are summarised by the Action's first report, and the document introduces concepts of tools and models, proposing classification and concepts of use (when to use what type of model). Dispersion modelling for emergency planning and response is specifically addressed: the modelling challenges are well described, such as the need for rapid provision of information in crisis situations when little information may be available. The document also considers quality assurance and model improvement, both of which are future work areas of the Action, which is currently active (as of the date of writing).

For releases to water, the WHO Chemical Toolkit describes MODFLOW, which is a public access model that is commonly used to assess the transport and fate of chemicals in aquifers or groundwater [48]. MODFLOW can simulate the flow of groundwater and contaminants therein, including the effects of wells, rivers, streams, drains, evaporation and recharge. A wide range of tools are available for estimating contaminant transport and fate in surface waters; the WHO Guidelines for drinking-water quality provide a useful introduction to such techniques [49].

The US EPA Office of Pollution Prevention and Toxics (OPPT) has developed several exposure assessment methods, databases, and predictive models. These are primarily intended for consumer product and industrial regulatory settings, but some of the models listed may assist when examining the environmental transport and fate of chemicals, particularly in longer-term incidents affecting land or water [50]. More detailed models for ground and surface water and food are described by the US EPA Center for Exposure Assessment Modeling (CEAM), which also provides on-line tools for site assessments [51].

4.1.8 Mapping

'Mappers' are people who can produce physical or software-based maps of an incident location and surrounding areas. Within this report, the term is used to describe those who have an active role in producing maps that inform risk assessors. In this context, mappers can include first responders who use in-vehicle systems to access and modify electronic maps that guide their approaches and decisions at the scene of an incident, and back-office staff who produce and interrogate thematic maps showing detailed information about receptors (e.g. vulnerable populations) that may be exposed. Mapping may be undertaken in isolation, but it is often integrated with other functions of exposure assessment, such as observation or modelling: where model outputs are superimposed onto maps that feature geographical and population-linked information.

Mapping of information is important in allowing spatial relationships between populations and hazards to be examined. It is sometimes considered to be part of modelling, but as it can be undertaken independently it is given according status in this chapter. The use of tools within Geographic Information Systems (GIS) may also allow certain analyses to be undertaken such as shortest path or best path analysis [7], providing more detailed information to risk assessors.

4.1.8.1 Requirements of mapping

CERACI's basic requirements for a mapping function are that:

Mapping resources must exist

Mapping outputs must inform risk assessment

4.1.8.2 Outcomes of mapping

CERACI considers that, in order to inform risk assessment:

Mappers receive timely and adequate input from responders, other exposure assessors, and risk assessors

Mappers receive sufficient information about the incident to undertake mapping

Mapping is undertaken in a timely and adequate manner

Risk assessors and exposure assessors receive timely and adequate input from mappers

Outputs are representative of population locations

Sensitive receptors and populations at risk are mapped and this information can be interrogated and readily extracted

Outputs are understandable/useable by exposure and risk assessors

Mapping outputs are compatible with observations and monitoring and modelling outputs

4.1.8.3 Barriers to mapping

CERACI has identified a number of common barriers to effective mapping during emergency response:

- Lack of in-house mapping software available to responders
- Limited access to data layers containing information about infrastructure and populations

- Out-of-date information and maps
- Geographic information that is not linked to information required by responders (e.g. phone numbers of premises, numerical population estimates etc)

4.1.8.4 Good practices in mapping

Good practices in mapping identified by CERACI are listed in Table 6. The categorisation of these good practices in the table relates them to the outcomes described above, showing which outcomes they can help to meet. Emergency response outcomes are split by input, function, and output, the rationale behind this is described further in Section 4.2.

These good practices focus on the response phase of incidents and are mapping-specific additional good practices to those generic good practices in emergency response identified in Section 4.1.4.4. They should be considered alongside the good practices identified in the section on emergency preparedness (4.1.3.4).

Some of these good practices help to meet aims for the emergency preparedness and cross-border phases of incidents and where this is the case it is also indicated.

There are a number of key practices that are of primary importance. These are:

- **Optimising communication, inputs, functions and outputs**

  For mapping, this involves the sharing of mapping data-layers between responders and the inclusion of information related to both hazards and receptors within mapping outputs. Mapping outputs should be tailored to provide information that supports risk assessment, identifying population characteristics and other information that is important to decision-makers.

- **Ensuring mapping outputs are compatible with observations and monitoring and modelling outputs**

  It is vitally important that mapping outputs are able to incorporate and display outputs from other functions, such as observed symptoms and complaints at and around an incident scene, and the outputs from models which display features such as plume and hazard "at risk" areas.

Table 6. Good practices in mapping

Good practices identified by CERACI are categorised to show which outcomes they can help to meet: these are listed in the top row. Practices may contribute to preparedness aims, response aims, or cross-border aims, or all three. Key practices are marked by ***bold*** *text.*

Area	Good practice	Emergency preparedness			Emergency response							Cross-border		
		Engages stakeholders in emergency preparedness	Maximises exposure assessment capabilities (resources)	Optimises the multi-agency response to incidents	Timely and adequate input	Receive sufficient information to undertake the function	Timely and adequate function	Timely and adequate output	Outputs are representative of exposure	Outputs are understandable & usable	Risk assessors receive sufficient information to undertake a risk assessment	Cross-border communication and sharing	Sharing informs cross-border assessment and action	Consistent cross-border risk management and communication
	Optimising communication, inputs, functions and outputs													
Mapping	Using central sources of data (e.g. Czech central data warehouse)				X	X								
Mapping	Providing access to multiple receptor layers (e.g. land use, population size, population type, vulnerable zones)		X		X	X								
Mapping	Sharing of data layers between responding organisations		X	X	X	X						X		
Mapping	Providing an EU-level rapid mapping service (e.g. SAFER [52])		X					X			X			
Mapping	Providing thematic products with risk-specific information (e.g. SAFER [52])						X	X	X	X				
Mapping	Mapping of both hazards and receptors						X	X		X				
Mapping	Mapping of sensitive receptors and facilities (e.g. hospitals, nursing homes)						X	X		X				
Mapping	Mapping of public complaints and symptoms						X	X	X	X				

Area	Good practice	Emergency preparedness: Engages stakeholders in emergency preparedness	Emergency preparedness: Maximises exposure assessment capabilities (resources)	Emergency preparedness: Optimises the multi-agency response to incidents	Emergency response: Timely and adequate input	Emergency response: Receive sufficient information to undertake the function	Emergency response: Timely and adequate function	Emergency response: Timely and adequate output	Emergency response: Outputs are representative of exposure	Emergency response: Outputs are understandable & usable	Emergency response: Risk assessors receive sufficient information to undertake a risk assessment	Cross-border: Cross-border communication and sharing	Cross-border: Sharing informs cross-border assessment and action	Cross-border: Consistent cross-border risk management and communication
Mapping	Providing information about land-use						X	X		X				
Mapping	Providing information about population size						X	X		X				
Mapping	Providing information about population characteristics						X	X		X				
Mapping	Mapping across different Member States' coordinate reference systems												X	
Mapping	**Ensuring mapping outputs are compatible with observations and monitoring and modelling outputs**						X	X		X				
Mapping	Presenting other exposure assessment information using mapping outputs (e.g. monitoring and modelling)						X	X	X	X	X			
Mapping	Ensuring mapping information can be interrogated and readily extracted (e.g. as data)						X	X		X	X			

4.1.8.5 Unmet needs in mapping

A number of EU-level needs were identified by CERACI:

- Commonly agreed standards and procedures for mapping during incidents (and a common use of symbols)
- Collated maps with all stakeholders' information i.e. aggregated data layers with all responder information added
- Collated maps showing information on all sides of a border

Gaps identified by CERACI (unmet needs) are discussed further in Section 4.6.

4.1.8.6 Mapping resources

Australian health service guidance [7] provides an introductory overview of mapping of data and the use of GIS in incidents.

Under the GMES initiative (Global Monitoring for Environment and Security), the GMES Emergency Response Service provides a reactive cartographic service to registered users involved in the management of humanitarian crisis, natural disasters and man-made emergency situations with thematic user-customisable maps that derived from satellite images [52].

4.1.9 Risk assessment

The WHO defines an assessment of risk to human health as “the process to characterize the nature and probability of adverse effects on the health of humans who may be exposed to chemicals in contaminated environmental media, now or in the future” [4]. Risk assessment is considered to be a four-step process, as described in Chapter 2 earlier in this report.

To offer advice about health protection, public health risk assessors require information about the incident characteristics such as the type and amount of chemical released, the likely exposure pathways and characteristics of exposure, and information from databases about the type, frequency and severity of the health effects of the chemical, as well as information about the exposure levels at which effects might be observed.

4.1.9.1 Requirements of risk assessment

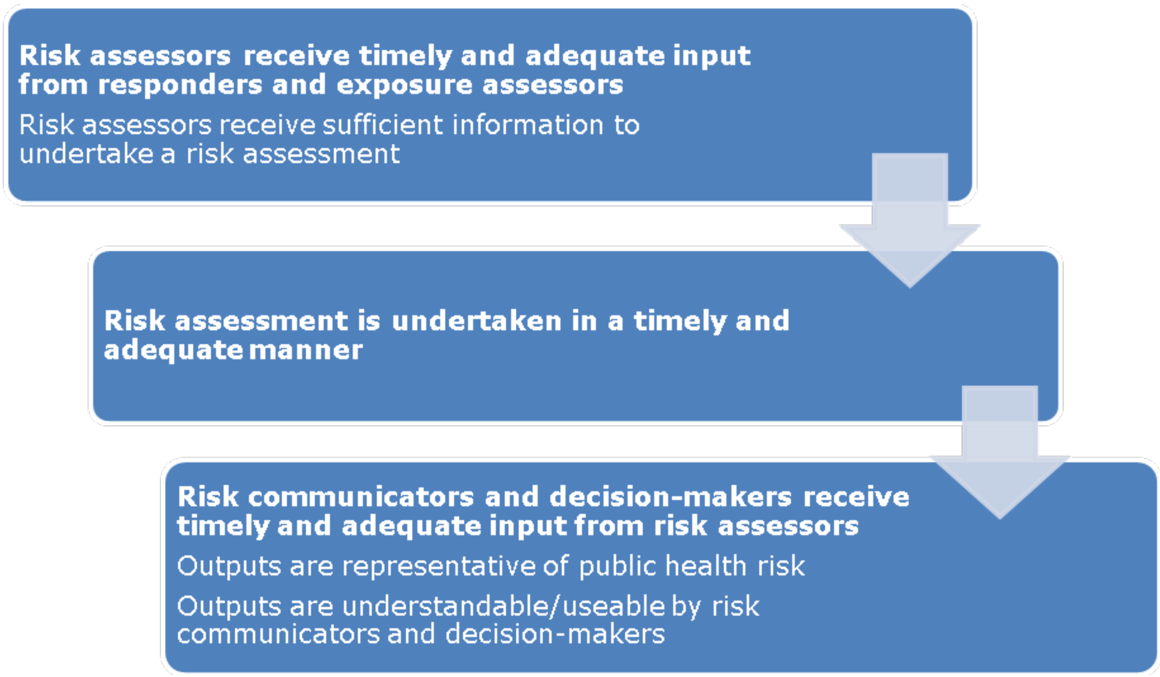
CERACI’s basic requirements for a risk assessment function are that:

Risk assessors must exist

Risk assessment must inform risk communication and decision-making

4.1.9.2 Outcomes of risk assessment

CERACI considers that, in order to inform risk communication and decision-making:



4.1.9.3 Barriers to risk assessment

CERACI has identified a number of common barriers to effective risk assessment during emergency response:

- Uncertainties in exposure assessment inputs and outputs exist but are not characterised
- Exposure assessment data and outputs may not be shared with public health risk assessors
- Member States may not have one organisation with a clear responsibility for public health risk assessment
- There may be no one lead organisation for the provision of advice to the public
- Risk assessment may be undertaken by multiple organisations at multiple levels
- There may be difficulties accessing toxicological advice or in the availability of toxicological information for a given chemical (characterising dose-response)
- Risk assessors may not have information regarding affected populations and their characteristics
- There may be language barriers in terms of the technical language and terminology used by exposure assessors in their communications with risk assessors

The implications of different types of incident (i.e. sudden releases of gases, sudden releases of aerosols; releases to contact media (such as water; fires; and explosions) for risk assessment are discussed by the WHO [4]. Each presents different issues for health risk assessment: e.g. for a sudden evident outdoor release of an aerosol, usually information about the composition of the emitted material and the particle size distribution is unavailable in the acute stage. Quantitative assessment of exposure with modelling and monitoring is very difficult; usually exposure is assessed by visual determination in the contaminated area.

4.1.9.4 Good practices in risk assessment

The focus of CERACI is on exposure assessment, rather than risk assessment, and the project did not set out to find good practices in risk assessment *per se*. The preceding sections identify good practices in emergency preparedness and exposure assessment response functions that can help ensure that outputs provided to risk assessors are 'timely and adequate'. As exposure and risk assessment are interlinked, the project found several good practices that are particular to risk assessment.

Preparedness

- Including public health risk assessors in training and exercising events organised by first responders
- Including the topics of public health risk assessment, risk management, and risk communication in training, exercising and plan preparation for chemical incident response
- Agreeing public health risk assessors' approaches to communication and decision-making if contradictory inputs are received during incidents

Response

- Having public health risk assessors available for a 24/7 response to acute incidents
- Using standardised/common approaches to public health risk assessment, for example:
    - o Using readily available acute exposure reference values such as Acute Exposure Guideline Levels (AEGLs)
    - o Using WHO-endorsed tolerable daily intakes when assessing risk from chemicals in water and food
- Joint issuing of public information by cross-border partners (i.e. one communications channel with the same message)

4.1.9.5 Unmet needs in risk assessment

A number of EU-level needs were identified by CERACI:

- An accepted approach is required for risk assessment of mixtures of chemicals in acute incidents [27, 32]
- An accepted approach is required for chemicals for which no established health criteria values exist [27]
- Harmonisation of the existing derivation and uses of acute guideline levels is required for emergency response [27, 32, 53]

Gaps identified by CERACI (unmet needs) are discussed further in Section 4.6.

4.1.9.6 Risk assessment resources

Possible sources of information to support the rapid assessment of health risks are described by the WHO [4], together with information regarding the application of exposure guidelines such as Acute Exposure Guideline Levels (AEGLs) [54]. The WHO Chemical Toolkit [1] includes a section on international risk assessment resources, and this includes a section on harmonisation of methodologies.

The appraisal and interpretation of environmental assessments is discussed in a useful chapter of Australian guidance [7]. Separate appendices in this document consider risk assessment in different media (air, water, land, food).

There are ongoing projects intended to improve the provision of chemical information to risk assessors within Member States and networking between them (such as the DG SANCO Chemical and Radiation Risk Assessment Network (CARRA-NET) [55] and Chemical & radiation inventory of public health measures & medical countermeasures (CARIMEC) projects). The use of common reference materials aids harmonisation by ensuring that different countries' risk assessments are based on similar hazard information and advice.

The WHO has produced a manual for the rapid risk assessment of acute public health events [56]. This complements the WHO Chemical Toolkit [1] and is aimed primarily at national departments with health-protection responsibilities, National Focal Points (NFPs) for the International Heath Regulations (IHR) [16] and WHO staff. It is intended to assist rapid and defensible decision-making about acute public health events that pose a risk to human health through application of a systematic process from event detection and risk assessment to communication with key stakeholders and the public.

4.1.10 Cross-border emergency preparedness and response

The information in earlier sections applies to chemical preparedness and response, whether or not the incident itself is cross-border. This section presents requirements for, outcomes of, and good practices in cross-border preparedness and response. Whilst many of these good practices are also listed within earlier discussions, those that are particularly relevant to cross-border incidents are presented all together in this section. This gives a broad overview of cross-border work, which is particularly valuable when considering mutual aid.

4.1.10.1 Requirements of cross-border emergency preparedness and response

CERACI's basic requirements for cross-border collaboration are that:

Exposure assessment inputs and outputs must be cross-border

Risk assessment inputs and outputs must be cross-border

4.1.10.2 Outcomes of cross-border emergency preparedness and response

As discussed in the Task D report, in terms of collaboration, it is important that Member States, and the organisations within them, understand their counterparts' structures and roles and responsibilities, and how they relate to their own. The outcomes of emergency preparedness and response outlined in Sections 4.1.1-4.1.9 also apply to cross-border situations.

Additionally, for cross-border collaboration, CERACI considers that:

Exposure and risk assessors readily communicate with counterparts across borders and share resources, outputs and assessments in a timely manner

Shared resources, outputs and assessments inform exposure assessment, public health risk assessment and decision-making on all sides of the border

Risk management and communication is consistent on all sides of the border, with a commonly accepted risk assessment and public messages

4.1.10.3 Barriers to cross-border emergency preparedness and response

CERACI has identified a number of common barriers to effective cross-border collaboration during emergency response:

- Responders may have little experience of cross-border incidents (in cases where there have been a limited number of cross-border incidents there may be less focus and investment in cross-border emergency preparedness)
- There may be insufficient emergency preparedness, including a lack of testing of communication or joint training and exercising
- There may be a lack of formal arrangements at national or local responder level for cross-border collaboration and mutual aid
- There may be a lack of understanding of neighbours' response structures and incident procedures
- There may be a lack of contacts across borders i.e. responders do not know whom to contact in other Member States
- There may be a lack of communication and information sharing across borders
- Language differences (compounded by the use of technical language) can impair communication and joint working
- Unfamiliarity with neighbouring regions' capabilities may mean that responders do not know that mutual aid may be available
- Resource mobilisation may be too slow to assist neighbouring Member States
- Resources may not be able to cross borders (e.g. due to administrative or geographical barriers)
- There may be different scientific approaches used by those carrying out exposure assessment functions in each Member State, which inhibit collaboration
- Comparability of monitoring and modelling outputs can be poor
- One Member State's outputs may not be validated, or seen as validated, by other Member States
- GIS systems may not contain information regarding receptors that are in neighbouring countries (e.g. vulnerable populations)
- Public health risk assessors may use different standards to judge risk (e.g. differing national standards may exist) [53]

4.1.10.4 Good practices in cross-border emergency preparedness and response

Good practices identified by CERACI in cross-border responses are identified in each of the tables of preceding sections, and they are not duplicated in full here, although key practices are listed. This is because cross-border good practices are part of wider emergency preparedness and emergency response functions for exposure assessment in chemical incidents.

There are a number of good practices that are of particular relevance to cross-border emergency preparedness and response. These are:

Preparedness

- Interagency training and exercising should include cross-border aspects and incorporate attempts to harmonise neighbours' responses
- Liaison officers can be trained to assist in cross-border communication (particularly so when they are able to provide translation services when countries have different languages)
- Preparedness materials should account for differences in approach, resources, and language (in order to be as accessible as possible). The adoption of standard terminologies and coding may assist in simplifying communication
- Focal points and defined links for emergencies should be provided for cross-border incidents
- Bilateral or multilateral agreements should be underpinned by detailed local and regional arrangements specifying protocols, procedures, and defined actions, which should include alerting arrangements
- Systems for sharing resources and communicating should be developed between neighbours. These should include administrative arrangements for moving equipment and personnel over borders
- Procedures and resources should be harmonised where possible so that neighbours are better able to work together
- Consistent approaches should be agreed for risk management and communication to ensure that there is no conflict in public messages and advice in the event of incidents, with contingencies in place for this eventuality
- Response plans should be prepared for common cross-border risks and shared between neighbours. Such plans should specify contact points and response details. For Seveso installations close to border areas, their mandated emergency plans should address the possibility of a cross-border response involving neighbour Member States
- Debriefing after incidents, implementation of follow-up actions and sharing of databases and information should occur across borders i.e. include responders from both sides of the border after a cross-border incident has occurred

Response

- Alerting should include international channels, with procedures for alerting neighbours and maintaining communication throughout an incident
- There should be links across borders both at national focal point level and at the responder level

- The use of checklists, pre-prepared material, and common approaches should take place at the response phase, supported by prior cross-border emergency preparedness work
- Resources should cross borders to provide assistance, where requested
- Sharing of information should take place between all those involved in exposure assessment, and particularly between those counterparts who undertake similar functions (e.g. modellers should talk to one another and compare outputs, mappers should share data layers)
- Outputs should be useable on both sides of borders, provided in a commonly-understood format that informs risk assessment (e.g. maps and modelling predictions which include both neighbours' areas)
- Common approaches should be taken to risk assessment and communication, with a sustained dialogue between those managing the incident on both sides of the border

4.1.10.5 Unmet needs in cross-border emergency preparedness and response

A number of EU-level needs were identified by CERACI:

- An EU Crisis or Emergency Cooperation Centre for all stakeholders that need to share cross-border incident response information and/or coordinate decisions (a CERACI Task D workshop delegate suggested a chemical version of the European Community Urgent Radiological Information Exchange (ECURIE) network)
- Regional and local cross-border networks for information sharing during incidents
- Cross-border focal points to facilitate shared decision-making and risk communication
- EU-wide standardised health criteria values (as discussed above in Section 4.1.9.5)

Gaps identified by CERACI (unmet needs) are discussed further in Section 4.6.

4.1.10.6 Cross-border emergency preparedness and response resources

The WHO [4] discusses the importance of establishing lines of communication with neighbouring countries and other potentially affected countries as part of emergency preparedness in detail. Resources for emergency preparedness, and the individual functions of exposure assessment, are as described in previous sections: these are also relevant in the cross-border context to improve preparedness and response.

In the context of mutual aid, the Joint UNEP/OCHA Environment Unit has published "Guidelines for Environmental Assessment Following Chemical Emergencies" [57]. This is designed as a set of practical guidelines that can be used as an emergency assessment tool to enable competent national authorities and/or international experts to gather the necessary data on-site, for onwards transmission to the Joint UNEP/OCHA Environment Unit by national focal points when they are requesting assistance and/or notifying major incidents. It considers all compartments (air, water, plants, and animals), indicating what might constitute a major environmental impact, and summarises information requirements in a questionnaire.

CERACI workshop delegates identified several frameworks for alerting and notification, such as the WHO International Health Regulations [16], the EU DG ECHO Monitoring and Information Centre (MIC) [58], the European Community Urgent Radiological Information

Exchange (ECURIE) [59], the Rapid Alerting System for Food and Feed (RASFF) [60], Rapid Alerting System used for exchanging information on health threats due to deliberate release of chemical, biological and radio-nuclear agents (RAS BICHAT), the Rapid Alerting System for Chemical Health Threats (RAS CHEM) [61] and the UNECE Industrial Accident Notification (IAN) system [62].

The potential of ICT systems to enhance cross-border collaboration is discussed in section 4.1.10.6), together with other examples of existing systems.

4.2 Self-assessment tool

Whilst a substantial body of information has been gathered in the CERACI Task B-D reports about individual Member States' exposure assessment capabilities and cross-border working, the project findings are not definitive. A self-assessment tool is proposed, which can be used at an organisational, local, regional, national or international level to assess exposure assessment capabilities, communication and collaboration across borders, and to direct emergency preparedness work in order to improve exposure assessment during incident response. The tool presents this information diagrammatically. Worked examples of its application are provided in Section 4.2.2.

The tool can be used to assess and visualise:

- Exposure assessment at local, regional, national and international levels
- Exposure assessment capabilities of individual organisations
- Cross-border exposure assessment within and between Member States at any level
- Functions of exposure assessment at an overview level (e.g. monitoring or modelling in its entirety) or further broken down by media (air, water, food, land)

Whilst the visualisation of communication and information exchange provided by the tool is useful to responders, the tool is for use in the emergency preparedness phase to improve response and is not intended for use during response itself.

4.2.1 Assessing exposure assessment in incident response

The self-assessment tool examines what happens during the **response to an incident**. Sections 4.1.9 present requirements and outcomes in each functional group of exposure assessment and risk assessment and illustrate the inherent importance of communication between collaborators during incidents. The tool identifies where inputs to a function, the function itself, or outputs from the function could be improved during an incident, by judging whether the exposure assessment outcomes listed in those sections are met.

The essential outcomes of effective emergency response are that exposure assessment inputs, functions, and outputs are all 'timely and adequate'.

Judging whether exposure assessment functions are timely and adequate during a chemical incident requires consideration by **both** exposure assessors and risk assessors. The terms 'exposure assessor' and 'risk assessor', within CERACI's context, are defined earlier in this report in Figure 3 in Section 4.1.1.

Exposure assessors are experts in their exposure assessment functions. They are best placed to judge whether they receive the inputs that they require and whether, in their position as technical experts, they consider that their products are scientifically and technically sound. This judgement is based upon their understanding of minimum requirements and best techniques, and it is informed by industry standards and technical guidelines. These vary according to the many sub-disciplines of exposure assessment: for example, standards for field monitoring are not the same as those for laboratory analysis, models and approaches vary between water modellers and food modellers, and within air modelling approaches to mesoscale and microscale models differ.

COST Action ES1006 [63] is one example of a network of experts who are developing specific standards for a sub-discipline of exposure assessment. The Action seeks to develop a commonly accepted approach to verify and validate local-scale dispersion models; this methodology can then be used to examine the advantages and limitations of individual model approaches. This knowledge allows specialists to choose a suitable model for the circumstances that they are asked to model. This Action illustrates the point that exposure assessors are best placed to decide what constitutes 'timely and adequate': here modellers consider inputs to their function and how the function can best be carried out, with comparison to standards that have been developed by experts in the discipline. CERACI has identified a number of other such specialist groups that are undertaking similar work to harmonise and standardise their disciplines [29, 39-40, 64-65].

Assuming that exposure assessors first consider that their outputs are produced in a timely and adequate manner, the ultimate 'timeliness and adequacy' of the exposure assessment outputs should then be judged by the risk assessor (i.e. the person receiving the information). Do they get what they need to inform a complete risk assessment? The opinion of the risk assessor may be quite different from the exposure assessor: whilst a modeller may be content with the mathematical basis and conclusions of their model predictions, the risk assessor may not receive the information in time for it to inform their risk assessment, or the output format or content may mean that they are unable to make use of the information.

In undertaking self-assessment, it is important to maintain a holistic view and to foster a dialogue between exposure and risk assessors so that discussion can lead to a common understanding of what is timely and adequate, particularly in cases where there is initial disagreement, which indicates that further preparedness work is required.

Figure 4 below presents a diagrammatic representation of this process. First, the scope of the assessment is decided. Because judgements can differ according to the type of incident, it is best to concentrate on one media at a time e.g. conducting separate assessments for chemical incidents that affect air, water, food, and land.

If there is no function (i.e. no resource), then there is no input to it or output from it. If there is an exposure assessment function, the exposure assessors that carry it out judge inputs. These may be absent, they may occur but they are not judged 'timely and adequate', or they may be judged 'timely and adequate'. This may vary between incidents and according to different incident scenarios. This is unavoidable and exposure assessors should take a general view based on what normally happens during incident response.

The exposure assessors then judge the function itself. It may not be undertaken, it may be undertaken but it is not judged to be ‘timely and adequate’, or it may be judged ‘timely and adequate’.

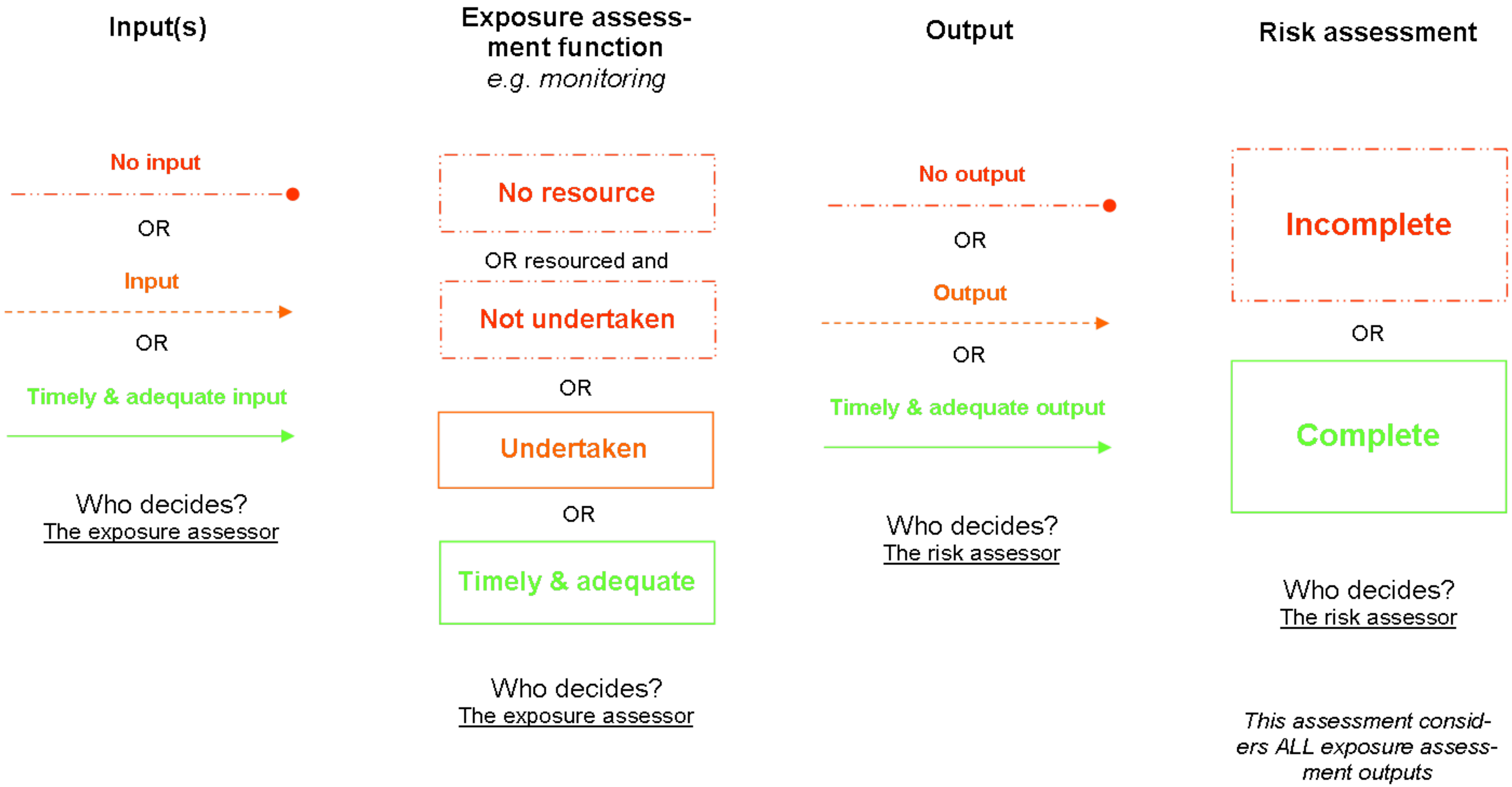
The risk assessors then judge the outputs from the function. They may not receive the outputs, they may receive them but they do not judge them to be ‘timely and adequate’, or they may receive them and judge them to be ‘timely and adequate’.

Ultimately, a risk assessor should also consider their risk assessment as a whole. Their risk assessment will be informed by outputs from a number of different functions of risk assessment (e.g. monitoring, modelling and observation); once they have received this information they may judge their risk assessment to be incomplete (i.e. they require further information) or they may judge it to be complete (i.e. they have sufficient confidence in the evidence-base behind their risk assessment).

A risk assessor could judge their risk assessment to be acceptable even though there may be some exposure assessment outputs that they are not entirely happy with. If the risk assessment is judged to be incomplete then there is reason to examine the process as a whole to determine what critical information is missing; in this case, improvement is most urgent. It is also fair to argue that risk assessment is never “complete” during an active incident. Risk assessors should take a general view and consider what normally happens during incident response and whether, after looking at an incident in its entirety, they consider the risk assessment process to have been satisfactorily informed.

It is worth noting that this process can apply to any form of incident in which exposure and risk assessment is carried out. For the purposes of CERACI, it is focussed on public health risk assessment. Equally, it could be applied to risk assessments with other aims, such as those judging environmental or ecological impacts.

Figure 4. Judging exposure assessment inputs, functions, and outputs



4.2.2 Worked examples

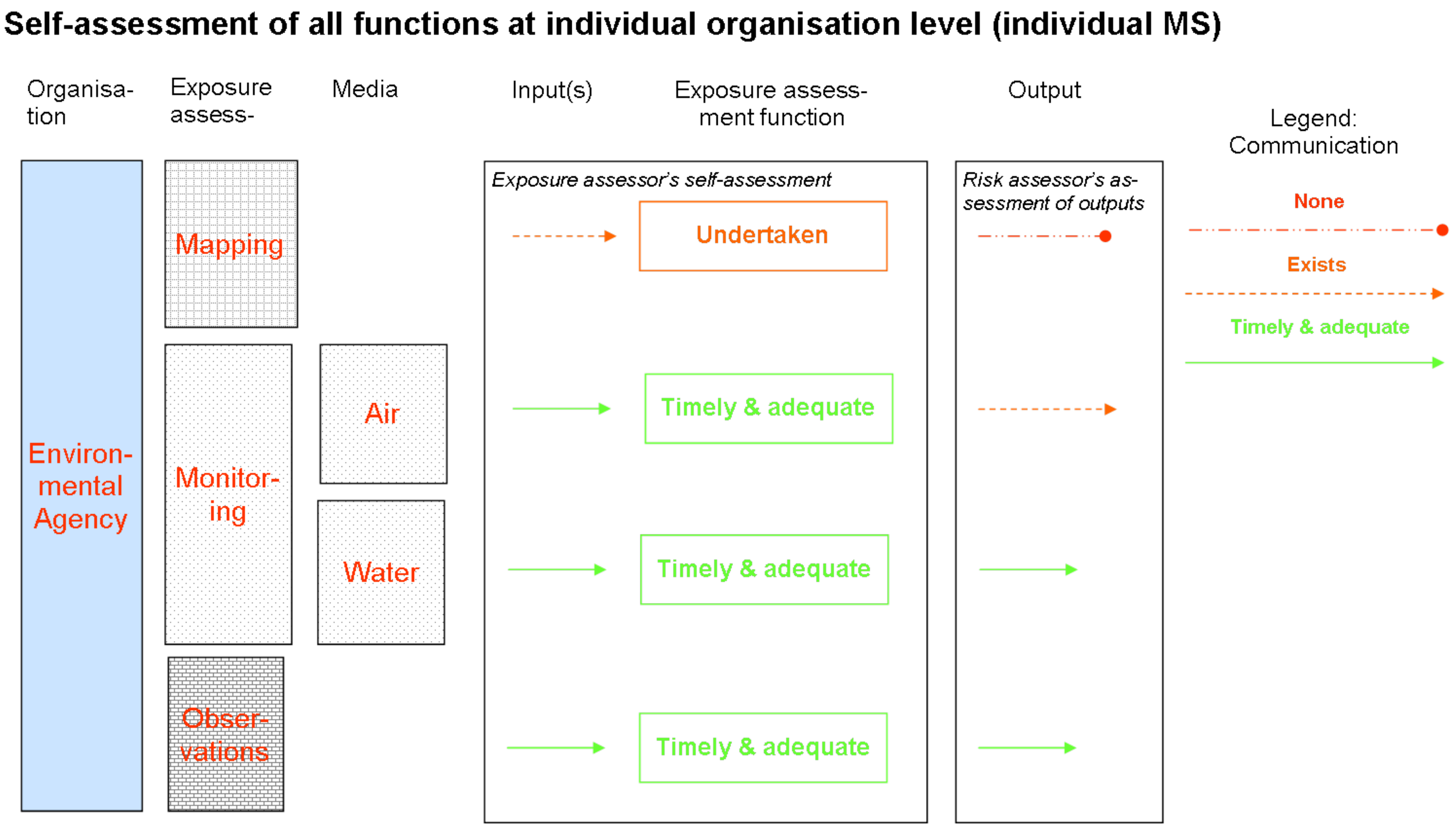
4.2.2.1 Self-assessment at an individual organisation's level

Self-assessment can be carried out by an organisation involved in incident response. In the example given in Figure 5 below an environmental agency has a remit that includes on-scene observations, monitoring of air and water, and mapping. Exposure assessors working for the environmental agency consider that they do receive timely and adequate inputs to their observation and monitoring functions, and that they carry them out in a timely and adequate manner, during chemical incidents. They recognise that the inputs to their mapping function, and the function itself, are not timely and adequate. There is room for further work to improve the inputs to the mapping function and to improve the function itself, depending on the reasons for their judgement: it may be that the environmental agency does not hold sufficient data layers or that mappers in the office do not receive the information about an incident location that they need from observers at the scene to be able to map the incident.

Public health risk assessors, in a different organisation, consider the outputs that they typically receive from the environmental agency during an incident. They consider the outputs from the observation and water monitoring functions to be timely and adequate. They do not receive mapping outputs from the environmental agency at all. They do not consider the air monitoring outputs that they receive to be timely and adequate: this could be because it takes too long to receive them during an incident, or because the format of the data means that they are unable to easily interpret it.

The process shows where the environmental agency's capabilities in exposure assessment lie, and identifies where further preparedness work could help to improve its functions, and their contribution to public health risk assessment.

Figure 5. Self assessment of all functions at individual organisation level



4.2.2.2 Self-assessment between organisations

In the next example, shown by Figure 6 below, a group of organisations that undertake a common function, in this case, monitoring of air, have undertaken self-assessment and have examined the interactions between themselves. They could do this at the local level, or it may be part of a regional or national assessment.

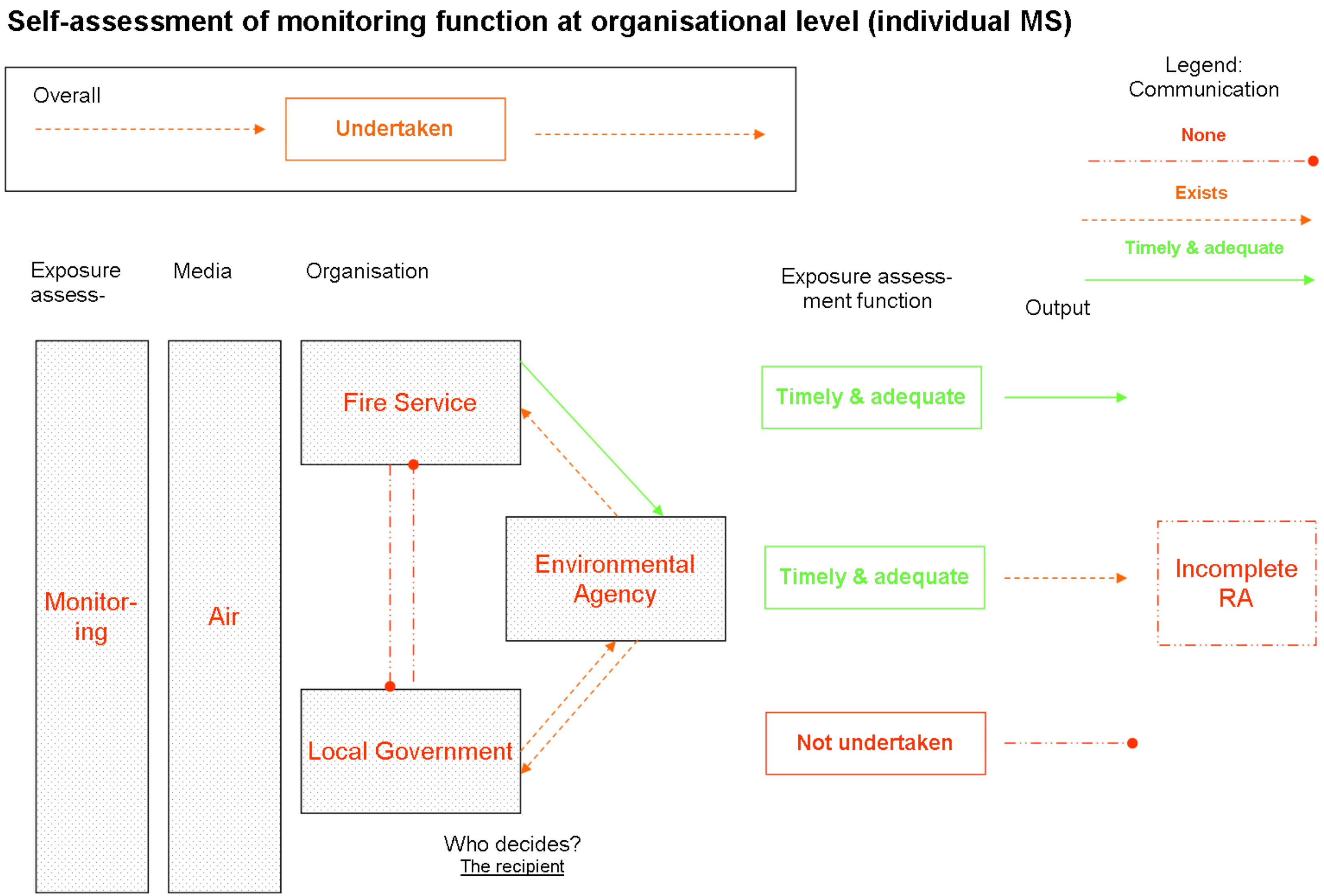
The fire service and the local government do not communicate with one another: each has no input from the other. The exposure assessors at the fire service receive inputs from the environmental agency, but they are not timely and adequate; the exposure assessors at the environmental agency are content with the information that they receive from the fire service: it is timely and adequate. The environmental agency and the local government do communicate, but neither judges the inputs that they receive from the other to be timely and adequate.

Each of the organisations considers the function itself. Both the fire service and the environmental agency consider that the monitoring that they do is timely and adequate. Local government does not undertake any monitoring during incidents: this could be because they receive insufficient inputs from the other organisations, or because they do not have the plans and procedures for monitoring during incidents.

Risk assessors at the public health organisation consider the outputs from the fire service air monitoring team to be timely and adequate. They receive outputs from the environmental agency but they do not consider them to be timely and adequate. Overall their risk assessment is judged to be incomplete: more preparedness work may be necessary to improve the outputs received from the environmental agency, or to improve communication between the agencies conducting monitoring; particularly local government, which has a monitoring resource that is not employed during incidents.

If these organisations are the only ones involved in monitoring of air, their self-assessments can be aggregated to give an overall assessment of the area's capabilities for monitoring of air: this could be done at a local, regional or national scale. In this case the overall assessment of monitoring of air would be that there are inputs, the function takes place, and risk assessors receive the outputs, but that no one part of the aggregated process is 'timely and adequate': even though some individual organisations may need to do very little (e.g. functions and outputs from the fire service air monitoring team may be timely and adequate), overall more needs to be done so that a complete risk assessment can be undertaken.

Figure 6. Self-assessment of monitoring function at organisational level



4.2.2.3 Self-assessment of an exposure assessment function at a national level

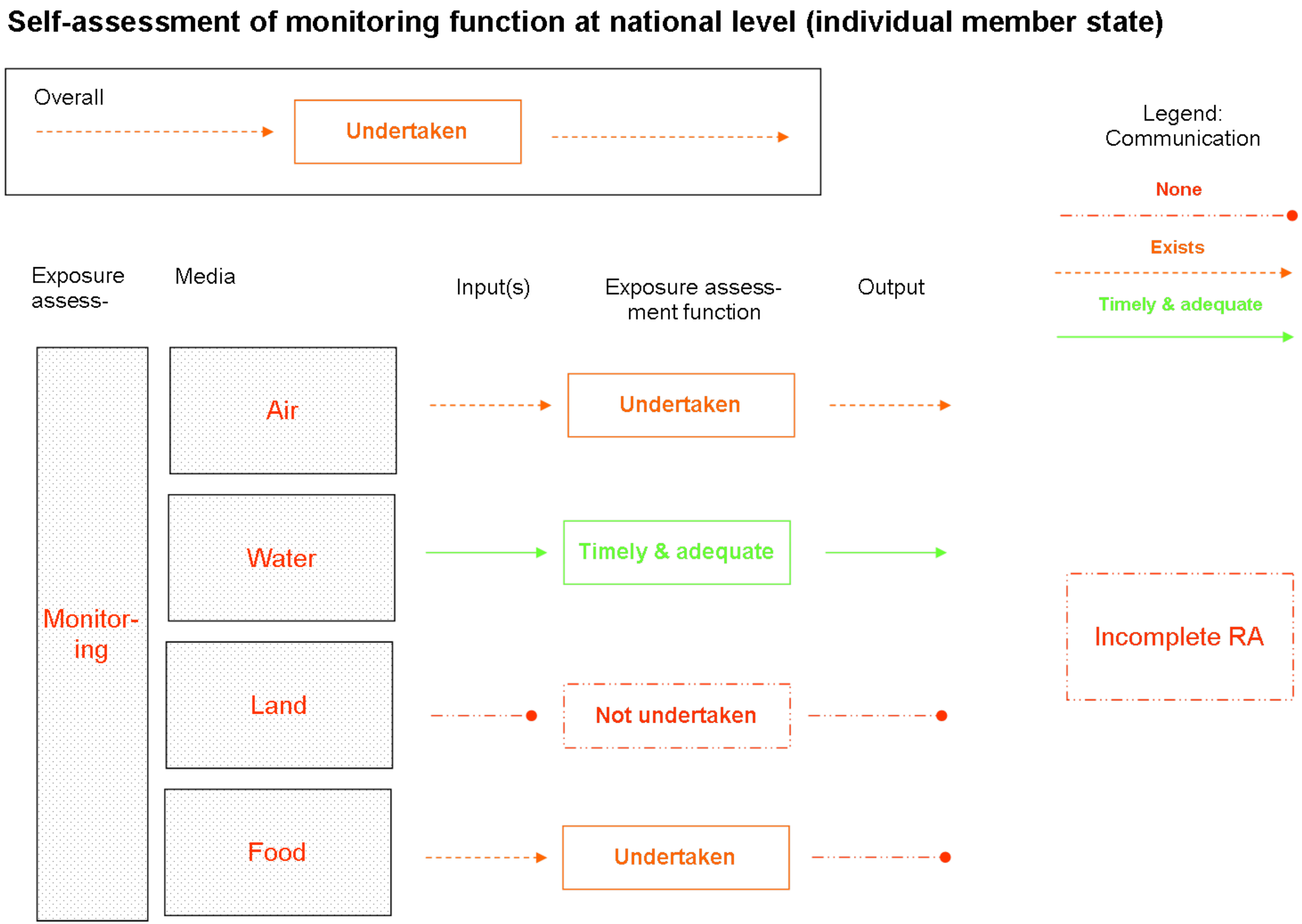
Figure 7 below shows how aggregated self-assessments from individual organisations, discussed in the previous section, can be applied to show capabilities at a national level. Of course, the process could also be carried out independently at a national level, without basing it on assessments undertaken by responsible organisations, but the former approach is preferred as it will result in a more evidenced and representative assessment.

In this example monitoring is considered, with an overall assessment of each media. For air, the overall assessment is as described in the previous section: there are inputs, the function takes place, and risk assessors receive the outputs, but no one part of the overall process is 'timely and adequate', although some of its components may be. For land, there is no capability to monitor at all. For food, there are inputs, and the function takes place, but exposure assessors consider neither the input nor the function to be timely and adequate and the outputs are not provided to public health risk assessors. Monitoring of water is satisfactory: inputs, the function, and outputs are considered to be timely and adequate by both exposure and risk assessors.

As in the previous example, these self-assessments can be aggregated to give an overall assessment of the country's capabilities for monitoring (of all media). In this case the overall assessment would be that there are inputs, the function takes place, and risk assessors receive the outputs, but that no one part of the overall process is 'timely and adequate': more needs to be done so that a complete risk assessment can be undertaken.

In this situation, resourcing may be required at a national level to develop a monitoring capability for land. For food, measures should be taken to link exposure assessors' outputs to risk assessors, who do not currently receive them, as well as improving inputs and the monitoring function itself. There is room for improvement in all areas of monitoring of air as inputs, function, and outputs are not yet 'timely and adequate'.

Figure 7. Self-assessment of an exposure assessment function at a national level



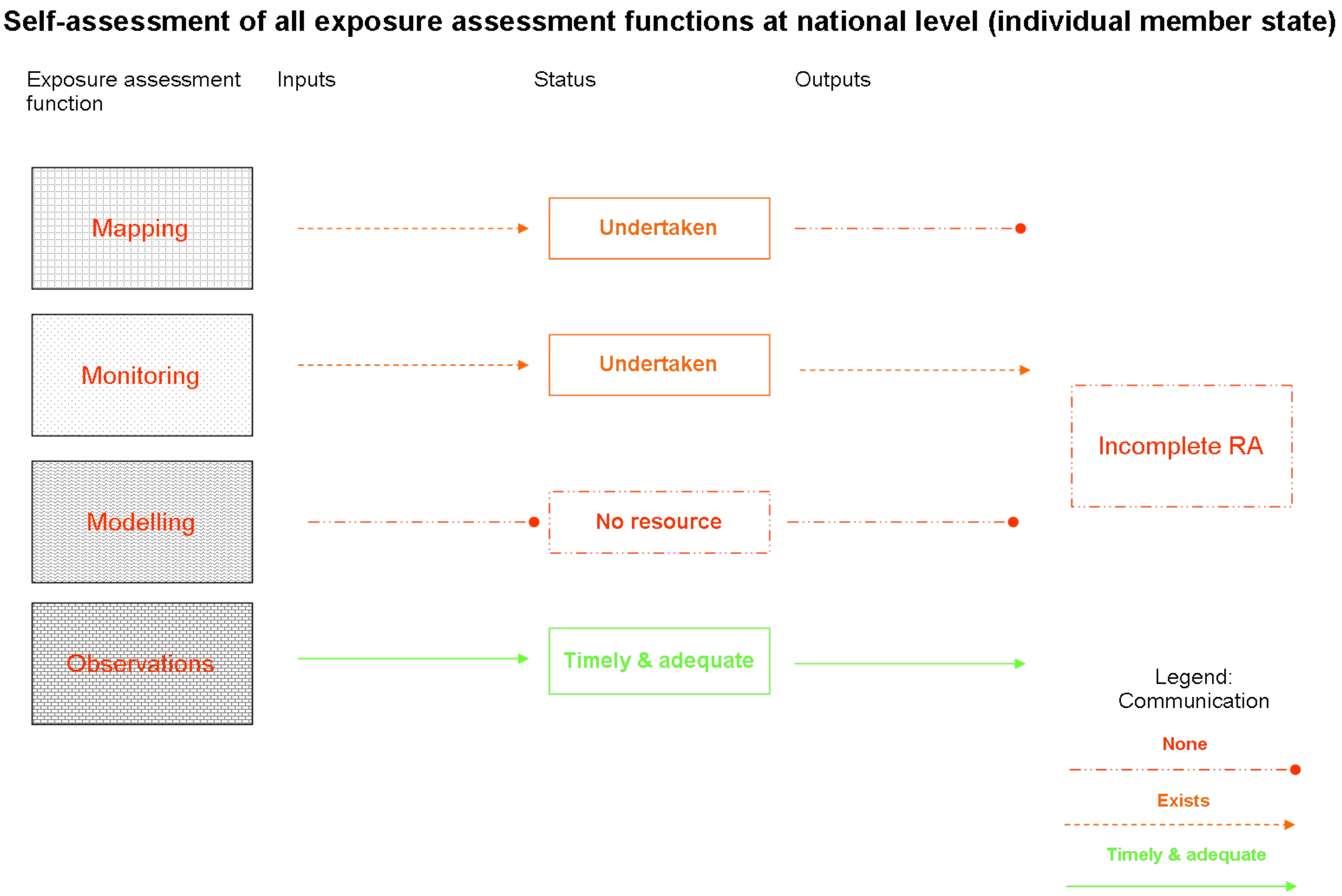
4.2.2.4 Self-assessment of all exposure assessment functions at national level

Figure 8 below shows a national assessment of all exposure assessment functions, where self-assessments have been aggregated for all media, for each function. In the example country, observation at the scene is optimal: inputs, function, and outputs are all timely and adequate. There is no resource at all for modelling, in any media. There is a capability for monitoring in incidents, but inputs, the function, and outputs can all be improved. Mapping takes place, but neither inputs nor the function are timely and adequate, and risk assessors do not receive mapping outputs.

Risk assessors consider that their risk assessments are incomplete for acute chemical incidents: they require more information. For this country, it is clearly beneficial to develop a modelling capability, to improve monitoring capabilities and communication between mappers and risk assessors.

The national assessments that this section, and the previous section, describe are high-level overviews. It is to be expected that most countries will have capabilities in each area of exposure assessment; the majority of national-level overviews will show that functions take place and that outputs are provided to risk assessors, but that there is room for improvement. Identifying specific areas for improvement requires organisations to undertake self-assessment, and related organisations to undertake joint self-assessment of their interactions, in order to focus preparedness work at the organisational, local and regional levels, where it can best achieve results.

Figure 8. Self-assessment of all exposure assessment functions at national level



4.2.2.5 Self-assessment at a cross-border level

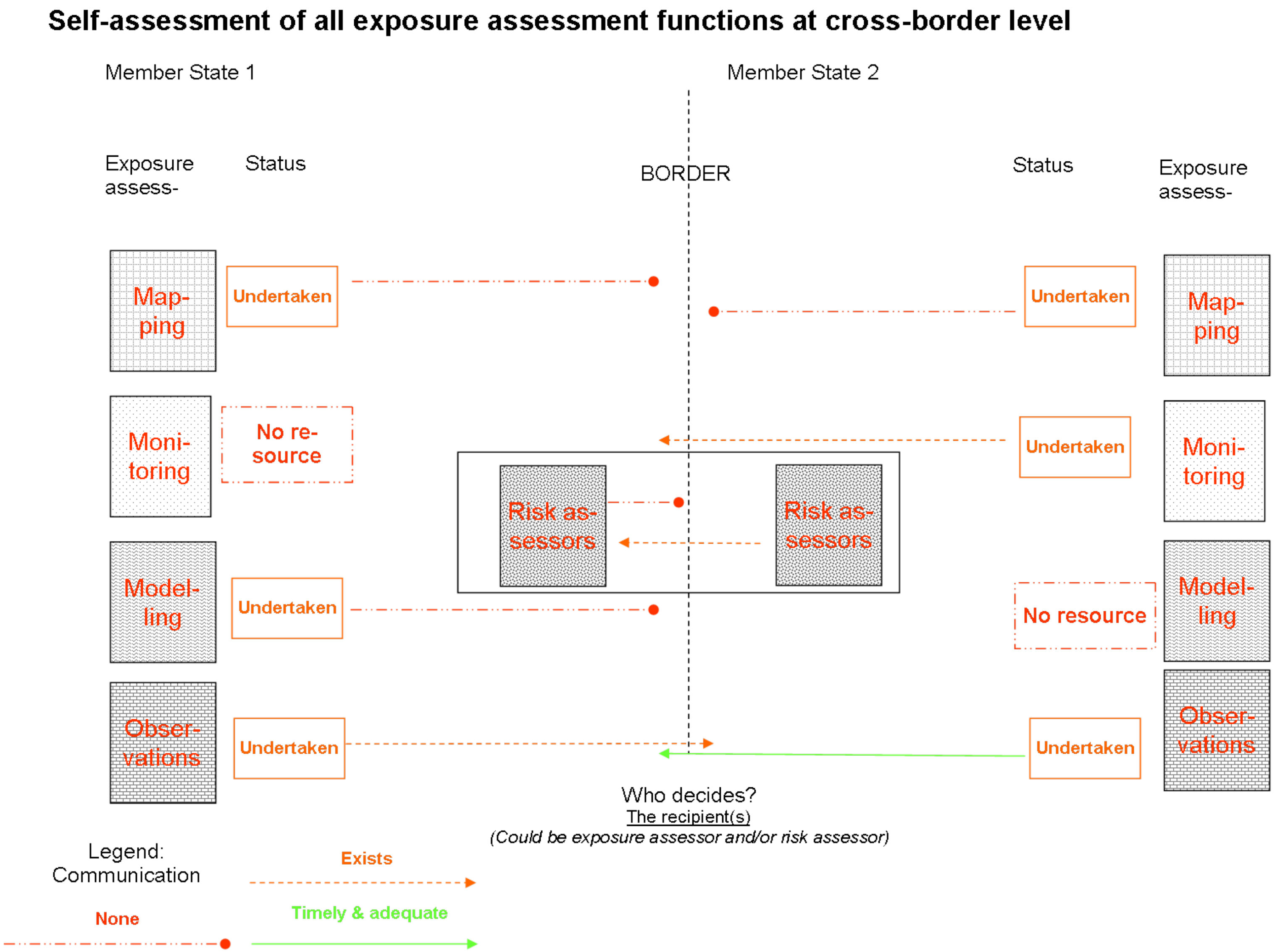
Self-assessment can also be usefully applied in a cross-border context. Assessment of cross-border functions and information flows requires stakeholders on both sides of the border to work together. Cross-border assessment can be undertaken at any level as borders may be local, regional, national, or international, with different stakeholders and assessments at each.

There are two ways of approaching cross-border assessment: this could be by cross-border colleagues undertaking self-assessments at a local or organisational level (see Figure 6), or through examining this at a national level, as illustrated by Figure 9 below.

In the case of cross-border assessments there are two sets (or more) of exposure and risk assessors to consider. The aim of the self-assessment is to show what capabilities each country has, and whether collaboration is occurring across the border. In this example, mapping is undertaken on both sides of the border but outputs are not shared. Monitoring is not undertaken by Member State 1; Member State 2 shares outputs from its monitoring function but Member State 1 does not consider them to be timely and adequate. Member State 2 does not have a modelling capability; Member State 1 does, but its outputs are not shared. Observers on both sides of the border share outputs: Member State 1 considers those it receives as being timely and adequate; Member State 2 does not consider those it receives in return as being timely and adequate. Risk assessments are undertaken in both countries: Member State 1 does not share its risk assessment; Member State 2 does, but Member State 1 does not consider it to be timely and adequate.

Clearly, this is a complex picture, and its complexity increases when one considers that, when judging cross-border information sharing, there is the potential for an output to be shared across a border with both exposure assessors **and** risk assessors on the other side. Information crossing a border can be an input for an exposure assessor and an output for a risk assessor. It is also the case that exposure assessors can share information between one another, across functions. For the sake of simplicity, these many iterations are not presented here, but it is possible to use self-assessment to capture and assess them; when considering whether shared information is 'timely and adequate' it is the view of the recipient that ultimately determines an assessment.

Figure 9. Self-assessment at cross-border level



4.2.2.6 Mapping cross-border collaborations

If cross-border self-assessment is undertaken, the result can be mapped: self-assessments can be aggregated to show collaboration across many borders.

Figure 10. Cross-border mapping at Member State level

Note that this map is included purely for illustrative purposes, and is not an assessment of actual Member State cross-border communications.

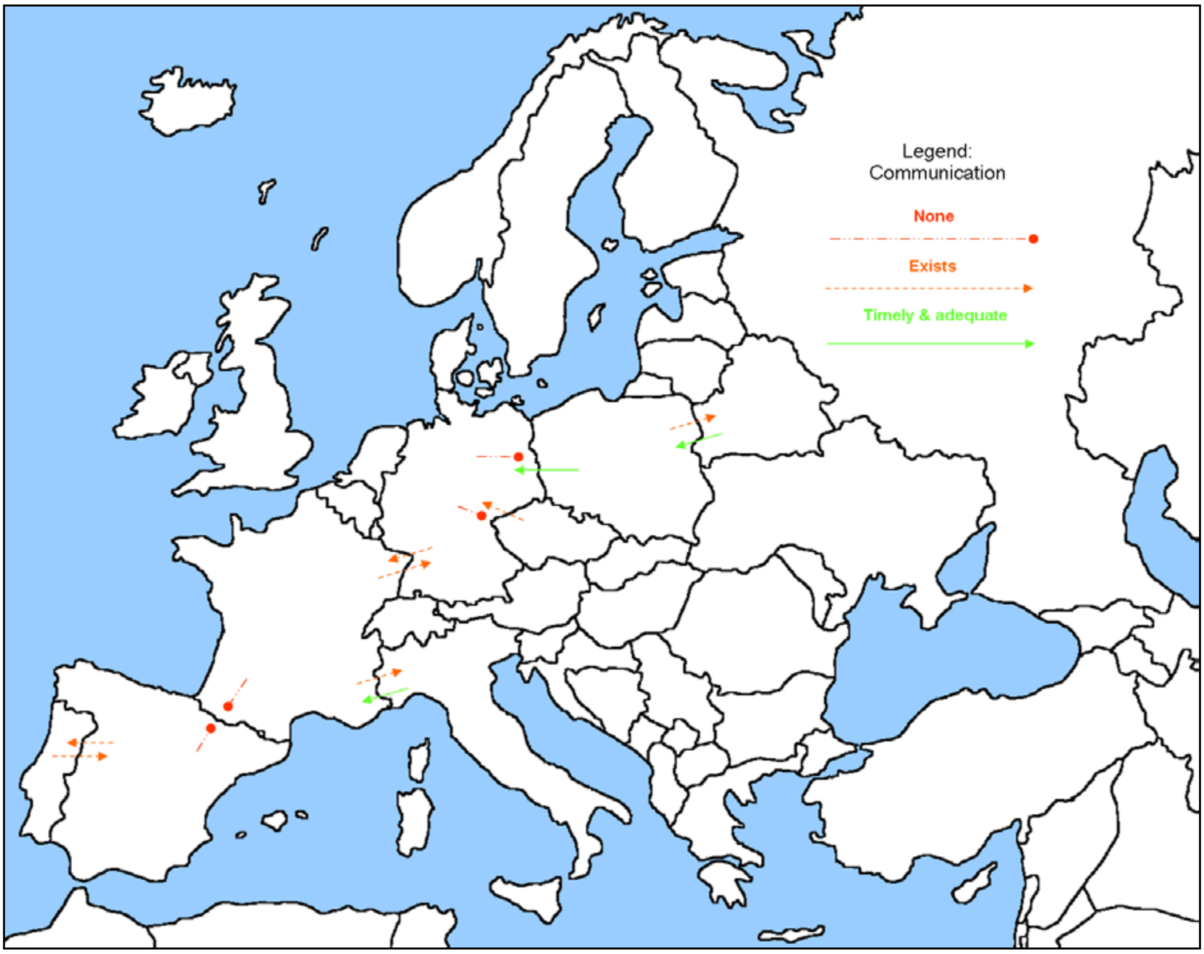


Figure 10 illustrates this at a Member State level: where countries share information it indicates whether it is timely and adequate and where there is room for improvement. It also shows where there is no communication between countries. Such maps can be tailored to show collaboration in exposure assessment function, showing exchange of monitoring, modelling, or mapping outputs, for example, or to show exchange of risk assessments by risk assessors. They are also useful in showing where bilateral and multilateral agreements exist between Member States, and where they are absent. Cross-border maps are also equally applicable over local and regional borders between and within Member States, whenever there are different organisations involved in exposure or risk assessment on either side of the border.

Mapping is useful in visualising borders over which some form of mutual aid in exposure assessment is provided. The best visualisation will depend on the type of incident and level of response being considered. For a large incident, sharing of risk assessments is likely to be the main focus at a national and international level. In the local and regional areas in which the incident has occurred, the focus is likely to be on each of the exposure assessment functions and on sharing of physical and back-office resources, as well as information.

4.2.3 Using self-assessment as part of emergency preparedness

Adopting the good practices identified by the project can help to deliver a ‘timely and adequate’ response. Each exposure assessment function, its inputs, and its outputs are linked to a number of generic and specific good practices. Improvement can be achieved by using the self-assessment process to identify areas where improvement is possible, then selecting and implementing applicable good practices in emergency preparedness and response from those listed in Section 4.1. Preparedness and response is a two step process: if the response is deficient then emergency preparedness actions are required. It is important to link preparedness and response work together and to have the right people involved in both steps (e.g. both emergency planners and emergency responders).

Good practices in emergency preparedness include tailored exercises (described in the following section, 4.3). An assessment using the tool provides a useful means of deciding which functions of exposure assessment would benefit most from new exercises and training. Conversely, if exercises are run *before* a first attempt to characterise using the self-assessment tool, the exercise outcomes can be used to inform an initial self-assessment.

The self-assessment process outlined by CERACI can be used to prioritise and direct efforts to improve communication and closer working, because once an assessment has been undertaken, the outputs identify exposure assessment functions and communication flows where additional resourcing or changes to working practices may be required.

As a rule of thumb, the more of the good practices listed in Section 4.1 that an organisation or Member State demonstrates in any given area of exposure assessment, the more likely it is to be judged ‘timely and adequate.’ However, the good practices listed by this report are not prescriptive or comprehensive; whilst an arbitrary scoring system could be associated with these good practices, ultimately it is up to each Member State and its component stakeholders involved in exposure and risk assessment to assess themselves. This is will always be a subjective process because one person’s view of what is ‘timely and adequate’ may differ from another’s. The tool accounts for this by recognising that the ultimate arbiters of what is acceptable are the responsible exposure and risk assessors and the desired outcome is that they are both content with their functions and interactions with one another, however those are structured and defined. For this reason, different Member States’ assessments of their own capabilities are not directly comparable: a monitoring function carried out by a Fire Service in one Member State will not be identical to a monitoring function carried out by local government in another Member State. However, in both cases, the tool outputs will show whether exposure assessment outcomes are met, the communication pathways to and from responsible organisations, and whether the public health risk assessors in each Member State receive the information that they need.

In cases where Member States cooperate to produce cross-border assessments, outputs can show whether risk assessors in each Member State receive the information that they need during cross-border incidents from exposure assessors within both Member States. As discussed in the previous section, this can also be done at a local and regional level to assess and visualise cooperation across local and regional borders. Assessments can be carried out for as many borders as are considered relevant.

This process of collaborative assessment and comparison is important. It is self-reinforcing; the documentation of capabilities and communication can provide the evidence and focus required to secure improvement. Organisations with strong working practices and "timely and adequate" functions can act as benchmarks for others, sharing their ways of working, and their own good practices, to help others working in the same area to achieve the same high standards.

The process is intended to be dynamic. The tool should be used to direct emergency preparedness work as part of an ongoing programme. After an initial assessment and follow-up actions, organisations should repeat the process by re-assessing their exposure assessment functions and communication and selecting new follow-up actions, if applicable. Used in this way, the tool also provides a means of documenting the status of emergency preparedness and tracking improvement over time.

4.2.4 Recommendations to further develop self-assessment

Although the self-assessment concept outlined in this report is, in essence, simple and can be readily used by responders, application of self-assessment requires coordinated direction and close working at all levels, from international to local.

Emergency preparedness is a wide area of work and preparedness for exposure assessment during acute chemical incidents is a small part of this. Coordinated use of the tool is likely to require either new consideration of exposure assessment within existing emergency preparedness work programmes, or new consideration of emergency preparedness within existing exposure assessment work programmes (such as those directed by networks of experts in exposure assessment functions), or both. This is discussed further in Section 4.5.

Each Member State will wish to consider how best it can apply the methodology to improve exposure assessment. Clear direction is required. Civil protection organisations are well placed to coordinate dissemination at a national level. The most important objective is to reach from the national to the local levels, ensuring that first responders are involved. The UK's Civil Contingencies Act, and the resilience structures that it implements, is a good example of one national approach to facilitate preparedness work that links national preparedness work to the regional and local levels, where area-specific work is undertaken under national guidance.

Further development and propagation of the self-assessment tool at a European level is recommended. Options for this can be found in Section 4.2.4.1 below. EU-wide cooperation and improvement of mutual aid in exposure assessment, both in terms of remote collaboration and the provision of physical resources, ideally requires a dedicated European forum. This is an integral part of the discussion in Section 4.5 regarding networks of experts and the concept of a cross-European CERACI network, coordinating emergency preparedness in exposure assessment for acute chemical incidents. Given that the Commission has adopted a proposal for a "Decision of the European Parliament and of the Council on serious cross-border threats to health" to better protect EU citizens against serious cross-border threats to health [2], further dialogue between DG ECHO and DG SANCO is recommended regarding the outcomes of CERACI, as the HSC may have an interest in the future chemical incident emergency preparedness initiatives proposed by the project, such as the development of the self-assessment tool. Although CERACI focuses on EU Member States, it is also important to address the interfaces between EU and non-EU countries, particularly when considering cross-border incidents and mutual aid.

4.2.4.1 Development of a self-assessment web-tool

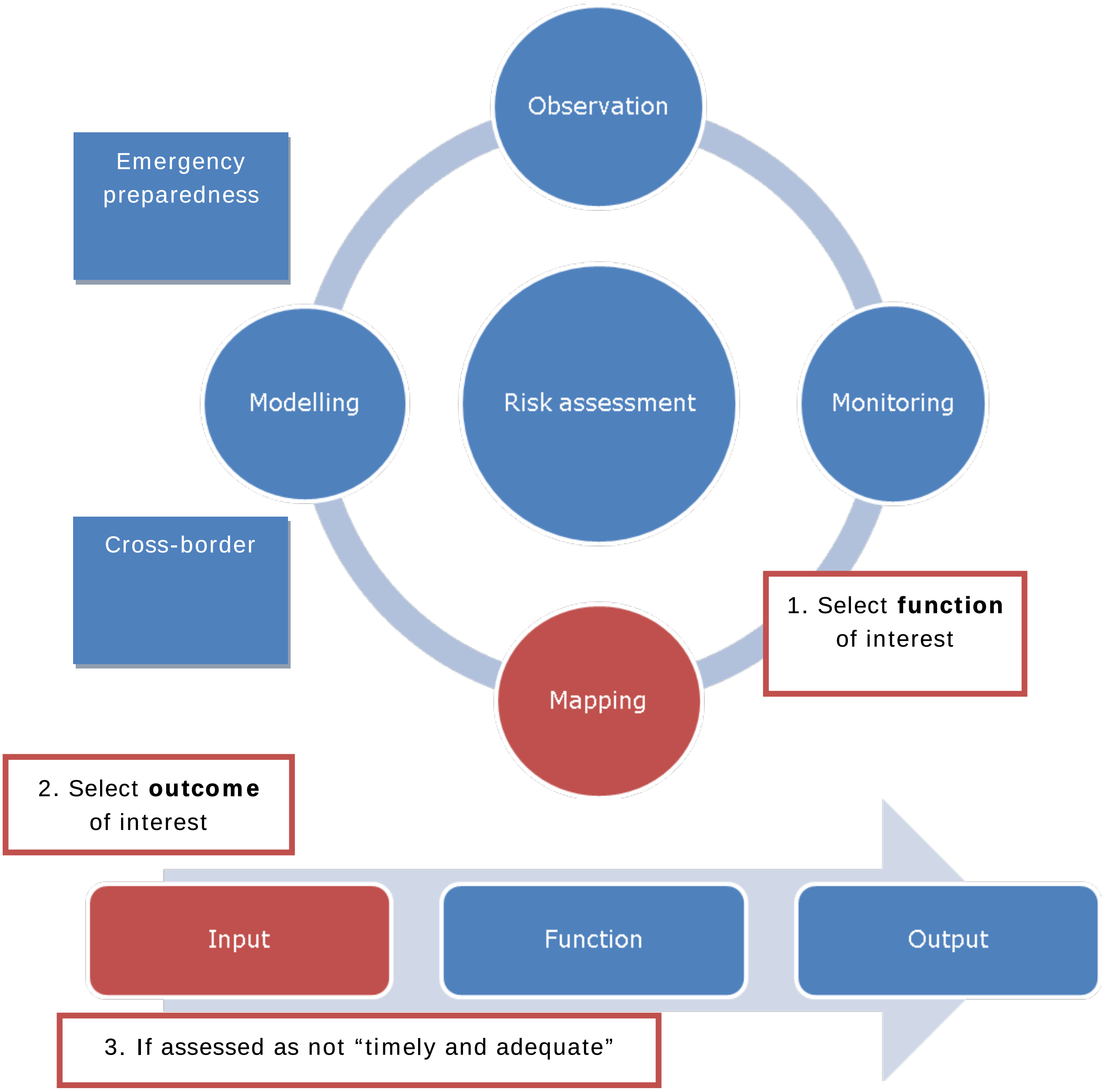
Self-assessment is best undertaken by Member States and responding organisations within Member States, rather than by the EU: a “bottom-up” rather than a “top-down” approach. As responders at all levels have interconnected exposure assessment networks, completion of a detailed assessment for any given Member State is like filling in a jigsaw, the small pieces of which are provided one by one by all of the different organisations involved in exposure and risk assessment in each Member State.

Self-assessment can be undertaken independently. However, it is preferable to centrally coordinate and collate assessments. The complexity of extended networks of exposure and risk assessors, at different levels, in different countries, and across borders, is great. Further development of the methodology and good practices into a tool on a central website, hosted by the EU, with a secure logon for Member State representatives, would maximise its potential application and usefulness at all levels within Member States. It is important that such a web-tool is focussed on, and tailored to, the requirements of Member States and that it is not perceived as being for the EU’s sole benefit. By ensuring that related assessments are linked, a picture can be built up of organisational and Member State capabilities, at a resolution ranging from local to international level. This could be used to readily visualise capabilities and information flows at multiple levels and to direct emergency preparedness in exposure assessment within and between Member States.

Users entering information would themselves form a virtual network of stakeholders in exposure and risk assessment – a directory of specialists – this network would subsequently facilitate communication between experts within and between Member States by identifying contact points across the EU. It could be used to align expertise between organisations within Member States and across borders and to connect experts undertaking different exposure assessment functions together, regardless of their occupation or profession. A “completed” assessment for a Member State forms a process map for that country’s exposure and risk assessment and can be used to visualise networks of contacts in the same way that it can be used to visualise exposure assessment outcomes and communication. In practice, a Member State will have different process maps for different geographical levels (local, regional, and national areas) and interactions across different borders.

Assessment would be undertaken by a series of online questions. These would be targeted, with separate lists of questions related to the different functions and their outcomes, as listed in Section 4.1. Where assessments identify that one or more outcomes are not met, the applicable good practices that could improve exposure assessment and meet the outcome are displayed, together with contact details for organisations that already have these practices in place. Users indicate which practices they already employ themselves, which new practices they will employ, and are later prompted to indicate whether the outcome has, in course, been met due to the new practices. Figure 11 presents an illustration of how this might be structured.

Figure 11. An illustration of online self-assessment



Mapping input good practices	Practice used?	Resolved issue?
Mappers use central sources of data (e.g. Czech central data warehouse)	Yes/No	Yes/No
Mappers have access to multiple receptor layers (e.g. land use, population size, population type, vulnerable zones)	Yes/No	Yes/No
Data layers are shared between responding organisations	Yes/No	Yes/No
Click to assess generic emergency preparedness good practices		

When used as part of an ongoing review and follow-up, users identify which good practice(s) helped them to overcome barriers and achieve the outcome. If they applied a good practice that was not already identified and listed by CERACI, they would be prompted to add this new good practice to those already found by the project. Practices can also be graded according to the cost or effort required to implement them. In this way, the users would expand and further populate the tool, creating a “living” database of good practices that can be applied to improve exposure assessment. Cross-working would be assisted by linking new and existing options to specific examples of practices (case studies) and contact points whom users can approach to share their own experiences from successfully having implemented them already.

Completion of self-assessment could be incentivised by linking its completion to funding for emergency preparedness initiatives e.g. where responding organisations within a region have completed a cross-border assessment they could be resourced to undertake joint training and exercising in order to improve areas identified as requiring improvement.

In order to take forward the self-assessment approach outlined by CERACI, it is recommended that a second stage of work is undertaken to develop and test a prototype version of the web-tool described above. This would be informed by a small number of Member States and their exposure and risk assessors, with feedback being used to develop a final version to be propagated for use across the EU. This process-driven approach to emergency preparedness and response potentially has a far wider application and benefit than for exposure assessment alone.

4.3 Framework for exposure assessment training and exercising

The Project Strategy requires Task E to deliver a "*Framework for a set of guidelines, and a training and exercise package to improve environmental modelling and monitoring in chemical incidents*".

Widespread evidence exists to show that preparation, particularly through training and exercising of key activities and functions, is fundamental to ensuring a robust and accurate response to chemical incidents in particular and short-term, dynamic responses to emergency situations in general [1].

CERACI's Task D report (Appendix 4) noted that some workshop delegates from EU Member States, particularly smaller countries, lacked 'real-life' experience of large-scale chemical incidents, and were consequently less familiar with chemical incident response. Transboundary incidents may have disproportionally greater impacts on countries that do not have large-scale chemical industries, chemical transport or associated emergency preparedness programmes within their borders that would naturally lead to them acquiring such experience. The potential for transboundary incidents, which could affect all environmental media (water, food, land, and air), should be seen as a key driver for organising joint training and exercises with neighbouring Member States. This serves to build and maintain competency even in geographical areas where the immediate 'local' hazards may be perceived as low risk or low probability.

To get the right balance between planning for specific 'known' events and creating generic responses for events that are rare or unexpected, governments must strengthen planning processes to anticipate and manage shock events: from clarity in the chains of command (especially where multi-jurisdictions are involved) to activating and connecting independent knowledge networks with policy-makers, to building common approaches in the management of complex risks [66].

Lee and Preston identify that strengthening relationships between agencies involved in risk management is a task to be carried out at governmental level downward, and that developing and maintaining the relationships and knowledge required within and without both organisations and Member States is vital for the delivery of timely and accurate responses to unexpected, emergency situations in general and, within the context of the CERACI project, environmental monitoring and modelling in particular [66].

Training programmes should be focussed and relevant to all attendees. Healey *et al.* [67] noted that typical multi-agency emergency responses (i.e. situations where "teams of teams" worked independently towards collective goals) met the description of multi-team systems. Such systems present a unique challenge to leadership, as their success depends on ensuring that individual teams are managed in such as way that their individual goals also deliver wider multi-agency goals.

In their report "*Determinants of Effective Multi-Agency Teamwork"*, Healey *et al.* observed that perceptions of exercise performance and benefits varied according to an individual's position within an organisational hierarchy. Players at higher levels (e.g. those at a 'Gold' or 'Strategic' tier) had more positive perceptions of "Multi-Team Systems" exercises than players at lower levels, who typically returned negative feedback about the value or function of the exercise. The authors provided three key recommendations to enhance multi-team system-based exercises:

- Developing shared understanding should be a key objective
- Design exercises to attain specific outcomes
- Participants' subjective experiences must be managed carefully

Exercises should be focussed at individuals' levels, but should also reflect a wider, joined-up view of an incident or series of events. Care should be taken to ensure that inputs and outputs to exercises are realistic and that they are documented: an output or request from one exercise event can be used to populate inputs for exercises at other levels. This provides realism for exercise participants at the responder level, better reflecting how data and information will appear when it moves between organisations and levels during incidents. Sharing of realistic outputs helps to develop closer links between different functions and to test the finer detail of exposure assessment; the factors affecting different functions (such as monitoring and modelling) and their outputs are often lacking from, or lost from the focus of, wider, less-specific chemical incident exercises.

Modular approaches to training and exercising, with different exercise modules for different levels of response and different functions of exposure assessment, can be combined with 'off-the-shelf' training packages. By using generic chemical incident material and then adapting it for a particular function of exposure assessment, specific skills, approaches and needs can be identified and exercised in detail, without expending other resources on skill-areas that are already well understood. Well planned and developed programmes are better than ad-hoc approaches; therefore, it is important to have strong coordination and direction as part of emergency preparedness efforts. The differing organisational roles and responsibilities of responding organisations in chemical incident response should be reflected within exercising approaches and their subsequent reviews.

Moreover, a modular approach that breaks down exercise structures into smaller, discrete sections is one strategy to overcome the difficulties that may be associated with mobilising large numbers of staff and resources to attend large-scale live exercises that attempt to test all aspects of incident response. A devolved timeline, rather than a real-time approach, can allow exercises to continue at different levels of command, or at different organisational levels, whilst still providing realistic inputs from other organisations and players.

It is, therefore, important to develop a structure within which exercises, training and education, both within Member States, and in a cross-border context, can be organised and focussed at **local**, **regional** and **national** levels and also at **operational**, **tactical** and **strategic** levels. Furthermore, this allows all relevant organisations to be involved in exercises and exercise planning at a level appropriate for them.

Reviews of past exercises and the effectiveness of responses to actual incidents may highlight specific areas where further clarity or resources are needed. Section 4.2, describing a self-assessment tool, provides a methodology through which Member States can identify areas of exposure assessment and cross-border working at which training and exercising may be best directed. Adopting a modular framework means that specific factors can be addressed through the creation of detailed scenarios (containing realistic, timely inputs) that pertain to individuals' concerns, without involving staff who do not directly benefit from the subject area or that level of technical detail.

However, high-level exercises are important and they should remain multi-tiered and realistic; for example, care should be taken to ensure that timescales and timelines are realistic or at least make reference to compressed 'game time'. There is evidence that the loss of realism often produced by exercises not reflecting real-world experiences lessens the credibility of the exercise and, subsequently, the impact of planned lessons [67]. It is important that exercises are held at the appropriate frequency: often enough to affect working practices, but not so frequently that learning points lose their impact or become diluted through undue repetition and reinforcement.

4.3.1 Existing training and exercising resources

A number of previous projects have produced workshop exercises based on generic chemical incident scenarios and it is recommended that existing material is used as a starting point for the development of future exercises and exercise frameworks that aim to test specific aspects of exposure assessment and cross-border collaboration.

A number of DG SANCO-funded projects (such as "Development of Generic Scenarios, alerting system and training modules relating to release of Chemicals by Terrorists" (GSCT) [68], Public Health Response to Chemical Incident Emergencies Toolkit (CIE TOOLKIT) [69], Risk Assessment and Management - European Training Programme (RISK ASSETs) [70], and Mass casualties and Health Care following the release of toxic chemicals or radioactive material (MASH)) [71] have developed or aim to develop materials and protocols related to the preparedness and response to acute chemical incidents. There are ongoing projects intended to provide a common approach to risk assessment and provision of common information to risk assessors within Member States (such as Chemical and Radiation Risk Assessment Network (CARRA-NET) [55] and "Chemical & radiation inventory of public health measures & medical countermeasures" (CARIMEC)).

A number of relevant projects are summarised below. Further detail is contained within the project review undertaken as part of the Task B report (Appendix 2).

4.3.1.1 ASHT Phase III

The general objective of the Alerting, Reporting and Surveillance System for Chemical Health Threats, phase III (ASHTIII) is to improve preparedness for and response to health emergencies [72]. Focuses will include promoting inter-regional co-operation and seeking to re-enforce the collaboration between industrial sectors and EU Member States in responding to emergencies involving chemical health threats.

ASHTIII seeks to further develop the functionality and sustainability of the Rapid Alerting System for Chemical Health Threats (RAS-CHEM) and promote the use and implementation of the project amongst EU Member States. A further aim is the development of a toxidrome matrix to enable RAS-CHEM system users to identify unknown chemicals from presented clinical features.

4.3.1.2 GSCT

This project undertook “Development of a Generic Scenarios alerting system and training modules relating to the release of Chemicals by Terrorists” [68]. Of particular interest is the development of core training models for the public health management of terrorist chemical releases. The development of core training elements has parallels with the development of modular exercise frameworks aimed at exercising individual elements of a wider cross-border, multi-agency, multi-tier response.

4.3.1.3 CARRANET

The Chemical and Radiation Risk Assessment Network (CARRANET) project [55]:

- Defines protocols and guidelines for collating appropriate information to be shared and transmitted between European Member States in case of a major chemical incident with trans-boundary effects; and
- Suggests protocols with which risk managers can use this information to guide health threat and risk assessment in order to make decisions about protecting public health.

Guidance is provided for public health risk assessors to cover planning, preparedness and response, and the project identifies key sources of information to assist in evaluating the health hazards and consequences of exposures which may arise during chemical incidents. The focus is on incidents or releases which may have the potential to lead to trans-boundary impacts. As noted elsewhere, many sources of information are available to risk assessors. CARRANET identifies suggested preferred reference sources, with the aim of achieving consistency of understanding amongst those involved with assessing risks following a chemical incident with cross-border significance. These standard resources should be used as part of exercise play, with the intention of producing consistent responses within all forms of exercise and response.

4.3.1.4 CIE Toolkit

The Public Health Response to Chemical Incident Emergencies (CIE) Toolkit [69] is useful as both a source of exercises (it features a fully comprehensive set of guidelines (Deliverable D7) for conducting training exercises involving major chemical incidents) and as a model for the development of a wider exercise framework that can be utilised by different agencies and tiers at different times. The toolkit provides exercise cards (Deliverable D3) presenting different scenarios together with instructions on their use.

4.3.1.5 NATO CBRN guidelines

Task D noted that:

"The NATO International CBRN training curriculum [73] has developed "Minimum Standards and Non-binding Guidelines for First Responders Regarding Planning, Training, Procedures and Equipment for Chemical, Biological, Radiological and Nuclear (CBRN) Incidents". These training guidelines encompass a number of learning outcomes relevant to CERACI, such as:

- *comprehending awareness requirements in relation to CBRN response*
- *comprehending detection requirements in relation to CBRN response*
- *comprehending command and control requirements in relation to CBRN incidents*
- *comprehending the implications of bilateral or multilateral assistance for local first responders"*

This resource is primarily focussed on emergency responders and agencies involved in incident management. Incident management is divided into different stages: information gathering, scene management, saving and protecting lives, and additional and specialist support. Further components of response, such as containment and substance identification, are also listed, and specific actions within these tasks are listed by "procedure", "capability" and "equipment". The document may be employed as a template, forming the basis for a wider training framework within which exposure assessment is addressed.

The emphasis of the guidance on the more operational aspects of response means that other areas, such as communication with public health risk assessors and strategic-level liaison, are covered in less detail.

4.3.1.6 WHO

The World Health Organisation's "Human Health Risk Assessment Toolkit" for Chemical Hazards [1] provides users with guidance to identify, acquire and use the information needed to assess chemical hazards, exposures and the corresponding health risks in their given health risk assessment contexts at local and/or national levels.

The WHO Toolkit displays and discusses the individual pieces of the wider risk assessment process, focussing mainly on the interpretation of individual inputs within this wider context. It introduces the concept of the "risk paradigm" to describe this overall view of every aspect of the risk assessment process.

It also features generic "road maps" for the four components of risk assessment: hazard identification, hazard characterization, exposure assessment and risk characterization. The Toolkit has been developed to be useful for all those involved in the risk assessment process, including public health and environmental professionals, regulators and industrial managers. The document covers various aspects of the risk assessment process in detail, including acronyms and standards across various media. The intended focus of the report is risk assessment itself, not the processes involved in providing information for risk assessment. Nevertheless, the report provides a comprehensive breakdown of the individual data inputs that are required for accurate risk assessment.

A companion document to the Human Health Risk Assessment toolkit is the WHO Manual for the Public Health Management of Chemical Incidents [4]. This focuses on the principles of public health risk assessment, covering much of the technical skills and knowledge which may be necessary in fields such as emergency planning and preparedness, communication, detection and alert, and response, placing them in the context of the management of the public health impacts of a large chemical incident. A number of case studies are cited which may provide the starting point for exercise creation or 'what-if' scenarios.

Primarily conceptual, the report lacks the detail of where (i.e. where within a specific organisation) individual functions that feed data into the risk assessment process may be carried out; CERACI has already shown that there is significant variation in the ownership of different services and skills across Member States. Exercises and training must be targeted at Member State organisations that produce the information described by the WHO.

4.3.1.7 Seveso installation off-site plan exercises

The Seveso Directive [8] requires that off-site emergency plans for upper-tier chemical installations are tested every three years. As a result, there is an ongoing programme of chemical incident exercises taking place across all Member States. Exercises take place based on plausible chemical incident scenarios that are associated with individual sites: these have a multi-agency focus and test the local response.

Seveso exercises present a valuable opportunity to exercise and test exposure assessment functions for chemical incident response. Adopting a modular approach to test exposure assessment functions within Seveso exercises can, for example, provide representative data for risk assessors, exercise monitoring teams and test communication cascades and alerting mechanisms. Through the use of table-top (desk-based) exercises, incident timescales can be expanded to better reflect the progression of a 'real-world' response, without compromising the effectiveness of the exercise or incurring significant costs.

CERACI workshop delegates indicated that, in many Member States, public health officials are often involved in Seveso site exercises. This is to be encouraged. However, delegates raised the point that there can be financial barriers to their participation: national legislation may not allow cost-recovery (to pay for involvement) for responders other than the emergency services, which can be a barrier to their participation.

4.3.2 Training and exercising exposure assessment functions

Many civil protection exercises with chemical incident scenarios concentrate on the 'blue light' phase of the response: the main focus is on emergency responders' actions at the scene. To consider exposure and risk assessment, a step back is needed: here, the focus is not solely on actions at the scene; many stakeholders can be involved and a different perspective is needed.

CERACI workshop delegates agreed that training, mutual education and exercises should be targeted at exposure assessment functions, with people working with and meeting their counterparts irrespective of their professions or their organisations' roles.

Delegates, whilst acknowledging the benefit and necessity of field exercises, felt that table-top exercises were often a cost-effective alternative to more expensive multi-agency 'real-life' training. Table-top exercises are particularly suited to testing wider working, information exchange, and strategies. 'Real-life' live exercises are, however, invaluable in testing and improving the mechanics of operational work in a realistic way. The concept and requirements of cross-border interoperation and response vary at operational, tactical and strategic levels of operation. CERACI delegates felt that, in some circumstances, there is no substitute for the actual deployment of equipment or the physical exchange of staff. An example cited in Task D was when German and Dutch fire-fighters found that their hoses did not attach to hydrants in the other country: as a result they developed a cheap adapter that allowed them to work together. It is unlikely that this level of detail would have been identified in anything other than a field exercise.

Targeting of exposure assessment functions can be achieved by:

- creating a separate, but associated addition (focussing on an exposure assessment function) to existing emergency service exercise frameworks (to widen their scope to include exposure assessment and cross-border issues), or
- by holding standalone exercises focussed on exposure assessment and cross-border issues. This is the preferable outcome if time, budgetary and logistical concerns can be overcome.

Delegates felt that, above all, exposure assessment and risk assessment are interconnected: it is important to address both and this is a key theme throughout this report, and its approach to assessment of effective exposure assessment (see Section 4.2). Consideration must be given to the "3 steps" associated with exposure assessment functions: inputs, the function itself, and the output to risk assessors (see Section 4.1). Hence, public health risk assessors should ideally be involved in any test of exposure assessment. In some Member States, this will mean changing existing practices by involving public health professionals in emergency services' exercises.

The remainder of this section outlines how each of the functional groups of exposure assessment and risk assessment can be tested and exercised when using chemical incident scenarios.

4.3.2.1 Emergency response (exposure assessment)

What needs to be trained?

CERACI workshop delegates discussed **communication** between experts in exposure and risk assessment, and between decision-makers and the public. Traditional scientific training may not typically prepare scientists to be effective communicators outside of academia. Delegates considered that exposure assessment experts should be trained to communicate complex information, both to influence decision-makers and to be able to communicate directly with the public.

Delegates felt that desirable elements of Member States' emergency preparedness programmes were:

- joint training and exercising with neighbouring countries;
- exchange of, and familiarisation with, information and response systems between responders;
- commonly understood arrangements for communication, and simple communication pathways (including cross-border communications);
- harmonisation of, and sharing of, response procedures and emergency plans;
- formalised working together agreements or memorandums of understanding; and
- standardisation of equipment, including equipment used for data gathering and reporting, across regions and Member States.

What needs to be tested?

Participants identified that building **communication and understanding** between responders was a significant factor in facilitating effective exposure assessment in incident response. For example, delegates identified that exposure assessors working across borders may encounter language difficulties, and that the differing roles of organisations in different Member States may cause confusion in operational scenarios.

How should it be tested?

A number of good practices and success factors were identified:

- joint training and exercising with neighbouring countries at different command and control levels and different geographical levels;
- targeting joint training and exercising at functions, with people working with and meeting counterparts irrespective of their organisations;
- mutual education;
- ensuring public health representation in interagency training and exercises even if there is no legal requirement for it; and
- turning existing exercises into cross-border exercises.

4.3.2.2 Observation

What needs to be trained?

Delegates shared a number of possibilities for using existing resources, and of using responders as a mechanism for **gathering data used for risk assessment** in the initial stages of an incident. For example, first responders could also make use of existing information on chemical effects to make initial assessments based on toxidromes. A toxidrome is a syndrome caused by exposure to a dangerous level of a toxic compound. Such a use may support initial decision-making, particularly in regard to decisions about basic treatment and decontamination.

Workshop delegates considered that the training of all responders in shared concepts to support early decision-making, such as exposure assessment based on toxidromes, was a good practice.

Delegates also suggested that health outcomes could be used as a crude method of validating dispersion model outputs i.e. if modellers know where symptoms occur then they can look at where the model predicts highest impacts to be and see if it is the same geographical area, or whether the symptoms are consistent with the symptoms that would be expected given the exposure concentrations predicted by the model. Furthermore, delegates also noted that, in a wider context, the use of complaint reports to adjust the source term for modelling outputs was a good practice. It was noted however that psychosomatic concerns and ‘false positives’ may influence this data stream.

The ASHTIII project (Alerting, Reporting and Surveillance System for Chemical Health Threats, phase III) includes a number of proposals to strengthen passive data-gathering, including:

- evaluation of automated data mining of EU Poisons Centres (PCs) data for chemical health threat surveillance purposes; consultation with EU PCs and Member State authorities to understand how such an approach can be adopted for surveillance and public health risk assessment purposes; and
- development of a toxidrome matrix to enable RAS-CHEM system users to identify unknown chemicals from presented clinical features.

What needs to be tested?

Clearly, any agreements to use observations, especially qualitative or unverified data, should focus on ensuring that the particular characteristics of that data remains attached to it (i.e. its providence and the levels of confidence that risk assessors may place in it) and that **observation gathers and describes information of use to risk assessors**. The terms of the ASHTIII project, in particular the development of a comprehensive toxidrome matrix should provide a benchmark of agreed symptom types and descriptions to standardise health effect observation.

How should it be tested?

Like more quantitative measures, the primary focus on testing should be on **establishing whether there is provision of information that is accurate and interpretable**. Any observational data should be formatted against agreed standards or descriptions (such as those developed by ASHTIII for health effects) and minimise errors in observation or interpretation.

4.3.2.3 Monitoring

What needs to be trained?

CERACI workshop delegates considered training of chemical specialists within the emergency services for **detection, identification and monitoring** of chemicals to be a good practice. They considered that the target should be for this to be undertaken as soon as possible during an incident, ideally during the “golden hour” described in the Task D report (Appendix 4).

The actual monitoring capabilities may rest with different services within individual Member States; this may be perceived as a barrier to effective communication and the establishment of a generic cross-border approach to monitoring. However, emergency preparedness programmes should recognise that this variation is likely to occur; exercising should cement this into individual and corporate knowledge and, ultimately, this should become an accepted fact during exercising of response rather than being seen as a barrier.

What needs to be tested?

Workshop delegates noted that exercises that typically deployed monitoring teams were often remote from other risk assessors and public health experts. This need not be a barrier to effective working, as the effective deployment of monitoring teams and equipment, in line with established procedures and timescales, need not be a detailed consideration for workers in the wider risk assessment community; what is important however is that **protocols relating to the role and function of monitoring teams are understood and adhered to**. Exercises should also focus on meeting the expectations of partner agencies; they may require receipt of monitoring data to perform their own functions and have particular requirements, such as the timely delivery of data, set reporting mechanisms, and data format.

How should it be tested?

Task D (Appendix 4) identified a number of approaches; however, it is suggested that testing of monitoring capability should not just focus on the **correct use of monitoring equipment**, but also look at 'upstream' and 'downstream' **communication routes**, and **alerting and deployment mechanisms**. These need not be exercised simultaneously; for example, physical operations (such as equipment setup and use) can be undertaken in isolation, separately to communications exercises, which may be more easily carried out as desktop exercises or as multiagency reviews.

4.3.2.4 Dispersion modelling

What needs to be trained?

Tasks C and D (Appendices 3-4) noted that the use and availability of dispersion models for air and water varied between Member States. It was noted that the body responsible for such assessment was not consistent between Member States. Training should therefore focus on **developing technical expertise** within individual member states, with existing good practice serving as a template for those seeking to establish additional capability.

Furthermore, it is vital that dispersion modelling is not carried out in isolation, but that dialogue is established with partners within countries and with cross-border agencies to reflect the fact that dispersion modelling should not be carried out as a stand-alone task. Focus on **communication** should remind all concerned of the significant benefits that can be achieved in terms of risk assessment through the establishment of dialogue and communication between information-providers (i.e. those feeding data and requests to modellers) and information-users (i.e. those involved in the risk assessment process).

What needs to be tested?

Clearly, the testing and validation of dispersion model function is a technical undertaking that should primarily be carried out by specialists in that field. However, both staff engaged with carrying out the dispersion assessment and staff in the wider risk assessment community should be involved in **developing a mutual understanding of**

what can be modelled with realistic inputs, accuracy and timescales that reflect actual incident response. It is suggested that individual dispersion-modelling agencies work to ‘map’ information flow into, within and from their organisations. Each potential source of information for model inputs should be identified and a relationship established with information providers. Both parties should clarify what their understanding of the other’s role is, and key areas for collaboration and understanding should be identified. For example, some emergency services utilise mesoscale plume dispersion modelling to gain a basic understanding of wind direction (e.g. use in the UK of the Met Office’s “CHEMET” service) and a general indication of dispersion, recognising that a quick, simple output assists a timely initial response. However, more detailed modelling can be undertaken that takes into account source and chemical-specific factors to give more complex outputs. Testing of a two-tiered approach of ‘quick and dirty’ modelling followed by a more detailed assessment later in an incident was considered to be a good practice by Task D delegates; testing of modelling should **explore the provision of different models over short and longer-scale timelines**.

How should it be tested?

Testing and exercising should focus on strengthening relationships and understandings between agencies, as well as the technical competence of modelling staff. Where added value can be achieved through partnership working (e.g. some Member States noted that staff were able to refine modelling outcomes through combining modelling expertise within one agency with detailed meteorological data from another), these links should be strengthened through exercise-focussed secondments and staff exchanges, **simulation of communication cascades and information flow.**

It is also important to **consider the end use and user of the modelling output** and exercises should seek to establish dialogue between agencies; for example, in the UK Health Protection Agency staff liaise with the Met Office to acquire detailed modelling outputs, which can then be compared against sampling data from air quality monitoring. Such comparisons can be used to refine models and estimate source terms and release rates, all of which contributes to the production of a more representative risk assessment.

Particular effort should be made to build cross-border and regional links between modellers. As no ‘default’ models exist across the EU, individual, often neighbouring, countries use different programmes and assumptions in developing and executing their models. Task D delegates identified that such procedures made sharing of cross-border information more difficult. Exercises should aim to **develop an understanding of different practices and seek resolutions and agreements on a more unified modelling strategy**, where different approaches exist. Particular attention should be made to **establish interoperability of outputs, models and results** to achieve a unified, cross-border or regional risk assessment. Organisational practices related to the use of units of measurement and model parameters should be harmonised, or at least identified, and user aids such as source-term conversion factors should be provided to end-users: **end-user understanding of the model outputs** should be tested too.

4.3.2.5 Mapping

What needs to be trained?

Task C survey respondents and Task D workshop delegates noted that Geographical Information Systems were potentially useful tools in incident response, as they allowed access to data relating to hazards and receptors and for this information to be manipulated and analysed (see Appendices 3-4). However, a significant disparity in the availability of mapping software and the capability of its users was noted. It may be beneficial for individual Member States to review **capacity and capability for GIS mapping** in the first instance; the **development of a common risk assessment mapping standard or template** that can be adopted across software platforms and boundaries would be a key step in standardising this capability across Member States.

Task C and D feedback also noted that Member States' GIS capability rested within different organisations that use the capability for their own organisation's uses. This may present an initial barrier, as mapping specialists may require more **understanding of the key principles of risk assessment**, and how their systems are used in assessments. Mapping specialists may benefit from training in the principles of risk assessment, to assist their production of thematic maps best able to inform risk assessors.

What needs to be tested?

A notable gap in existing capabilities was identified by Tasks B and C, in that individual Member States' knowledge of receptors in neighbouring countries was limited in many cases. Training programmes should be developed that teach staff a) **what data does exist**, and b) **how best to obtain cross-border map layers or information**. Care should be taken to ensure that different agencies gain an understanding of their colleagues' requirements in terms of data type and availability, to ensure an accurate and timely transfer of information.

Ideally, training programmes should be designed to **identify specific obstacles around data sharing**, for example, concerns over data ownership and politically-sensitive matters, and cover the evolution of mapping outputs in a risk-assessment scenario, from basic information surrounding incident or release location to complex outputs containing information from multiple sources. Training should involve all potential 'donators' of information that may be useful for mapping to inform risk assessment, and logs should be made during exercises of difficulties that were encountered and, crucially, their nature (i.e. technical aspects regarding incompatibility of data, or a political reluctance to share population or vulnerable receptor data), as well as information flow from individual organisations or sectors. Such training should be scalable and function well at multiple tiers of organisational involvement; e.g. the same lessons and information should be captured during training exercises involving staff from a local or regional exercise as for an international event.

How should it be tested?

As with many aspects of risk assessment, individual tasks around competency and capability can be exercised in isolation by individual organisations. As noted above, the main areas where variations may occur, and are more difficult to simulate, are in interactions between multiple agencies within and between Member States. Agencies wishing to develop their expertise in mapping, in specific relation to risk assessment, should, in the first instance, utilise existing exercises to **evaluate the quality and consistency of data or requests that may arise in different scenarios.** The Seveso Directive [8] is a mandatory framework for exercising around potentially significant accident hazard sites (as discussed in Section 4.3.1.7); whilst it should be noted that mapping exercises may not necessarily run in 'real-time' during exercises for Seveso installations, **producing maps to meet requests made during exercises and utilising mapping outputs in exercises injects** may provide a means of testing mapping.

Agencies should also build on the good practices identified in previous task reports by taking opportunities to 'add value' through partnership working in emergency preparedness e.g. dispersion models may already be produced for exercises or for pre-emptive risk assessments (contained within, for example, off-site plans for top-tier Seveso sites) by other agencies and their outputs overlaid against static maps. Sharing pre-prepared outputs and information so that Geographic Information Systems are able to present outputs more quickly during incidents enables a more dynamic, systematic, risk assessment to be made.

4.3.2.6 Risk assessment

What needs to be trained?

It is obvious that public health risk assessment, particularly in acute situations, is a complex balancing act of data quality, quantity and understanding against time. Any risk assessment process is dynamic, and training should **enhance the ability of individuals and organisations to filter and interpret information** in relation to the wider context of the incident situation. The "risk paradigm" described in The WHO Human Health Risk Assessment Toolkit [1] summarises the complex relationship between each stage of the risk assessment process.

What needs to be tested?

When undertaking all aspects of training of exposure assessment and incident response functions that may feed into the ultimate risk assessment process, it is important to realise that decisions and measures taken may have an impact on the **quality and speed of risk assessment decisions**. For example, exposure assessment impacts directly on risk assessment; quantitative decisions on levels of potential risk are difficult without some meaningful measure or prediction of potential exposure. Risk assessors should ideally be involved in, or able to influence, the exposure assessment process to some degree. It may be impracticable to expect risk assessors to be involved in the minutiae of exposure assessment, but there are considerable benefits to be had from risk assessors providing input to exercises, and the development and **use of exposure assessment outputs that are inputs in testing of public health risk assessment**. In some Member States, this will mean changing existing practices by involving public health professionals in emergency services' exercises.

This approach is also applicable for other parts of the risk assessment process and can be understood as the 'input – function – output' model discussed in Section 4.1. Ideally, each individual information flow into the risk assessment process should be assessed against this framework, and the **communication routes** and methods clarified. The **interpretation of the exposure assessment information** should be clearly understood, and the provider of that information should also understand the purpose or role of that information within the wider risk assessment process. Risk assessment outputs themselves may be information, recommendations, or decisions, and again, **the destination and use of risk assessment outputs should be clearly understood by risk assessors and useful to recipients** involved in risk communication and risk management.

This generic approach is applicable to all functions of exposure assessment and, when presented graphically, offers an opportunity to identify areas of weakness, or where there is a lack of clarity (as described in Section 4.2). Together with training and exercising, other good practices can then be used to improve that specific step (input, function, or output); these are discussed in Section 4.1 of this report.

How should it be tested?

The primary function of risk assessors is to undertake a public health risk assessment. However, this is often a dynamic process where, on occasion, decisions may be qualitative, and based on expert judgement, rather than quantitative. As noted previously, **testing should be multi-faceted and focus on both the delivery of the various forms of resources required for risk assessment, as well as the risk assessment process itself.** These testing elements may take place independently in some instances.

Risk assessors should make use of existing resources and opportunities to establish and strengthen partnerships with agencies who may provide input to the risk assessment and decision-making process; these may take the form of formal exercise scenarios (e.g. those required under the Seveso Directive), or the use of publications, such as these CERACI reports, that contain listings and frameworks of agencies that may be involved in providing information to risk assessors after a release to a particular medium. The disparity in service provision across Member States, coupled with specific functions being carried out by different agencies in different Member States, means that a generic, cross-EU training plan would be inappropriate. Planners should therefore isolate specific scenarios for testing (for example, releases to air or water in a regional or cross-border setting) and seek to **test all applicable mechanisms associated with the provision of data to risk assessors.** Frameworks and best practice for the provision and collation of this information are described in Section 4.1.

When exercise plans are developed with the involvement of public health risk assessors, a focus on risk assessment can be embedded within exercise materials, health resources can be engaged, and scenarios prepared that can best test public health risk assessment. **Public health bodies should provide resources to assist with the planning and exercising process** as part of chemical incident emergency preparedness.

4.3.2.7 Cross-border emergency response

What needs to be trained?

CERACI Task D (Appendix 4) noted that workshop delegates stressed the importance of coordinating **communication on both sides of the border** and that, ideally, there should be a regional, cross-border, network for sharing information. Delegates mentioned the use of **checklists to prompt incident information exchange** between countries; common checklists would also allow standardisation of variables such as measurement parameters, and data formats. The CARRA-Net (Chemical and Radiation Risk Assessment Network) project [55] is developing procedures across the European Union for a coordinated multinational response to risk assessment for chemical incidents with cross-border public health impacts.

CERACI workshop delegates also noted that, while regular cross-border training of operational staff from neighbouring regions and countries increases familiarity with neighbours' capabilities and understanding of their response structures, bordering countries hosting joint training and exercising for the first time should initially concentrate on **building familiarity and understanding** before focussing on standardising and harmonising their responses.

Such relationships should, where possible, be established at local, regional and national levels and at operational, tactical and strategic levels. Anecdotal evidence summarised in CERACI Task D highlighted that **training and liaison exercises should reflect potential real-world involvement of staff**; for example, operational staff should be able to give greater emphasis on practical measures around communication and collaboration, sharing of physical resources, and command and control, whereas strategic-tier collaboration will have a different focus.

The use of different languages was identified as a potential barrier to communication by Task D. Workshop delegates suggested that a potential solution was to **train incident liaison officers capable of providing translation services** during incidents.

What needs to be tested?

Exercises should test **cross-border communication circuits** in order to identify gaps and areas for improvement. As previously noted, the level of interaction between different agencies will vary according to their role; operational responders will need to be familiar with the equipment, working practices and chains of command of their cross-border equivalents.

At a more strategic level, **the 'input-function-output' model again provides a framework for testing cross-border exposure and risk assessment**; individuals and agencies involved in the testing of cross-border responses should assess their role in terms of this model. Are their individual tasks understood within this wider framework? Do outputs produced by one agency function well as an input to another in the wider cross-border context? The development of common methodologies for the recording and provision of data, requests and interpretation was described as an unmet need in CERACI workshops when delegates noted that *"harmonised guidelines for information sharing did not exist".*

Again, the CARRA-Net project [55] would provide resources for agreeing, and testing against, a common structure for response across the European Union.

How should it be tested?

CERACI Tasks B and C (Appendices 2-3) highlighted that all Member States already have some form of agreement on international collaboration with their neighbours. Interviewees mentioned the importance of **personal contacts between the incident responders** as a key success factor for effective cooperation during an emergency.

The CERACI workshops reported that regular international training of operational staff increases familiarity with neighbouring regions' capabilities and understanding of neighbouring response structures, increasing the number of contacts within peer organisations in neighbouring countries. If this is to be regarded as good practice, care should be taken to retain a **focus on working practices and alerting mechanisms**, and that these remain documented and appropriate.

Some countries hold regular cross-border response conferences. Delegates stated that a good reason for organising international joint training and exercises is that some countries lack 'real-life' experience due to the low number of HazMat incidents.

Table-top exercises were felt to be a cost-effective way of getting to know each other as an alternative for expensive multi-agency real life or field exercises. The Public Health Response to Chemical Incident Emergencies (CIE) Toolkit is useful as a source of exercise material [69]. However, anecdotal evidence again reinforces the fact that **face-to-face working and co-operation is particularly vital at operational level**; for example, when considering the practical use of equipment and resources, and possible disparities between working practices in individual countries or between different response teams.

Secondments and exchanges may also provide valuable opportunities for information and skills to be shared between cross-border responders.

4.3.3 Supporting training and exercising and collaboration work

CERACI workshop delegates expressed a need for coordination and support for applications for funding; in particular, delegates discussed the EU's potential role as a facilitator of international exercises: for example via European Cooperation in Science and Technology (COST), Innovation and Environment Regions of Europe Sharing Solutions (INTERREG) or DG ECHO-funded programmes. It was noted that the local responders who would benefit most from such schemes are not always aware of the existence of these programmes, or of the possibility of applying for funding to support cross-border actions.

INTERREG is an initiative that aims to stimulate cooperation between regions in the European Union. It started in 1989, and is financed under the European Regional Development Fund (ERDF). The current programme is INTERREG IV, covering the period 2007–2013. The overall objective of the programme is to **improve the effectiveness of regional policies and instruments** and it builds on the exchange of experiences among partners.

Areas of support include "The Environment and Risk Prevention", and support for information exchange might typically extend to thematic workshops, seminars, conferences, surveys, and study visits. Project partners cooperate to identify and transfer good practices, and possible project outcomes include case study collections, policy recommendations, strategic guidelines or action plans.

INTERREG funded the CivPro project which developed "Regional Strategies for Disaster Prevention" [74]. The main objective of CivPro was to share knowledge to prevent and reduce any potential threat and damage inflicted on people, property and the environment by accidents and disasters, including both natural and man-made disasters. The project also aimed to improve instruments and establish modalities to strengthen the link between crisis management and disaster prevention. Experiences with risk mapping, early warning systems, risk screening models, awareness raising policies and specific experience from disaster events were exchanged.

At a more operational level, the HERITPROT scheme on Fire Risk Prevention and Improvement of the Fire Extinction Systems of the Historic Town Centres [75] will use workshops, thematic seminars and study visits to develop a joint analysis of potential hazards and prevention measures in the old quarters of World Heritage Cities in line with the type of building, and produce an interregional good practice manual, arranged according to building type, as a basis of a common method for prevention and action in the case of fire.

Together with INTERREG, the EU-funded (DG ECHO) programme for the international exchange of experts in civil protection [9] was identified as a good practice by CERACI workshop delegates. The programme offers the opportunity for international exchange between all EU Civil Protection professional roles, extending to all those working at the operative, tactical, and scientific levels.

4.3.4 Recommendations to facilitate training and exercising

CERACI recommends that there should be **central collation and provision of exercise resources** at European level. A curated database of chemical incident exercise material, and lessons learned from exercises, should be made available to Member States, and responders within Member States, as a resource.

Emergency responders, exposure assessors and public health risk assessors should be encouraged to **explore the potential for establishing memorandums of understanding for training and exercising**, and sharing and organising training through cross-border multi-agency groups.

Wherever possible, the scope of planned chemical incident exercises should be widened to include exposure assessment and cross-border issues. **Forthcoming (future) exercises should be included in an accessible central EU and Member State listing** so that all responders, including exposure and risk assessors, and those in cross-border areas, have the opportunity to get involved at the planning stage and to facilitate the scope of exercises being widened to include the considerations discussed in the sections above.

Furthermore, the adoption and **development of a modular framework for exercising** should be promoted so that modular training packages, focussed on specific areas of concern or improvement, can be produced. Such training packages should exist as discrete subject areas (e.g. for different functions of exposure assessment) that can be undertaken as exercises in isolation, but care should be taken to ensure continuity with other modules so that data and information produced by one module can serve as inputs for others.

The World Health Organisation's "Human Health Risk Assessment Toolkit" for Chemical Hazards [1] features a "risk paradigm" framework which shows the relationships between different aspects of exposure and risk assessment and information flows, and it may provide a useful framework for planning a modular training package. Any such training package should also make use of existing templates for cross-border response (e.g. CARRANET [55], which suggests key pieces of information that should be shared when reporting cross border incidents).

4.3.4.1 Using Seveso emergency preparedness to improve exposure assessment

Routine Seveso exercises provide a well-developed existing framework and programme for multi-agency preparedness that can be used for the exercising of functions of exposure assessment and cross-border chemical incident response. **Emergency preparedness and response can be improved by including consideration of exposure assessment, public health risk assessment, and cross-border response within Seveso plans and exercises.** Ideally, this should be a legislative requirement. The forthcoming Seveso III Directive is at an advanced stage, and Member States will be required to transpose it into new national legislation. This will provide an opportunity to promote updated guidance at European and Member State level to include these considerations. This opportunity should be considered by DG ECHO and Member States, as part of their future chemical incident emergency preparedness work.

CERACI workshop delegates thought that the generation of an EU database of past, current and future exercises at Seveso plants within the EU should be made available to Member States. This would provide insight into exercises in border areas (where it may be possible to collaborate to test cross-border aspects) and allow Member States to learn from exercises in other areas of Europe. These recommendations are reiterated in the "lessons learned and way forward" section of this report (Section 4.6), where CERACI recommends that this approach is extended to include all chemical incident exercises, not just Seveso alone.

4.4 Mutual aid in exposure assessment

The Project Strategy requires Task E to deliver a "*Report assessing capabilities in the EU to provide mutual aid during incidents involving hazardous airborne chemicals.*"

This section discusses what is required for Member States to be able to offer and receive mutual aid **in exposure assessment**. It summarises the theoretical capabilities of Member States to provide mutual aid and describes actual examples in practice: this is based on the information gathered by Tasks B-D. Cross-EU mutual aid mechanisms and the drivers for provision of mutual aid are discussed, and recommendations are made regarding mutual aid.

Mutual aid in exposure assessment is comprised of physical resources that can be deployed to the scene of an incident in another Member State (e.g. mobile monitoring teams, mobile laboratories and expert personnel) and assistance that can be provided remotely (e.g. provision of exposure information, modelling outputs, and advice). The greatest benefit given is where a capability is provided that a requesting Member State otherwise does not possess: "filling the gaps" in exposure assessment capabilities. Section 4.2 presents a tool that can be used during the preparedness phase to visualise available exposure assessment resources and the sharing of them between Member States.

There is no difference in the desired outcomes of effective exposure assessment in an incident involving mutual aid compared with an incident where there is no mutual aid: the outcomes of exposure assessment and guidelines for achieving them that are presented in Section 4.1 are just as applicable in incidents that involve mutual aid. Cross-border aspects in Section 4.1.10 are particularly relevant when considering mutual aid, where the 'border' is international.

In order to effectively share physical resources, there is a requirement for rapid activation, transport and deployment, hence time is a constraint. Remote assistance can be provided much more quickly as it involves the transfer of information rather than physical resources. The provision of both physical and remote assistance is entirely reliant on effective communication and sharing of information. Without this, effective mutual aid is impossible.

4.4.1 Mutual aid in the EU

Mutual aid is described in a European resolution on improving mutual aid between Member States in the event of natural or technological disasters [76]. The Council and Member State representatives agreed that Member States would "if requested by another Member State, furnish all such assistance as they deem possible and available in the event of a disaster in the territory of that other Member State entailing serious physical damage or danger to persons, property and the environment, and clearly exceeding that Member State's own assistance capability."

This resolution is neither specific to acute chemical incidents nor to exposure assessment. Exposure assessment resources are a small part of the much wider mutual aid that one Member State could provide to another. However, the resolution sets out requirements regarding the general provision of mutual aid assistance and these are relevant to exposure assessment too. Operational aspects are paraphrased below with exposure assessment in mind:

- Teams, and their equipment, should be dispatched early in the incident to the locality affected. Their work should contribute to the protection of persons, property and the environment.
- Teams must be logistically independent and self-sufficient in situ for at least 48 hours. Thereafter, their subsistence and continued operation should be resourced by the requesting Member State (the Member State requesting mutual aid).
- The requesting Member State will direct aid operations and will give guidelines and define the limits of tasks. The precise execution of such tasks will be decided by the team from the offering Member State; meaning the team's operational approach will be up to the responding team from the offering Member State, but the requesting Member State will assist with defining parameters.
- The requesting Member State will take measures to ensure the safety of members of the team and will assist the team to ensure speed and efficiency of operation (for example with communications, administration and access, such as permit, border checks, and infrastructure charges. To facilitate this, the offering Member State will provide documentation of the mission and composition of the team, together with a complete list of aid equipment and material sent, ideally at the time of entry into the requesting the Member State or at the latest one month afterwards).

By its nature, the resolution [76] is primarily concerned with major incidents: those that would be considered to be 'disasters' due to their significant impacts that overwhelm the resources of an individual Member State's responders. CERACI also considers mutual aid at a smaller scale, such as in situations where aid is provided as a result of cross-border collaboration in exposure assessment emergency preparedness or local emergency response, rather than as a result of high level requests during a major incident. In both such cases the resolution's general requirements for mutual aid, listed in the bullet points above, remain applicable and Member States should consider them when collaborating in exposure assessment across borders.

4.4.2 Mutual aid for cross-border threats

The Task B, C and D reports discuss some of the specific aspects of mutual aid agreements in place across the EU. Of the 27 EU Member States, 23 were found to be party to at least one bilateral or multilateral agreement on mutual assistance in civil protection or disaster and accident operations in EU territory. The post-Cold War era has resulted in several bilateral disaster relief agreements in Central and Eastern Europe. The Netherlands, Austria, Belgium, France and Germany have formulated agreements with all of their European neighbours.

Within the EU Member States civil protection is under the responsibility of national governmental administrations. The framework under which it operates varies from country to country depending on which ministry has the lead, such as the Ministry of

Interior or the Ministry of Defence. The detailed operational arrangements vary significantly between agencies and organisations. Brief overviews of Member States' civil protection institutes and ministries, along with bilateral and multilateral agreements, can be found at the DG ECHO website [5]; the International Civil Emergency Planning Handbook 2009, published by the Swedish Civil Contingencies Agency [77]; and the European Commission Red Cross / European Union Office Project website "Informed, Prepared, Together" [11].

The International Federation of Red Cross and Red Crescent (IFRC) Societies of Austria, Bulgaria, France, Germany, the Netherlands and the United Kingdom have commissioned a report on the Analysis of Law in the European Union pertaining to Cross-Border Disaster Relief [78]. It is one element of a broader project being undertaken by the International Federation to study EU and Member States' regulations for cross-border disaster assistance within Europe. This report presents a broad overview of the treaties that were publicly available and accessible to the researchers.

The IFRC research covered 33 bilateral agreements concluded between 1973 and 2002. The instruments range from general declarations on good neighbourly relations, training and data exchange to detailed treaties regulating the crossing of common borders of personnel and material, data protection, exemption of taxes and customs duties and the repatriation of evacuees. Most agreements regulate the compensation of costs as well as death, injury and damage claims [79]. The report provides a summary of the agreements and appends them in an annex at the end of the report [78].

The resolution on improving mutual aid between Member States [76] recognises the usefulness of bilateral and multilateral agreements in improving mutual aid. Such agreements can be informal (memoranda of understanding) or formal (specified by European and national legislation and conventions (e.g. the Danube River Protection Convention [80]). They can also be formulated across borders at local, regional, and national levels. High-level international agreements tend to set out the principles of an agreement to cooperate, whilst local and regional agreements, formulated by responders rather than policymakers, contain the specific details of how cooperation will work in practice. <u>Both types of agreement are required between countries in order to drive mutual aid work</u> i.e. there needs to be an agreement that cooperation will occur and specification of what that cooperation will entail. It is important that collaboration in exposure assessment informs risk assessors: both exposure assessment and public health risk assessment should be part of agreements about emergency preparedness and response to chemical incidents.

The Joint UNEP / OCHA Environment Unit considered some of the complications and barriers to effective international response to environmental emergencies, highlighting that "there is no overarching framework within which the different institutions and agreements operate". It also summarises a number of agreements in place [81] and provides comprehensive recommendations regarding the strengthening of international governance systems to respond to environmental emergencies.

4.4.2.1 New EU measures to tackle cross-border public-health threats

A new legal framework has been proposed to help national governments to deal with cross-border public health threats, including environmental disasters [2]. It acknowledges that, in order to protect citizens of the EU, preparedness planning, monitoring, early warning and a coordinated response is required. The new framework has been conceived partially in response to recent cross-border public health threats, such as the volcanic ash cloud from Eyjafjallajökull, Iceland, in 2010. The legal basis for the initiative is the Lisbon Treaty [82], which is aimed at supporting and coordinating Member State actions. It requires "monitoring, early warning of and combating serious cross-border threats to health" under Article 168(1) TFEU [82]. The proposal is expected to come into effect in late 2012 to early 2013. If agreed this would involve the following of relevance [83]:

- Decision 2110/98 would be replaced with a new Decision which includes environmental disasters as well as communicable disease.
- The EU Health Security Committee (which was set up to manage serious cross-border threats, but currently primarily focuses on communicable disease) would be formalised (it is currently an informal body) [84].
- National governments would have increased capacity to mount a coordinated response.
- The Early Warning and Response System (EWRS) (currently used solely for communicable disease) would be widened to include all cross-border threats (except radionuclear), with an added monitoring requirement and crisis management structure for addressing health threats.
- The WHO International Health Regulations [16] would be supported by ensuring adequate Member State coordination.
- New monitoring requirements would apply for crises involving health threats other then communicable diseases.
- A more coordinated public health risk assessment would be undertaken.

Therefore, these new measures provide a clear opportunity to facilitate cross-border collaboration and mutual aid in exposure assessment for chemical incidents, though more specific guidance is needed on how the framework would be used to facilitate action during chemical incidents; for example, the current proposal describes how an ad hoc network will form for serious cross-border threats to public health other than communicable diseases, to provide information and data for risk assessment and monitoring of emerging threats.

4.4.3 Why is mutual aid important?

There are a number of factors which influence the need for mutual aid to support risk and exposure assessment; these will vary depending upon the nature of the need or incident being considered. The following sections consider some of the factors which influence the need for and importance of mutual aid; other factors which are not discussed in detail include mutual benefit from good practices; allowing better use of resources; and ensuring effective information flow, both in preparedness and response. Some examples of mutual aid in practice, which demonstrate some of the factors discussed below that influence emergency preparedness and response, can be found in Section 4.4.5.2.

4.4.3.1 Public health protection

Mutual aid is important to support the common goal of protecting public health across the EU and within individual countries; this is particularly pertinent where there are potential transboundary implications of not effectively managing a risk in a particular country [2]. This is easy to visualise when considering the potential for spread of an infectious disease from one country to others. In the case of chemical and environmental incidents, the same is also true (consider how easily contamination can be transported in air or water). Individual Member States, and the EU as a whole, have a responsibility to ensure that the health of the public is protected from threats from any source. For instance, Member States must comply with the legislative requirements of the International Health Regulations [16].

As discussed in Section 4.4.2.1, the new EU legal framework proposal to assist national governments to deal with cross-border public health threats, which includes the formalisation and expansion of responsibilities of the Health Security Committee to include environmental disasters, could become a driver for more prescriptive agreements regarding mutual aid, that facilitate exposure and risk assessment in chemical incidents. This framework will potentially assist in raising the profile of the need and importance of emergency preparedness for chemical incidents.

In practice, high-level legal frameworks such as this are unlikely to apply in smaller-scale incidents where there is not judged to be a “serious” cross-border threat to public health, and in cases where Member States already have agreements with their neighbours (such as bilateral agreements) that sufficiently provide for mutual aid and collaborative working, enabling them to respond effectively to cross-border incidents. An example of this is the Greece and Turkey Joint Standby Disaster Response Unit agreement, facilitated by the UN following earthquakes in 1999; a unit was specifically set up to enable Greece and Turkey to work together to respond to cross-boundary disasters, specifically where the health of the public is at risk [85].

Another practical example where mutual aid has been important in order to protect public health is the use of the SAMU (Service d'Aide Médicale Urgente) international ambulance service coordination used by Portugal, Spain and France. The primary aim of SAMU is fast and effective emergency clinical response, but it may also be a means of collecting exposure information and observations useful for cross-border risk assessment [86].

The Non-Governmental Organisation (NGO) Bomberos Sin Fronteras (Firefighters Without Borders) was established in Spain, but assists with practical disaster response worldwide, through sharing expertise, providing physical response units and encouraging coordination through training. They list a number of guiding principles for mutual aid, many of which are related to human health and well being [87].

4.4.3.2 Shared natural resources

Natural resources are not restricted to constitutional boundaries and the fact that many countries share physical resources across borders is clearly important when considering the need for effective mutual aid in exposure and risk assessment. Such physical resources include air; water bodies, such as seas and rivers; food sources which may be affected, such as fisheries; and other physical resources such as forests. The identification of shared natural resources is part of effective cross-border emergency preparedness, but there are also a number of specific arrangement for cross-border incident response that have arisen due to Member States' shared natural resources.

At an EU level, the EU Fisheries Control Agency may be cited as one result of an agreement that is in place to protect the water environment and the fisheries resource. The Agency would assist with communication and risk assessment in case of a major incident with cross-boundary effects on fisheries.

The UK is party to a number of agreements for the protection of shared seas: for example, under the Bonn Agreement the English Channel is the joint responsibility of France and England, which includes responsibility for counter-pollution measures, such as sea and river monitoring and modelling [88]. Many other similar agreements are in place for the protection of water bodies in which a number of Member States have an interest, such as the Convention on the Protection of the Rhine, which forms the basis for international cooperation for the protection of the Rhine. It was signed by representatives of the governments of the five Rhine bordering countries: France, Germany, Luxembourg, the Netherlands and Switzerland and by the European Community. The length of the River Rhine is subject to an international warning and alarm plan, linked to a network of alarm centres for international warning, information sharing and prevention of pollution [89-91].

The Danube River Protection Convention is also a good example of a legislated mutual aid agreement in place to ensure that a shared natural resource can be protected. The convention requires the conservation of waters; preventative measure to control hazards from accidents (including hazardous substances); and measures to reduce pollution entering the Black Sea from the Danube River Basin [80]. As part of the convention, seven expert groups have been established, including:

- The Monitoring and Assessment Expert Group (MAEG) – they are responsible for issues concerning water quality and the operation of the "Accident and Emergency Warning System".
- The Information Management and Geographical Information System Expert Group (IM +GIS EG) – they provide maps and a Strategic Plan and support all activities in relation to information systems.

The expert groups can form "Task Groups" where a specific need arises to access expertise from the group of other experts [92].

A final example of mutual aid related to natural resources is given by DG Environment and the Joint Research Centre (JRC), who created the European Forest Fire Information System (EFFIS) in 1998. This provide services and support to Member States' fire fighting services and supplies the European Parliament with information on European forest fires and statistics to aid in preparedness and response [93].

4.4.3.3 Protecting the EU

Mutual aid is also important in order to effectively prepare the EU to respond to internal and external threats and to mitigate the potential impact of such threats. A number of considerations are related to civil protection, some of which may be politically-sensitive, such as protecting the reputation of Member States and the EU; defence and security issues (such as anti-terrorism), that may include the lifting of border restrictions in order to provide a rapid response; and assisting financially or technologically restricted Member States by providing assistance from Member States with more capabilities, when it is required. Examples of defence-driven aspects of mutual aid are given below.

The Civil Military Emergency Preparedness Council (CMEPC), previously known as the Civil Military Emergency Planning Council for South Eastern Europe (CMEPC SEE) acts as a consulting and coordinating body for regional cooperation in disaster management. The Council advocates the development of common standards and procedures, to be used by all the nations of the SEE region for planning and response to regional disasters and emergencies. Focusing on transboundary cooperation, the Council has drafted an agreement for facilitating border crossing procedures during an emergency. The Council proposes developing and maintaining emergency response and GIS databases for the region; opening emergency operating centres in all the member countries; and developing an emergency information network [94].

The DG ECHO Civil Protection Modules include a number of modules to drive practical aspects of incident response, such as flooding and forest fires; they also include CBRN modules which can carry out CBRN detection and sampling and provides technical assistance and support during chemical incidents [95].

The North Atlantic Treaty Organisation (NATO) Guidelines for first response to a CBRN incident are designed to improve multi-agency interoperability in first response to a CBRN incident and provide guidance on when regional, national or international assistance may be required. They encompass the provision of specialist support by prompting appropriate authorities to engage specialist advice and services, including carrying out environmental monitoring and sample analysis; undertaking dispersion modelling; establishing effects on populations; providing Detection, Identification and Monitoring Equipment (DIM); and providing geographical information (mapping) and meteorological equipment, amongst others [21].

4.4.4 Existing mechanisms to facilitate mutual aid

The detailed “Baseline Review of Instruments, Institutions, and Practice”, prepared for the Joint UNEP/OCHA Environment Unit, looks specifically at strengthening international governance systems to respond to environmental emergencies [81]. It is a major review of multilateral agreements focussing on environmental emergency response, some of which have prescriptive detail regarding information sharing. In addition to these thematic and geographic agreements, there are also numerous agreements related to international watercourses. This study gives a good overview of existing structures and legislation that apply to Member States’ responses to environmental emergencies.

There are a number of existing mechanisms that can facilitate mutual aid for cross-border chemical incidents in the EU; the tables contained in Appendix 8.1 summarise key worldwide, EU-level and specific Member State / regional or other geographic arrangements. The majority of these are discussed in the earlier Task B report; however, the tables provide more detail regarding the relationship between these mechanisms and mutual aid in chemical incidents.

In examining the nature of these mechanisms, four key aspects of the mutual aid requirements for effective incident response are summarised:

- **Preparedness** – mechanisms to ensure the EU and individual Member States are prepared for potential incidents.
- **Field Aid** – mechanisms to ensure that practical aid is available in the field, such as monitoring; sampling; analysis; observations and modelling.
- **Provision of Risk Assessment and Expertise** – mechanisms to ensure that people with relevant expertise can be available to receive exposure assessment information and undertake public health risk assessment.
- **Information Exchange** – mechanisms to ensure that information can be received by risk assessors and that the outcomes of risk assessment can be communicated to authorities and the public.

As can be seen from the information summarised in the tables in Appendix 8.1, the mechanisms that exist are primarily focussed on preparedness and information exchange and there is little information regarding the provision of risk assessment and expertise or field aid. It is also noteworthy that mechanisms for information exchange primarily relate to alerting, early warning systems and coordinating requests and offers of aid, rather than facilitating the exchange of exposure assessment data and information during and after an incident.

4.4.5 Mutual aid in practice

This section discusses the requesting of, and offering of, mutual aid and some of the practical considerations associated with the offering of, and receiving of, mutual aid by Member States. It provides examples of mutual aid and categorises these by the type of agreement or geographical level under which the action was undertaken e.g. world and multi-lateral level; EU-level; and regional and bilateral agreements.

4.4.5.1 Requesting and offering mutual aid

In order to request mutual aid, a Member State must first be aware of its availability and mechanisms for requesting it. Knowledge may vary at national, regional, and local levels: the Task D workshops found that some delegates - first responders at local level - were not aware of EU-level aid mechanisms. Awareness-raising is important as part of emergency preparedness efforts (on which guidance is provided in Section 4.1.3).

This project has identified substantial differences in the organisation of, and capability for, exposure assessment within and between Member States. A Member State must have resources in exposure assessment to be able to offer mutual aid in exposure assessment to another country; the project's impression of exposure assessment organisation and capabilities in each individual Member State are summarised in the Task

B and C reports. The resolution of this information is primarily at a national level and the amount of available detail varies between countries.

There are a number of general considerations that influence the availability of mutual aid in exposure assessment across the EU:

- Exposure assessment resources in any given location tend to be dependent on that location's distance from centres of population, as the resources to undertake monitoring and modelling are concentrated around urban and industrialised areas.
- Topography can determine the ease of transport of physical resources: sharing of these is more difficult and less likely to occur when Member States are separated by mountain ranges, water bodies or areas of poorly developed transport infrastructure.
- Language can determine the ease of sharing of information: Member States that share a common language are more likely to effectively share exposure and risk assessment information.
- Time is an important factor: in short-lived chemical incidents there isn't enough time to mobilise long-distance mutual aid. Major disasters and long-lived incidents are most likely to be associated with complex and high-level cooperation between Member States.

Further assessment of regional and local exposure assessment capabilities must be compiled by responders at those levels, as must assessment of the capability for mutual aid across local and regional borders. Section 4.2**Error! Reference source not found.** presents a tool that can be used during the preparedness phase to visualise available exposure assessment resources and sharing of them across local, regional, and national borders. It may also be used to identify gaps in exposure and risk assessment capabilities, which could be used as a political driver for improving a country's own resources as well as encouraging the formation of bilateral agreements. The information presented by Tasks B and C is a starting point for this process at national level: it should be led nationally by each Member State.

A Member State must have relevant resources to be able to offer mutual aid in exposure assessment to another country. If resources are available and Member States are willing to cooperate then the next prerequisite is that there must be a mechanism for one Member State to request and receive mutual aid from another. Ideally this mechanism is predetermined and understood before an incident occurs: if this is not the case then Member States are reliant on ad-hoc communication, negotiation and prompt action during the acute phase of incidents. Emergency preparedness is vital to expedite timely mutual aid in an incident. Agreeing the fine detail of a cooperative response for the first time during an incident is not ideal and effective mutual aid and response is reliant on good emergency preparedness, on which guidance is provided in Section 4.1.3.

Mutual aid between neighbouring countries is facilitated by cross-border cooperation during incidents and agreements for cooperation across borders can exist at local, regional and national levels. However, it would be wrong to assume that mutual aid and cross-border cooperation during incidents are synonymous: countries may offer mutual aid to others even if they do not share borders.

The receiving Member State must ensure that it is capable of coordinating physical resources and information provided by other Member States, as well as its own organisations. It is important that there is a central oversight and management of mutual aid requests, particularly for large-scale incidents. There are examples of international incidents where the capabilities of the receiving Member State to coordinate response was stretched or overwhelmed by the level of aid received. A relatively recent (though non-EU) example of this was apparent following the earthquake in Haiti in January 2010; the UNEP observed in their report "UNEP in Haiti 2010 Year in Review (February 2011)" that between 14 and 30 January there was an "enormous and chaotic inflow of aid from hundreds of organisations" which led to paralysis of the local airport and other logistical problems [96].

Regardless of how action is undertaken in practice, there must be an agreed procedure for the flow of exposure assessment input information from the scene of an incident to a Member State's risk assessors and, likewise, a flow from those risk assessors to relevant communicators and decision-makers, to ensure that incident response is effective. Effective emergency preparedness should predetermine the roles that will be played by experts from the offering and receiving Member States and how decisions will be made.

One question that merits further consideration is whether Member States' civil services, which are involved in incident response and mutual aid, communicate with their diplomatic services. Diplomats, particularly staff in the Ministries of Foreign Affairs, can help to facilitate mutual aid: diplomatic cargos can pass through customs quicker, and diplomats can help to smooth the way for the entry to a receiving Member State of another's teams and resources. They have local links to a receiving Member State's civil service, so an offering Member State could use its embassy's links in a receiving Member State in cases where their mutual aid teams had limited information or contacts. Because diplomats may not always be engaged or informed during chemical incident response, using them would require direct contact between planners and responders to inform them of the mutual aid that a given Member State can provide, or wants to receive. The diplomats would then be able to reach local links in another country in order to provide this information and act on it. This may be a complementary approach below higher-level intergovernmental links, which may take longer and may not easily reach local responders. It is also particularly useful in cases where there are no formal agreements for mutual aid between Member States, in cases where they do wish to cooperate. This area is discussed in more detail by a Joint UNEP/OCHA Environment Unit report [81].

4.4.5.2 Examples of mutual aid in practice

The sections below present some examples of mutual aid in practice and categorise these with reference to geographic level or type of agreement, with reference to Appendix 8.1, which contains a series of tables that display some of the key mechanisms for facilitating mutual aid. Note that some of the examples given relating to regional and bilateral agreements refer to the nature of the agreement itself, rather than being an example of what action has been taken under the agreement.

4.4.5.2.1 Example actions under worldwide and multi-lateral agreements

4.4.5.2.1.1 Kalush mining area, Ukraine, joint UN / EC mission

In March 2010 the Kalush mining area of the Ukraine was declared an "emergency ecological situation zone". A request for financial and expert assistance was made to the UNEP and UNECE by the Head Secretariat of the President of Ukraine, and a separate request was made from the Director of the Regional Office for Europe to the Executive Director of UNEP. As a result, a mission was convened through the United Nations Disaster Assessment and Coordination (UNDAC) system [97] and the EC-MIC [98]. The joint UN / EC team were supported by the Environmental Assessment Module (EAM) from the Netherlands (RIVM) to undertake a scoping of risks identified at the mining facilities and the potential for spread of hexachlorobenzene and other hazardous waste. The mission was convened to assess the risks before a serious incident occurred and the UN/EC Technical Scoping Mission presented the results of their assessments in terms of an order of criticality, thus helping the Ukraine government to focus on what action was urgently required in order to avert a major disaster [99].

The mission comprised undertaking field analysis and risk assessment and presenting the results of this assessment to the Ukraine government to provide guidance to decision-makers and to assist them with setting priorities. The personnel collecting field information were the same as those undertaking the risk assessment, facilitating a coordinated response [99].

4.4.5.2.1.2 Aluminium sludge spillage, Hungary, WHO Regional Office mission in support of EU

On 7th October 2010, the Hungarian Government activated the EU Civil Protection Mechanism [100] for urgent international assistance, following a large spillage of aluminium sludge, which had resulted in the flooding and contamination of local settlements and the Danube river with an alkaline sludge [101]. The EC-MIC then communicated the request for expert assistance to other Member States.

In October 2010, the WHO Regional Office for Europe organised a mission to Hungary to support the Hungarian government and the EU technical team who had responded to the international call for assistance. The WHO team focussed on the public health impacts of the incident and presented findings and recommendations to the Hungarian government, including those related to cross-border considerations and risk communication. The mission comprised of experts from the WHO Regional Office for Europe, the WHO Collaborating Centre for Chemical Incidents (UK) and a specialist in industrial risk management (Italy) with contributions from international experts from Finland, Germany, Italy, Spain, Hungary and the UK [102].

4.4.5.2.1.3 Cyanide spill at Baia Mare, Romania, UNEP / OCHA assessment mission

In January 2000, requests for assistance were made by the governments of Hungary, Romania and The Federal Republic of Yugoslavia. The UNEP (in consultation with OCHA) sent a team of international experts to carry out a scientific assessment of environmental damage, caused by the breach of a tailings dam that had resulted in a major spill of cyanide-rich tailings waste into the river Somes, which flows to the Danube before reaching the Black Sea. The missions involved input from UNDAC for logistical coordination; representatives of the WHO and UNECE; and three mobile laboratories, provided by Germany, Switzerland and the Czech Republic, as well as consultation with the International Commission for the Protection of the Danube River; the Regional Environmental Centre (REC); the Worldwide Fund for Nature (WWF); and donor countries. As well as providing a report of the findings of the mission to the government, the mission also established a website to communicate with public authorities, industry and the public [103].

The mission received financial and/or technical support from the following Member States: Austria, Czech Republic, Finland, Germany, Sweden, and the UK, as well as non-EU countries Norway and Switzerland. The mission made various technical and general recommendations relating to the incident, but also in relation to improving mutual aid responses. In 2000 Romania were not yet members of the EU, however, the mission recommended that Romania should acceed to the UNECE Convention on the Transboundary Effects of Industrial Accidents. It further recommended that "the Disaster Response Branch of OCHA and it's Joint UNEP / OCHA Environmental Unit should take appropriate steps to further develop the application of the concept of the UN Disaster Assessment and Coordination (UNDAC) to various environmental emergencies…[and] The establishment of a small team of associated environmental experts should also be considered" [103].

4.4.5.2.2 Example actions under EU-level agreements

4.4.5.2.2.1 Forest fires, Greece, EU Civil Protection Mechanism

In June 2012, Greece activated the EU Civil Protection Mechanism due to forest fires close to residential areas. The country specifically needed support from aerial fire-fighting modules called Canadair fire bombers. The fires posed both a physical hazard and a public health risk due to poor air quality from smoke. The EC-MIC sent out requests for assistance to participating Member States and was able to make a first offer from the Italian Civil Protection Department; other offers were also made by Bulgaria and Croatia [104].

4.4.5.2.2.2 Ash cloud, Iceland, EU response

The EU response to the eruption of Eyjafjallajökull in 2010 and the subsequent ash cloud has been subject to much scrutiny; this scrutiny has generally been surrounding the closure of air space rather than public health risk assessment, though the two can be considered to be interrelated. There were a number of EU agencies (and worldwide agencies, such as the London Volcanic Ash Advisory Centre (VAAC)) involved in the response to the ash cloud issue. The EU has since conducted a review of the approach to responding to such an ash cloud incident and established an expert group to develop a risk management methodology, bringing together experts from the EC; European air traffic controllers (Eurocontrol); and the European Aviation Crisis Co-ordination Cell (EACCC) [105]. As a result of the review, international procedures in case of volcanic activity (the International Civil Aviation Organization (ICAO) guidelines for Europe) were revised, as they were based on a very strict precautionary principle.

During the incident the London VAAC (operated by the UK Met Office) coordinated meteorological information, primarily for the Civil Aviation Authority [106]. A review of available meteorological products was also conducted and, as a result, new radar systems have been established in Iceland, and the London VAAC now has a new aeroplane and instruments to improve analysis capabilities from test flights [107]. The London VAAC also undertook modelling using the Met Office's Numerical Atmospheric-dispersion Modelling Environment (NAME) computer model to forecast the movement and dispersion of ash, which was shared with other Member States. The Met Office is currently working on the inclusion of chemicals and gases into NAME’s volcanic ash plume modelling [108]. A European National Meteorological Service (EUMETNET) (described in the Task B report) also exists for cooperation between Member States on sharing alerts [109]. Despite the work undertaken by meteorological and aviation experts, it would appear that there remained a cross-border gap in collaboration between exposure assessors and public health risk assessors: there is anecdotal evidence that Member States conducted their own public health risk assessments in relation to exposure to the ash, without there being international collation or coordination of these assessments.

4.4.5.2.3 Example actions under regional and bilateral agreements

4.4.5.2.3.1 Examples of Bilateral agreements between emergency / response services

As discussed in Section 4.4.3.1, the Greece and Turkey Joint Standby Disaster Response Unit agreement was set up following earthquakes in 1999, with the assistance of the UN, to enable Greece and Turkey to work together to respond to cross-boundary disasters [85].

The central ambulance control function SAMU (Service d’Aide Medicale Urgente), set up by France, is used by France, Spain and Portugal under a bilateral agreement to provide emergency response vehicles, including mobile intensive care units. Although not directly associated with exposure assessment, this organisation is well placed to feedback at-scene and patient observations to aid public health risk assessors [86].

The NGO Bomberos Sin Fronteras (Firefighters Without Borders), discussed in Section 4.4.3.1 [87], was not specifically setup to assist with exposure assessment. However, they would be well placed to provide at-scene observations and, potentially, field monitoring to assist with risk assessment.

Finn Rescue Force (under the Finnish Ministry of the Interior, supported by the Ministry of Social Affairs and Health) is a Finnish organisation that was set up specifically to respond to disasters in Finland and incidents with potential cross-border impacts. It has undertaken collaborative cross-border response with its neighbours, including Russia, Sweden and Norway. Finn Rescue Force is also a member of the International Humanitarian Partnership (IHP).

The IHP was set up in 1995 by the UK Department for International Development (DFID) and the Danish Emergency Management Agency (DEMA) to “provide collaborative support to humanitarian operations of the UN”. Other partners later joined the partnership, including the Norwegian Department for Civil Protection and Emergency Planning (DCPEP), the Finn Rescue Force, the Dutch Ministry of Foreign Affairs (N-MFA) and the Estonian Rescue Board (ERB). The secretariat and focal point for the partnership is provided by UN OCHA [110]. IMP includes an environmental module which can provide environmental experts and analytical equipment with field capabilities to undertake monitoring. This module can provide very useful exposure assessment information to feedback to risk assessors, coordinated by UN OCHA [111].

4.4.5.2.3.2 Oil pipeline leakage, Latvia, ad-hoc cross border bilateral agreement

In March 2007, an oil product pipeline leaked approximately 120 tonnes of diesel in Belarus, about 130 kilometres from the border with Latvia. The oil slick travelled down the River Daugava and River Ulla, having the potential to reach the Baltic Sea, via the Gulf of Riga in Latvia. The fuel reached 100 kilometres downstream, however the clean-up operation prevented significant damage and no human or social consequences were reported as a result of the spill. Ad hoc mutual aid was provided by Estonia, Sweden and Lithuania, who provided emergency equipment and rescue brigades. Their staff therefore contributed at-scene information towards the Latvian risk assessment, which was conducted by the Latvian State Environmental Service. No restrictions on water use were made as the efficient emergency response meant that pollution levels did not exceed permissible levels. The Latvian Government also made use of the Bonn Agreement for assessment methods of environmental damage. The lessons learnt from the incident included the need to improve response and information-sharing in the case of cross-border incidents, and the need to sign a multilateral agreement on the "Use and Protection of Water Resources in the Basin of Zapadnaya Dvina / Daugava" [112].

4.4.5.2.3.3 EU Carpathex 2011, Poland cross-border cooperation project on CBRN incidents, testing crucial elements of international assistance

The exercise was designed to engender a common understanding of procedures for co-operation in the event of international civil protection assistance interventions, verifying the abilities of Polish and international partners to work together in a crisis [113]. It identified a crucial element of international assistance as being cooperation on the basis of bilateral agreement, in addition to the European Community Mechanism, and examined new geospatial technologies to support and coordinate rescue operations. The exercise scenario consisted of five simultaneous chemical incidents. Participating teams included the Polish State Fire Service specialised teams, army, border guard and police; Czech CBRN team; Slovakian fire-fighters with a mobile laboratory; Hungarian civil protection team; Polish Red Cross units; and the EU Civil Protection Team [100]. The exercise focussed on bilateral agreements with neighbours including considerations associated with operating CBRN teams in bordering countries. It acknowledged that, although agreements are signed at a national level, competences in response functions are devolved to first responders and the incident command level for execution. It also acknowledged that European expert teams were required to provide chemical expertise and simple modelling (e.g. undertake public health risk assessment) [114].

4.4.5.3 Information exchange

It is clear that mutual aid is reliant on effective sharing of information. At a practical level, optimal sharing of information would be by a shared Information Communication Technology (ICT) system, which would allow multi-agency and country use, such as the collation and sharing of incident information to improve interoperability and collaboration between those organisations that respond to acute chemical incidents. Such systems can be used by responders to quickly share information, including exposure assessment information (e.g. monitoring and modelling outputs), and coordinate public communications. Examples of existing systems for real-time data exchange, incorporating monitoring and modelling outputs, include the Real-time Online Decision Support System (RODOS) system for nuclear emergency management [115] and the Distributed Information Acquisition and Decision Making for Environmental Management (DIADEM) system [116], which incorporates the existing ARGOS prognostic tool [117].

Appendix 8.1 highlights a number of the existing mechanisms that facilitate information exchange for mutual aid in the EU.

For chemicals, in order to share real-time information, work has been undertaken to explore the application of RODOS for CBRN incidents [118], and ARGOS and DIADEM have specific application for sharing chemical monitoring and modelling data; the latter included a work package that specifically considered the challenges of collating information from large systems of geographically separated experts.

For both chemical and radiological incidents, there is no one ICT incident management system that is universally used by Member States. There are commonly used systems that address specific issues: the EURDEP network, linked to fixed sensor networks, is used to share radiological monitoring information from Member State national networks, but this concept is less suited to chemical incidents as fixed sensor networks are not used in the same way: chemical contamination tends to be over smaller scales and involve ad-hoc field monitoring, rather than the use of fixed networks. Systems for the exchange of meteorological model predictions do exist, but they are not specific to chemical incidents. ENSEMBLE is one such web-based platform for the inter-comparison and evaluation of atmospheric chemistry transport and dispersion models [39], focused more on mesoscale outputs.

EU 1388 AIDAIR, a EUREKA EUROENVIRON project [119], developed a modular software system for air quality assessment and management that integrates monitoring data analysis, mapping, modelling, decision support, and reporting. EU3266 WEBAIR [120] extends the scope into on-line, real-time monitoring, modelling, and forecasting, as well as to accidental emissions from industrial plants. The projects are focussed on ambient air quality and industrial regulation, but the real-time collation and presentation of monitoring and modelling information has potential application in acute incident scenarios. Related work has developed real-time information systems for industrial users that combine monitoring and continuous modelling to support emergency management [121-122]: this has potential application for emergency responders.

It is inevitable that Member States will develop differing ICT systems for use in emergency response and related areas, according to their needs. At European level, it is important that systems used for information exchange contain sufficient information about chemical incident exposure assessment to meet the requirements of other Member States: at a national level summary information may be sufficient.

The ICT systems discussed above are distinct from communication systems that exist solely to exchange simple information and facilitate requests for mutual aid. The EC

Directorates share information within the EU using the ARGUS general rapid alert system. The Common Emergency Communication and Information System (CECIS) is a secure EU Civil Protection system for alerting and communication between MIC national focal points [123]. The system facilitates communication between the MIC and National Authorities, making response to disasters faster and more effective. The UNECE Industrial Accident Notification (IAN) System is used by the Points of Contact (NFPs) of Parties to the Convention on the Transboundary Effects of Industrial Accidents to notify other Parties of an industrial accident and to ask for mutual assistance [62]. The Global Disaster Alert and Coordination System (GDACS) [124] exists for information exchange and coordination of bilateral assistance in the early phase after major disasters, but it is not specific to chemical incidents. The Joint UNEP / OCHA Environment Unit have published “Guidelines for Environmental Assessment Following Chemical Emergencies”, which outline the information that countries should collect and provide when making international notifications [57].

The information shared through high-level international warning and informing systems for information exchange between Member States can be somewhat limited in scope. This means that they are unlikely to be suited to the specific needs of local responders and exposure and risk assessors, who are likely to require their own systems. At the local responders’ level it is important that ICT systems exist that connect exposure and risk assessors, and that they provide risk assessors with exposure assessment outputs. When separate, incompatible systems exist in different Member States then this is a natural barrier to information exchange.

It is important that the potential for ICT systems to enhance collaboration is fully utilised; it is also clear that there is a need for ICT systems to function between different countries, an aspects which may not always be considered when a Member State is developing such systems nationally. The success of ICT projects in facilitating mutual aid is dependent on them identifying and meeting the needs of stakeholders and overcoming barriers such as differing operating procedures, output formats, languages and importantly, the potential political and legal sensitivities of openly sharing detailed information, which may be open to interpretation.

Other information exchange systems exist that are related to preparedness, rather than response. The open access system eMARS [125] (operated by MAHB [126]) exists to allow sharing of information on major accidents reported under the Seveso Directive by EU Member States (and voluntarily by other OECD countries); though this system is retrospective and some information is redacted (such as local contacts and location information). As such, it is not of use during the response phase of an incident, as it does not include exposure information and is not intended to be dynamically used as part of a response; however, it is useful for sharing lessons learnt and supporting emergency preparedness. Other open-access incident databases at Member State level include ZEMA (Zentrale Melde und Auswertestelle für Ereignisse in verfahrenstechnischen Anlagen, Germany – ‘Central Reporting and Evaluation Office for incidents and disturbances in process plants’) and ARIA (analysis, research and information on accidents, France) [127-128]. Other international databases, such as EM-DAT (the Emergency Events Database) [129], collate wider incident reports that include technological disasters.

4.4.6 Improving mutual aid

Although there are mechanisms in place that can provide for mutual aid in exposure and risk assessment for cross-border incidents, this section has also highlighted some areas where improvements could be made to the efficiency and effectiveness of cross-border response. These are summarised below.

- Improve communication – possibly through common ICT systems for sharing exposure assessment inputs and monitoring, modelling and risk assessment outputs. A common platform for sharing of chemical monitoring and modelling input and output information would greatly improve information sharing, but could also act as a means of focussing Member States on the nature, quality and extent of information which may be required to provide an effective response to a chemical incident.
- EU and world level mechanisms may be facilitated when bilateral agreements are also in place, supporting with the detail of how Member States will work together in practice. Bilateral agreements can be more effective than EU or wider multi-lateral level agreements as they are more likely to consider the finer detail of cross-border response, addressing practical matters such as political restrictions and border issues; mandated information sharing; agreement of where resources would be obtained from and placed; and agreeing risk assessment and decision-making frameworks.
- The Task D report indicates that first responders' knowledge of existing high-level mechanisms to facilitate mutual aid could be improved. This could be through national strategies to raise awareness (with first responders and risk assessors) and also through exercises and awareness-raising between bordering countries. It is apparent that multi-lateral and world agreements are most effective in facilitating the response to larger-scale incidents and, once a formal request has been made, they are quite timely in providing a response. However, whilst the response itself might constitute an international "mission" of selected experts, the majority of the in-field response will likely be undertaken by emergency responders and responding agencies. It is therefore clear that responders must be able to work together and any in-field mutual aid workers must understand the 'chain of command' and communication pathways in the Member State that they are assisting, particularly when it comes to being able to effectively share exposure information to aid risk assessment.
- Some of the bilateral agreements related to mutual aid for emergency responders could be built upon to provide a more wide-ranging mutual aid network across the EU. Cross-border responders such as SAMU and Bomberos Sin Fronteras could be trained and prepared to collect and report information related to exposure assessment to public health risk assessors, including at-scene observations regarding the characteristics and impacts of incidents.
- Engaging diplomats in Member States may be one means of facilitating mutual aid, particularly in cases where detailed bilateral or local agreements are not in place to govern the movement of people and resources or their interactions with a receiving Member State. The advantages of this complementary strategy are discussed in more detail elsewhere [81].
- The proposed new legal framework to help national governments to deal with cross-border public health threats, including environmental disasters [2], has the potential to improve mutual aid in exposure assessment. It should be seen as an opportunity

to formulate and propagate guidance and bilateral agreements regarding the specifics of chemical incident response between Member States. The DG SANCO Health for Growth Programme 2012 – 2020 includes a budgetary and research framework for new decisions on serious cross-border health threats. The proposed decision on serious cross-border threats also includes a series of table-top exercises to determine any shortcomings in EU-level response to chemical incidents. It states that “Standard operating procedures for public health impact of a chemical event at EU level, and possibly proposal of new provisions would provide a stronger basis for addressing the public health aspects of chemical incidents” [2].

4.5 Framework for networks of experts

The Project Strategy requires Task E to deliver a "*Final network of experts as a starting point for an operational and knowledge exchange platform.*"

4.5.1 Existing networks of experts

There is no one list of European organisations and contacts in the field of exposure assessment in acute chemical incidents, although Section 4.2.4.1 outlines a means for the future creation and population of a Member State directory of specialists and recommends that this is taken forward. There are disparate functional groups and subgroups within exposure assessment. A large number of existing networks of experts work within the different fields of exposure assessment and examples of such networks are listed in the Task D report and throughout this report.

Existing networks of experts contain specialists working in well-defined discrete areas of exposure assessment (e.g. poisons centres or laboratory analysis), which can partly or wholly compose a wider function (e.g. health surveillance or monitoring during incidents). These networks are often technical in nature and are very much focussed on the detail of methodologies, procedures, and validation (e.g. [29, 40, 63]). They provide a clear means to influence and develop standardised approaches to technical functions and national and international comparability, both of which are objectives when seeking to harmonise exposure assessment. They can exist at local, regional, national, and international levels and may be cross-border.

It is not realistic to expect to be able to create just one definitive "network of experts in exposure assessment" because the functions of exposure assessment, professions and organisational roles within it, and their interests and work programmes, are so different. The focus of those involved in exposure assessment functions, naturally, is on the function itself rather than the risk assessment that is informed by, and demands it. First, it is important to recognise that disparate networks of experts exist and that they all have their own different purposes and objectives. Then, the question is how to keep improvement of exposure assessment in chemical incidents on the agenda of these mixed groups of experts who carry it out as a part of their work?

CERACI has considered this question; the expectations of exposure assessors and risk assessors can differ, and earlier parts of this report have discussed the importance of bridging gaps between exposure and risk assessors. Many of the good practices identified for CERACI are related to the shaping of exposure assessment functions and outputs to meet the needs of risk assessors during chemical incidents. Timely provision of useable exposure assessment information to risk assessors facilitates their risk assessment, which, in turn, leads to faster decision-making, risk communication and interventions to better protect the public during crisis situations.

In the same way that there are existing networks of experts in areas of exposure assessment, there are networks of experts in public health risk assessment too, which consider chemical incident emergency preparedness to be a part of their work (e.g. the EU Health Security Committee (HSC) and the Global Health Security Initiative (GHSI)). Any new CERACI network must ensure that exposure assessment meets the demands of risk assessors. The next section considers how best to provide a future European-wide focus on chemical incident emergency preparedness that links exposure and risk assessors, coordinating further work in a way that interacts with and uses existing networks of experts.

4.5.2 Proposal for a CERACI network

When considering networks of experts, it is worth comparing and contrasting radiological and chemical incidents. Radiation incidents are potentially long-lasting, with the potential for wide dispersal of material and widespread public health impacts. Consequently there is an enduring public and political interest in radiological incident preparedness work. In comparison with chemical substances, there is less agent variation and radionuclides are more easily monitored using fixed networks of monitoring stations. EU and Member State structures and work programmes are well established for radiological emergency preparedness and response, driven by legal initiatives such as Council Decision 87/600/Euratom on Community arrangements for the early notification and exchange of information in the event of a radiological or nuclear emergency [130]. Information from modellers and fixed monitoring networks is more readily shared across borders. This information can be integrated within real-time decision support systems, such as RODOS [115] and ARGOS [117], and platforms for rapid information exchange that are tailored to radiological events, such as European Community Urgent Radiological Information Exchange (ECURIE) [59], EURDEP (European Radiological Data Exchange Platform) [28], and, for meteorological outputs, ENSEMBLE (Reconciling National Forecasts of Atmospheric Dispersion) [39]. Emergency preparedness is coordinated through voluntary European networks such as NERIS, the portal of the European Platform on Preparedness for Nuclear and Radiological Emergency Response and Recovery [131].

In contrast with radiological incidents, there does not appear to be an umbrella group such as NERIS with an overarching, all-encompassing steer over emergency preparedness for chemical incidents at European level. This is a gap. The picture is complicated by the fact that there *are* a number of groups with an interest in emergency preparedness for chemical incidents (e.g. the DG SANCO HSC CBRN working group and the GHSI Chemical Events Working Group [132], the DG ECHO working group on CBRN resilience in Civil Protection, the OECD Working Group on Chemical Accidents, and Bureau meetings of the Convention on the Transboundary Effects of Industrial Accidents). The issue is that their scope is often focussed on narrower aspects of chemical preparedness and response, such as industrial accidents and process safety, CBRN threats, chemical policy, or risk assessment alone, rather than encompassing all of the steps of chemical incident response or going into the detail required to consider the technical functions of exposure assessment. Moreover, the members of such groups may be from particular disciplines within, and outside of, incident response; they are not necessarily representative of all responders and there does not appear to be any one group that unites exposure assessors and public health risk assessors across **all** of the functions of exposure assessment for chemical incidents.

This is perhaps illustrated by the RAS CHEM portal [133], a rapid alert system linking EU poison centres, national chemical agencies and Ministries of Health for the exchange of information on incidents, including chemical agents relevant to terrorism. The work of RAS CHEM undoubtedly forms an important part of chemical emergency preparedness and response, and it links exposure assessors in poisons centres with risk assessors and risk managers at a senior level within the EU, though the CBRN section of the HSC [134]. However, it does not set out to provide an overarching framework for sharing all types of chemical incident exposure assessment outputs.

The findings and recommendations of the project are predominantly concerned with emergency preparedness at the European and Member State levels. Propagating and taking these forward requires coordination by an existing European risk assessors' body adopting this responsibility, or through a new cross-European body. This is in line with the European scope of CERACI, and UNEP/OCHA has expressed support for a regional (e.g. European) approach involving regional networks of nations, with regional coordination and cooperation [135]. Worldwide coordination of preparedness and response would remain the preserve of organisations such as the WHO and UN.

A network structure is proposed by CERACI, detailed in the section below, to coordinate chemical incident emergency preparedness. Any such network must connect public health risk assessors with the exposure assessors' networks. This is required to translate risk assessors' information needs for risk assessment into technical requirements, standards, and working practices for exposure assessment.

It is important to consider how an international network can best link with national networks and reach down to local stakeholders within Member States. An idealised structure is provided below in Figure 12. The exact approach taken to linking national and local networks would vary between Member States, the key thing to recognise is that this is possible because structures do already exist at international, national and local level; comprehensively identifying and linking them is an initial requirement for an effective exposure assessment emergency preparedness programme that reaches stakeholders at all levels within Member States.

Figure 12. Coordinating networks of experts

- **International risk assessors' forum** – a small group of risk assessor focal points from each Member State, together with international representatives of exposure assessment functions (e.g. those with expertise in health surveillance, field monitoring, laboratory analysis, dispersion modelling etc). This may be part of a wider forum (e.g. a subgroup), but its remit must include emergency preparedness for chemical incidents. It is responsible for determining international priorities, cross-European sharing of existing information and resources, and dissemination of newly developed material. It considers international standards and guidelines and drives harmonisation of Member States' exposure assessment approaches, ensures compliance with international legislation and alerting and mutual aid requirements, and fosters international and cross-border collaboration and mutual aid. It links directly to *international networks of exposure assessment experts,* and to forums of national risk assessors via Member State focal points. The international risk assessors' forum informs and is informed by:
- **National risk assessors' forums** – Member State forums of risk assessors from all national organisations involved in public health risk assessment, together with representatives of national exposure assessment functions. It may be part of a wider network, but its remit must include emergency preparedness for chemical incidents. It is responsible for determining national priorities, national sharing of information and resources, and dissemination. It considers national standards and guidelines and drives harmonisation of national organisations' approaches, informed by the overarching international risk assessors' forum, and fosters interagency and cross-border collaboration and mutual aid, working with national risk assessors' forums in other Member States to coordinate joint approaches. It links directly to *national networks of exposure assessment experts* and to exposure assessment stakeholders in order to coordinate a consistent national approach. National risk assessors' forums inform and are informed by:

- **Exposure assessment stakeholders** – first responders and local, regional, and national groups involved in incident response and exposure assessment (e.g. resilience forums, groups coordinating cross-border work, and organisations involved in any aspect of exposure assessment in incident response). An example from the UK is the Atmospheric Dispersion Modelling Liaison Committee (ADMLC). Here the focus is on technical requirements and the operational response rather than strategic direction and policy; such groups can translate and implement emergency preparedness work operationally. They cannot work effectively in isolation; a consistent approach is provided through oversight and direction from the national risk assessors' forum. Engagement of local-level groups, such as forums for emergency responders at local and regional levels, fosters close local working and cross-border collaboration and mutual aid.

Figure 13 presents a hypothetical example of how a Member State's national risk assessors' forum can link to national networks of experts in exposure assessment in order to facilitate emergency preparedness work. Exposure assessment functions are associated with institutes, societies, and professional groupings that can provide a link to specialists that undertake the function. Observation at the scene is an area in which many organisations and different professionals can be represented. Emergency services' networks and civil protection structures are likely to provide a route to the majority, whilst those responsible for health surveillance are accessible via surveillance networks and environmental and public health structures. For specialist functions, such as modelling, national interest groups may exist, particularly for releases to air and water. For monitoring there is likely to be a national laboratory network, or networks, covering laboratory analysis of samples taken from all environmental media, and additional forums linked to professionals who have an interest in field monitoring of one, or more, media.

Figure 13. Illustration of a national risk assessors' forum linking to national networks of experts in exposure assessment

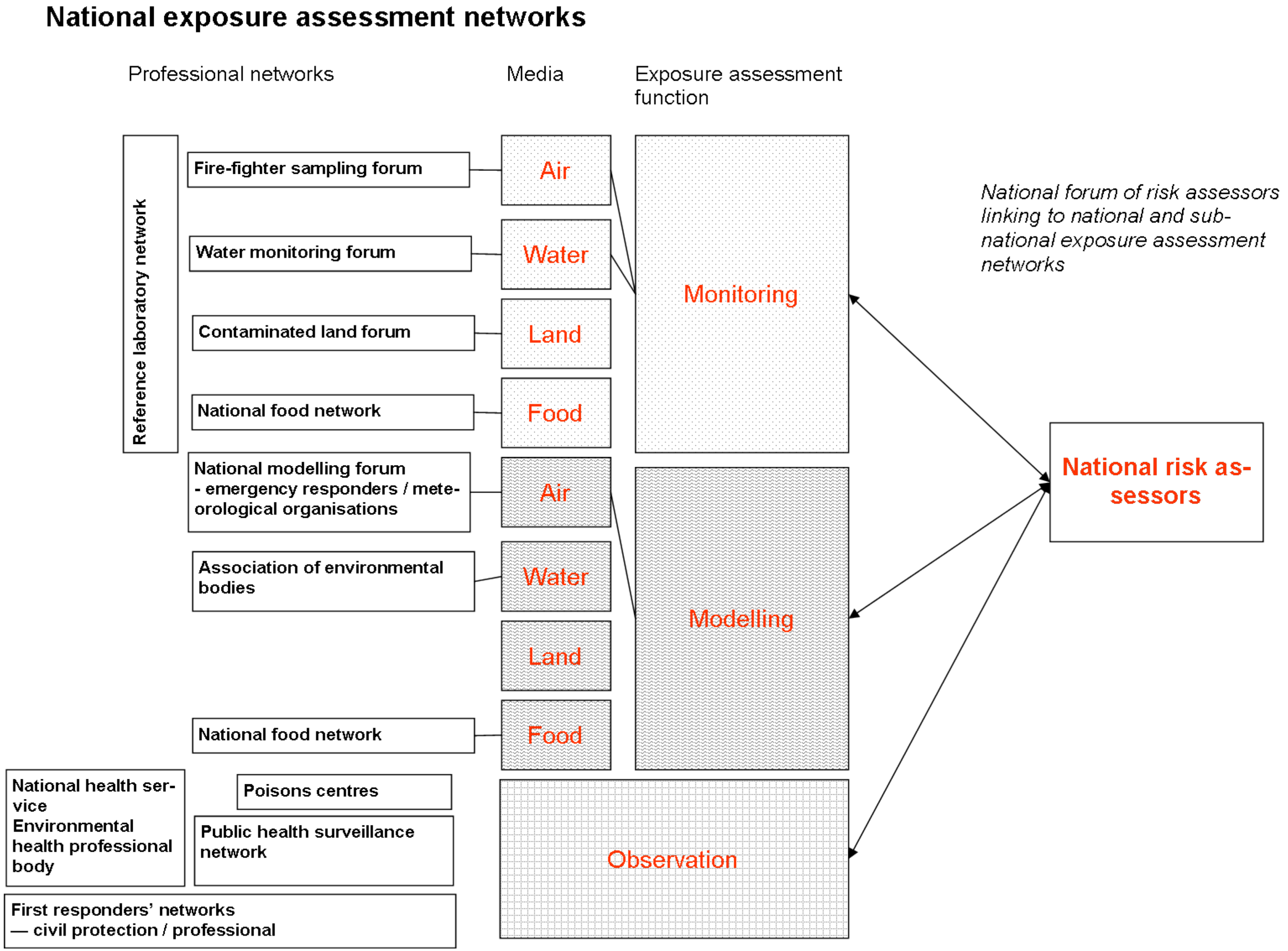
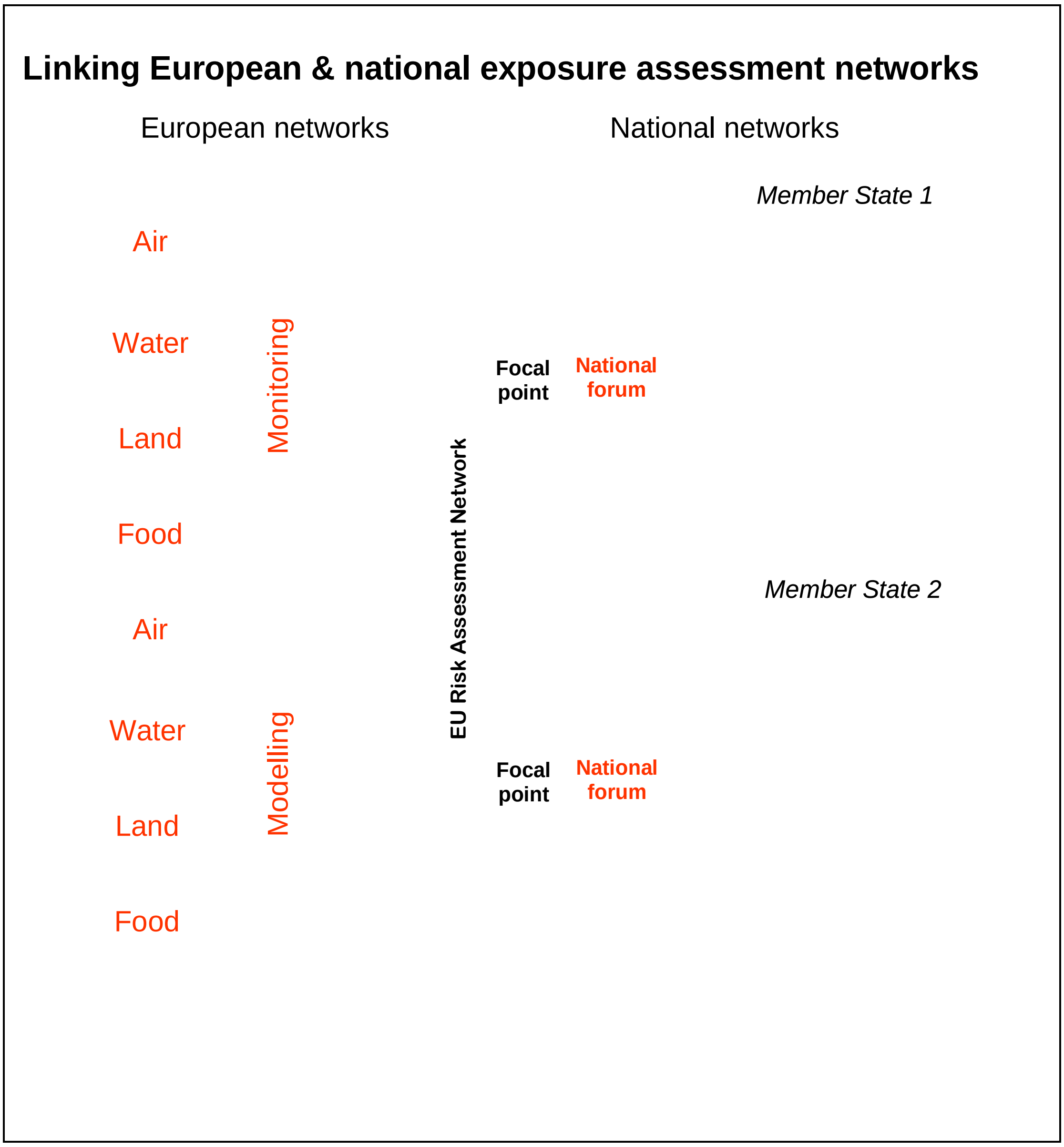


Figure 14 presents an example of how an international risk assessors' forum can link to Member States' risk assessors' forums, and, via these, to the national networks described above. It also links to international networks of experts in exposure assessment: described in the Task D report, these are specialist networks related to functions of exposure assessment, such as the CASCADE Network of Excellence [136], a collaborative network focussed on research and training related to endocrine disrupting chemicals in food; the NORMAN network of reference laboratories for the monitoring of emerging environmental pollutants [64]; and the The Network of European Meteorological Services, Economic Interest Group (EUMETNET EIG) [18]. These international networks also link to national networks of experts: this means that there are two routes by which the international risk assessors' forum can connect with the specialists that deliver exposure assessment functions.

Figure 14. Illustration of an international risk assessors' forum linking to national risk assessors' forums and international networks of experts in exposure assessment



4.5.3 CERACI network structure and objectives

It is worth discussing whether a CERACI network should provide an advisory or facilitation role during emergency response: CERACI's view is that it should not. Mechanisms for European mutual aid in exposure assessment *already exist* and are discussed in Section 4.4.4. Furthermore, there are other considerations against having a CERACI network focussed solely on providing mutual aid in exposure assessment during the response phase: there are security concerns associated with maintaining listings of expert responders and contact lists of experts already exist (e.g. those held by the GHSI [132], MIC, and WHO); there are issues around quality and accountability of advice and dealing with occasions of conflicting advice; and ultimately an effective response is primarily achieved through a focus on emergency preparedness, rather than response. By focussing on multi-agency international preparedness, responders' capabilities in exposure assessment will improve. An improved response will be a consequence of this as Member States improve and stakeholders develop stronger working relationships as a result of preparedness collaboration. This does not preclude the possibility of developing an operational, reactive, expert network in time; it is more the case that this should only be done once emergency preparedness work is well established.

While the focus of CERACI is on exposure assessment, this report has already discussed the fact that exposure and risk assessment are intimately linked, and that exposure assessment outputs should be shaped by the needs of risk assessors. If creating a new network with a remit for preparedness for, and response to, chemical incidents then it is important that its focus is not predetermined to be on exposure and risk assessment alone, just because those were the areas of interest to the project. As described in Chapter 2, the 4-step process of risk assessment includes other areas, such as dose-response assessment. Risk assessment informs risk management and risk communication, so risk assessors' outputs should themselves be driven by the needs of risk managers and communicators and tailored as part of emergency preparedness work. The self-assessment process proposed by CERACI can equally apply to the inputs, functions, and outputs related to these later steps of incident response too. They should be included in any coordinating network with a remit for incident response, the composition of which should include toxicologists, crisis managers and communication experts, linking to their international and national networks of experts in the same way as described above. The objectives and work area discussed below relate solely to exposure and risk assessment, which could form subgroups of a wider network.

Focus: the network should focus primarily on chemical incident emergency preparedness. The generic objectives and actions of the NERIS network [131], for radiological emergency preparedness, should be addressed by any counterpart chemical network: they are improving the effectiveness of approaches, promoting more coherent approaches, identifying gaps and needs, addressing new and emerging challenges, and maintaining and improving know-how. Initial work areas in chemical exposure assessment emergency preparedness should include 1) development, propagation and coordination of the self-assessment and improvement process via national forums of risk assessors 2) mapping of international and national networks of experts in exposure and risk assessment 3) collation and signposting of international and Member State resources, guidance and training materials related to exposure assessment in chemical incident response 4) collation and provision of lessons learned from cross-border chemical incidents and joint training and exercising events, acting as an international repository, with the development of associated open-access databases 5) support and implementation of shared harmonisation and cross-border initiatives, training, exercising and research. In time, different work areas may be grouped into clusters, following the model used by the EU Network for the Implementation and Enforcement of Environmental Law (IMPEL) [65].

Composition: the network should include experts in public health risk assessment, appointed from each Member State, who have a good working knowledge of exposure assessment. It should include international experts in each of the exposure assessment functions: there should be sufficient representation to ensure that both at-scene and back office roles are represented and that experts are present whose knowledge covers monitoring and modelling of chemical releases to all media.

Meeting frequency: the network should be a standing group whose members meet in person at plenary meetings at least annually. Meetings should tie-in with regular workshops between risk and exposure assessors (see below) and other networking opportunities.

Such a network could start with a congress on various topics of exposure assessment. A relevant example of an existing event in the US is the “On-Site” symposium in Baltimore. This three day forum focuses on the latest developments in field analytical chemistry, emerging techniques, new applications, instrumentation, software, standards, and future developments. This level of technical content makes the event of interest to exposure assessors involved in monitoring and is extremely important in informing risk assessors about exposure assessment capabilities. Such a forum could be extended by holding parallel meetings exploring the latest developments in other fields of exposure assessment, such as dispersion modelling, at a similar level of technical detail in order to engage specialists. Plenary sessions must then bring together exposure and risk assessors to discuss the emergency planning for, and response to, chemical incidents.

Support: the network could function informally, but a formal network is preferable. It should be supported by a permanent secretariat and a web-portal hosting resources and providing a virtual discussion forum for members. The extranet tool, CIRCA (Communication and Information Resource Centre Administrator), developed under the European Commission IDA programme, may assist [137]. It enables a given community (e.g. committee, working group, project group etc) geographically spread across Europe (and beyond) to maintain a private space on the internet where they can share information, documents, participate in discussion fora and benefit from various other functionalities. Such a private space is called an ‘Interest Group’.

4.5.4 Potential hosts of a CERACI network

As discussed in Section 4.2.4, taking forward CERACI recommendations is likely to require either new consideration of exposure and risk assessment in chemical incidents within existing emergency preparedness work programmes, or new consideration of emergency preparedness within existing exposure and risk assessment work programmes.

Support is required from EU organisations in order to develop a European network: it is important to have a strong host organisation for emergency preparedness and response networks [81]. There is no existing Member-State-funded or network-member-funded structure for overarching chemical incident emergency preparedness. The disparate professional groups and focuses within exposure assessment and risk assessment means that a united network, incorporating both disciplines, is unlikely to form naturally. Therefore, strategic direction and support is required. While worldwide, international organisations have an interest in interacting with, and linking to, European networks, they are unlikely to host a dedicated European network as its scope is too geographically limited.

DG ECHO (with its remit in civil protection emergency preparedness) and DG SANCO (with its remit in health risk assessment) are the EU organisations most closely aligned with CERACI objectives. There is an overlap between the roles of each and exposure assessment in chemical incidents falls into a grey area as it is not solely concerned with civil protection, nor does it solely involve public health risk assessment.

The first hosting option is a network led by civil protection. This would require a dedicated working group with a focus on emergency preparedness for chemical incidents, as the scope of wider emergency preparedness work is too broad for such specific work. Any such group requires representation from public health risk assessors, therefore a dialogue between DG ECHO, DG SANCO and the HSC is advisable.

As discussed earlier in this report, the Commission has adopted a proposal for a "Decision of the European Parliament and of the Council on serious cross-border threats to health" to better protect EU citizens against serious cross-border threats to health [2]. This initiative seeks to improve preparedness across the EU and to strengthen the capacity to coordinate response to health emergencies.

The proposal will facilitate Member States' compliance with the International Health Regulations, which require reporting and communication regarding significant chemical incidents. As part of the proposal, the Commission undertook a gap analysis [3] to assess how far existing systems covered the monitoring of threats to health, their notification, and risk assessment and crisis management capacities and structures, from the public health perspective. This gap analysis revealed that the existing structures and mechanisms at EU level do not address these threats sufficiently as far as public health is concerned. During chemical events, cross-border public health emergencies are managed case-by-case on an ad hoc basis. The proposal seeks to strengthen the links between public health risk assessors during incident response.

The second hosting option is a network led by health. If it is willing to widen its focus from response (alerting and risk assessment), to include emergency preparedness, and to coordinate work that is not solely public health-focussed, the HSC's expanded remit and new position as a legal organisation (rather than an informal group) would mean that it may be the best-placed forum to host and develop a CERACI network at EU level. Because Member States' existing HSC focal points will not necessarily be experts in chemical exposure assessment or risk assessment, it may be more efficacious to develop work under the HSC CBRN subgroup or a new dedicated working group for wider chemical incident emergency preparedness.

As mentioned above, there are other cross-European and international groups, such as the OECD working group on chemical accidents, with an interest in this area; whilst they would not host a European network they are likely to be able to assist a CERACI network achieve its objectives e.g. by engaging stakeholders and encouraging collaboration. They should be engaged when taking forward the recommendations of CERACI. A dissemination plan for CERACI outcomes is included in Chapter 6.

4.5.5 Recommendations for networks of experts

CERACI has identified an unmet need for a group with an all-encompassing steer over emergency preparedness for chemical incidents at European level: one which brings together exposure and risk assessors. As discussed in Section 4.5.3, such a group should ideally address **all** of the steps of incident response, from hazard identification to exposure and dose-response assessment, risk assessment, risk management, risk communication, and recovery.

DG ECHO, in consultation with the organisations discussed in Section 4.5.4, should consider the proposal to adopt a CERACI network in order to take forward the wider recommendations throughout this report. Such a CERACI network would need to be formally requested in order to progress this work: for that reason Section 4.5.3 outlines initial objectives that can be used to inform a tender for the delivery of a network.

4.6 CERACI lessons learned and the way forward

The Project Strategy requires Task E to deliver a “*Report on lessons learned from the workshops and the way forward.*” The lessons learned from the workshops are summarised in Section 3.3 and can be found in the discussion section of the Task D report.

This section summarises European and international-level gaps (unmet needs) identified by CERACI. It sets out separate recommendations to the EU and to Member States. These recommendations reiterate and summarise those made earlier in this report (regarding exposure assessment guidelines, mutual aid, and networks of experts). Readers should refer back to earlier sections for a fuller discussion of these.

4.6.1 EU-level unmet needs

The most important of these is the need for a **common multidisciplinary, multisectorial European approach to exposure and risk assessment preparedness and response** for chemical incidents. This should be coordinated by a **European network for exposure and risk assessment**, linking to national forums and networks of expects.

Emergency preparedness

Emergency preparedness should be underpinned by **formal legal requirements within Member States’** national legislation for stakeholders' cooperation in exposure assessment, if this does not exist, and a **common prescriptive framework for mutual assistance in exposure assessment** at the local level. **Incident response plans should specify detailed approaches to exposure assessment**, including cross-border exposure assessment.

An EU database of Member States' resources for exposure and risk assessment (e.g. monitoring capabilities, dispersion models and acute health reference values) would assist information exchange and consistency.

Funding, and awareness-raising and support for applications to existing sources of funding, is required to facilitate joint training and exercising for exposure and risk assessors involved in the responses to chemical incidents. **First responders at the scene should be trained in the use of toxidromes**, so as to be able to provide better characterisation of chemical threats in the early stages of an incident.

Cross-border

Cooperation in exposure assessment should be part of **formal legal requirements at EU level for mutual cooperation** between Member States (such as bilateral agreements). A common framework is also required for semi-formal international collaboration between Member States (e.g. **memoranda of understanding**).

A specific **approach to preparedness and planning for cross-border areas** should be adopted for non-Seveso chemical threats, using a similar framework for consultation and plan preparation as is specified by the Seveso Directive [8]. **An EU "risk profile" map should be developed** that identifies cross-border areas with the highest risks, to focus preparedness work.

A database of EU Seveso and other chemical incident response exercises is required at the EU level that can be used to exercise exposure assessment functions, linked to geographical location so that it can identify exercises that could be used to test cross-border aspects of response.

CERACI delegates indicated that an EU Crisis or Emergency Cooperation Centre is required for all stakeholders that need to share cross-border emergency response information: **information sharing in exposure assessment should be part of the remit of existing EU-level and responder-level information exchange mechanisms**. Adaption of EURDEP [28] for sharing monitoring data during chemical (in addition to radiological) incidents was suggested by CERACI workshop delegates as one option. The EU should ensure that a **rapid-response service callout** is available for Member States requiring support in exposure assessment functions (with deployment taking less than two days).

Exposure assessment in incident response

EU-wide sampling standards should be developed for field monitoring and laboratory analysis during incidents. Standardisation of outputs should be led by exposure assessors (and their networks of experts). This work should be informed by public health risk assessors and not undertaken in isolation. There is a need for continued support of technical projects. One such requirement is for improvement of the international comparability of chemical measurements e.g. by a standard, repeatable, approach to sampling and analysis such as is being developed for CBRN materials by the Standardization of Laboratory Analytical Methods (SLAM) project [29]. Sampling capabilities should be able to detect historically “difficult” chemical types and an **accepted approach for the monitoring of chemicals and chemical mixtures** needs to be adopted.

Support is required to **develop modelling outputs that are compatible with open-source applications** like Google Maps and Google Earth.

When producing maps, there should be a **common recognition of what information will be mapped and a standard use of symbols**. At EU level there is a need for **aggregated data layers for response** that show information on all sides of borders. **Awareness-raising and development of existing EU mapping services** (such as SAFER [52]) would assist incident response.

Risk assessment

It is preferential to **harmonise risk assessment across the EU**. A common risk assessment approach means common requirements for exposure assessment. It would also lead to a common understanding of risk assessment requirements by exposure assessors, irrespective of their country. This can be done by producing **EU guidelines on risk assessment requirements for exposure assessment** that are authored through collaboration between exposure and risk assessors.

The derivation and application of acute guideline levels for emergency response should be harmonised, as recommended by previous European work [27, 32, 53]. An **accepted approach for risk assessment of mixtures of chemicals** is required, together with an **accepted approach for chemicals for which no established health criteria values exist**.

4.6.2 Recommendations at European and international level

The workshops and delegate network questionnaires in Task D provided some insight into what exposure assessors and risk assessors require of the EU. It is seen as having a coordination role in emergency preparedness, fostering standardisation and harmonisation, and providing guidance to Member States. It also has a role in facilitating requests for mutual aid between Member States.

Priority recommendations can be summarised as follows:

Adopt a holistic approach to emergency preparedness for chemical incidents

- Adopt a common multidisciplinary, multisectorial European approach to preparedness and response for chemical incidents. This should ideally account for **all** of the stages of incident response (e.g. hazard characterisation, exposure assessment, risk assessment, risk management, and risk communication).

  With regard to the EU CBRN Action Plan, the European Parliament calls on the Commission and the Council to give greater importance to developing the preparedness and response mechanisms required to protect public health and the environment should a CBRN incident actually take place on EU territory [138].
- Use and develop legal and institutional frameworks that help Member States deal with public health threats (such as the legal establishment of the HSC [2], the EU CBRN Action Plan [138], and the UNECE Convention on the Transboundary Effects of Industrial Accidents) to drive emergency preparedness for chemical incidents.
- Agree a common approach to chemical incident *emergency preparedness* between European and international bodies with overlapping interests in chemical incident preparedness and response (e.g. DG ECHO, DG SANCO, DG Environment, MAHB, WHO, UNEP, OCHA, and UNECE).
- Agree a common approach to chemical incident *emergency response*

  This is supported by the existing recommendations of EC work, undertaken in support of the proposal to formalise the HSC and widen its remit to include cross-border chemical incidents, which advises that "Standard operating procedures for [assessment of] public health impact of a chemical event at EU level, and possibly proposal of new provisions would provide a stronger basis for addressing the public health aspects of chemical incidents" [2].

Coordinate and drive chemical incident emergency preparedness at EU level

- Coordinate emergency preparedness for exposure and risk assessment for chemical incident response through a multidisciplinary, multisectorial cross-European forum of exposure and risk assessors, linking to national forums and networks of experts within Member States (see Section 4.5.3).

  The Joint UNEP/OCHA Environment Unit supports a regional (which in CERACI's case equates to a European) approach involving regional networks of nations, with regional coordination and cooperation, indicating that the UN should be responsible for the worldwide coordination [of preparedness and response] [135].

The role of such a European forum is to:

- Link international with national and local chemical incident emergency preparedness work.
- Provide a central international focus and a clear direction on exposure and risk assessment during chemical incidents.
- Collate and disseminate existing resources.
- Drive assessment and improvement of exposure and risk assessment (through the translation and application of the CERACI self-assessment tool, see Section 4.2).
- Facilitate the exchange of good practices.
- Coordinate supranational training programmes
- Incentivise emergency preparedness work by linking it to legislative and other drivers.
- Prioritise, develop and implement European programmes to improve preparedness and response in exposure and risk assessment, using the results of self-assessment to target work.
- Harmonise European approaches to exposure and risk assessment.
- Coordinate and facilitate European research in topics related to chemical incident emergency preparedness and response, in conjunction with existing related research networks (such as European Research Area – Environment and Health (ERA-ENVHEALTH) [139])

  Under Article 14 of the Convention on the Transboundary Effects of Industrial Accidents there is also a requirement to cooperate in research and development of methods and technologies for the prevention and preparedness to respond to an industrial accident [140].
- Address the EU-level unmet needs discussed in Section 4.6.1.

Provide resources to support chemical incident emergency preparedness

- Develop the CERACI self-assessment methodology and coordinate assessment via a central web-tool (see Section 4.2).

  With regard to the EU CBRN Action Plan, the European Parliament calls for regular mapping of national capabilities and assets [138]
- Use self-assessment to generate a living directory of good practices in exposure and risk assessment.

  With regard to the EU CBRN Action Plan, the European Parliament calls for sharing of best practices [138].

- Use self-assessment to generate a living directory of contact details for specialists working in exposure and risk assessment.
- Collate and signpost resources in exposure and risk assessment (i.e. information and guidance).

Facilitate emergency preparedness in border areas

- Develop a Seveso-style approach to planning and exercising for cross-border chemical incident response, driven by identification and prioritisation of cross-border threats.

  This should be undertaken in collaboration with DG Environment, whose "Industrial Emissions, Air Quality & Noise" unit has oversight of Seveso-related work and may be able to assist in the identification of cross-border industrial regions with high concentrations of Seveso installations.
- Develop dedicated resources for cross-border preparedness (e.g. template agreements and plans for exposure assessment at the local responder level).
- Develop a European database of cross-border incidents (focussed on practices and lessons learned). This <u>must</u> include information related to population exposure and public health outcomes, which is beyond the traditional focus of chemical process risk management.

  With regard to the EU CBRN Action Plan, the European Parliament calls for sharing of best practices [138]. This should build on previous European publications, databases and sharing of incident lessons learned [112, 125, 127-129].
- Develop a European database of exercises, to facilitate joint and cross-border working. Candidate exercises should be at European, national, and sub-national levels.

  With regard to the EU CBRN Action Plan, the European Parliament calls for joint exercises among Member States [138], reinforcing the Commission's recognition of the importance of training and exercises [22].
- Raise awareness of opportunities and support applications for funding for cross-border initiatives (e.g. training and exercising, expert exchange, and emergency preparedness and mutual aid projects) and highlight existing initiatives.

  This should include direct support for cross-border Member State projects (e.g. [141-142]) and assisting Member State applications to other funding sources such as INTERREG (e.g. [143-144])
- Collaborate beyond EU borders with non-EU neighbours and international bodies.

Facilitate mutual aid

- Raise awareness of existing international and European support mechanisms for mutual aid in exposure assessment (e.g. rapid response capabilities available through MIC). Awareness raising should detail capabilities in exposure assessment in both general and technical terms, together with an explanation of how they can be accessed.
- Provide information systems for the cross-border sharing of exposure and risk assessment outputs (e.g. monitoring and modelling data) between both Member State focal points **and** between local responders.

With regard to the EU CBRN Action Plan, the European Parliament calls for strengthening of the role of the Monitoring and Information Centre (MIC) which has already been established under the EU Civil Protection Mechanism so as to ensure proper exchanges of information and good practices between Member States [138].

- Drive bilateral legal agreements for mutual aid that address exposure and risk assessment.
- Develop dedicated resources for cross-border response (e.g. joint monitoring teams, provision of shared modelling service).

4.6.3 Recommendations to Member States

To meet the requirements of IHR [16], countries are required to establish a set of core capacities to address all types of potential public health emergency of international concern, including those that involve chemicals (Annex 1 of the Regulations). These CERACI recommendations to Member States directly align with the core capacities for chemical incidents and emergencies that have been identified by the WHO [4].

Priority recommendations reflect the recommendations above at European and international level, and can be summarised as follows:

Adopt a holistic approach to emergency preparedness for chemical incidents

- Adopt a common multidisciplinary, multisectorial national approach to preparedness and response for chemical incidents. This should ideally account for **all** of the stages of incident response (e.g. hazard characterisation, exposure assessment, risk assessment, risk management, and risk communication).
- Use and develop legal and institutional frameworks that help responders deal with public health threats to drive emergency preparedness for chemical incidents.

  The requirement for a body responsible for coordination and management of chemical incidents at the national level is stated by the WHO [4].
- Agree a common approach to chemical incident *emergency preparedness* between national bodies with overlapping interests in chemical incident preparedness and response.
- Agree a common approach to chemical incident *emergency response*.
- Develop and implement national and local programmes to improve emergency preparedness and response, using the results of self-assessment to prioritise and target work.

Coordinate and drive chemical incident emergency preparedness at national level

- Coordinate emergency preparedness for exposure and risk assessment for chemical incident response through a multidisciplinary, multisectorial cross-national forum of exposure and risk assessors, linking to national forums and networks of experts (see Section 4.5.3).

The role of such a national forum is to:

- Link national and local with international chemical incident emergency preparedness work.
- Provide a central national focus and a clear direction on exposure and risk assessment during chemical incidents.
- Collate and disseminate existing resources.
- Drive assessment and improvement of exposure and risk assessment (through the application of the CERACI self-assessment tool (see Section 4.2).
- Facilitate the exchange of good practices.
- Coordinate national training programmes.
- Incentivise emergency preparedness work by linking it to legislative and other drivers.
- Prioritise, develop and implement national programmes to improve preparedness and response in exposure and risk assessment, using the results of self-assessment to target work.
- Harmonise national approaches to exposure and risk assessment.
- Coordinate and facilitate national research in topics related to chemical incident emergency preparedness and response, in conjunction with related European and national networks.
- Address national unmet needs.

Provide resources to support chemical incident emergency preparedness

- Coordinate assessment at national and local level via application of the CERACI self-assessment tool.
- Use self-assessment to generate a living directory of good practices in exposure and risk assessment.
- Use self-assessment to generate a living directory of contact details for specialists working in exposure and risk assessment.
- Collate and signpost resources in exposure and risk assessment (i.e. information and guidance).

Facilitate emergency preparedness in border areas

- Use and develop legal and institutional frameworks that help responders deal with cross-border chemical incidents e.g. form bilateral agreements and agree detailed protocols between organisations involved in emergency response and exposure assessment.

  With regard to the EU CBRN Action Plan, the European Parliament calls for Member States to develop regional preparedness solutions [138].

  Existing legal agreements and previous studies stress the need to agree clear procedures for notification and information exchange between countries [13, 112, 140].
- Work with neighbouring countries to identify shared risks and to prepare an effective collaborative response to incidents which may lead to impacts in both countries.

- Develop dedicated resources for cross-border preparedness (e.g. template agreements and plans for exposure assessment at the local responder level).
- Plan and exercise cross-border chemical incident response, with a programme driven by identification and prioritisation of cross-border threats (e.g. a regional risk profile, as discussed by Task D).

  Previous European work has stressed the need to train and test communication across borders [112].
- Inform an international database of cross-border incidents (focussed on practices and lessons learned).
- Inform an international database of exercises, to facilitate joint and cross-border working.
- Support applications for funding for cross-border work (e.g. training and exercising and cross-border projects to improve mutual aid).
- Collaborate beyond EU borders with non-EU neighbours and international bodies.

Facilitate mutual aid

- Raise awareness of existing international and European support mechanisms for mutual aid in exposure assessment (e.g. rapid response capabilities available through MIC). Awareness raising should detail capabilities in exposure assessment in both general and technical terms, together with an explanation of how they can be accessed.
- Provide information systems for the sharing of exposure and risk assessment outputs (e.g. monitoring and modelling data) between local responders and between counterparts in neighbouring Member States.
- Drive multi-country (e.g. bilateral/trilateral etc) legal agreements for mutual aid that address exposure and risk assessment.
- Develop dedicated resources for cross-border response (e.g. joint monitoring teams, provision of shared modelling service).

  With regard to the EU CBRN Action Plan, the European Parliament calls for Member States to develop regional preparedness solutions, including the sharing of existing capacity [138].

4.6.4 Recommendations for further work

Widen the scope and application of chemical emergency preparedness work

Hazard identification, dose-response assessment, risk assessment, risk management and risk communication were not within the scope of CERACI, which focussed on exposure assessment. The discussion in this report was widened to include risk assessment, in terms of the requirements of risk characterisation for exposure assessment, because they are sequential steps in the wider risk assessment process, and hence interlinked. As is stressed throughout this report, there is a strong argument to take a holistic view of incident response that encompasses the whole process and **all** of the steps above, including those that were not the direct focus of CERACI. This should be applied when considering all of the recommendations above; ideally the scope of a CERACI network should not be on exposure and risk assessment alone, but should be widened to include all areas of response. In practice, for self-assessment, this necessitates extension of the areas which the self-assessment tool examines (using the same process) and of the scope and objectives of European and national networks, which coordinate emergency preparedness for all aspects of chemical incident response, not just exposure and risk assessment.

The CERACI Project Strategy suggested other areas of further work to build on the outcomes of CERACI. Expanding the project's focus from chemical incidents to include biological, radiological and nuclear incidents is one option. The development of a harmonised approach to the application of human biomarkers for exposure assessment is another need, to complement more established approaches to environmental exposure assessment such as modelling and monitoring.

Further development and application of the CERACI self-assessment methodology is discussed in detail in Section 4.2.4. It is recommended that a second stage of CERACI work is undertaken to develop and test a prototype self-assessment web-tool. This would be informed by a small number of Member States and their exposure and risk assessors, with feedback being used to develop a final version to be propagated for use across the EU.

It would also be beneficial to apply the same self-assessment approach to areas other than public health risk assessment. The methodology proposed by the project can be applied to ecological and occupational health risk assessments. The viability of tool development may be increased by pooling the expertise and resources of risk assessors from different disciplines. Furthermore, the scope of public health risk assessment could also be extended: in CERACI it was on acute chemical incidents, but there is a slightly different focus when considering risk assessors' requirements for exposure assessment when it is undertaken to inform follow-up health studies and surveillance following major incidents, or to inform risk assessment of chronic exposures to chemicals. Further work in these areas is advisable.

5 Conclusions

CERACI aimed to strengthen public health risk assessment during the acute phase of chemical incidents by improving exposure assessment. It also aimed to facilitate cooperation across administrative boundaries by improving interoperability of exposure assessment guidelines, tools and practices. To do this, the project addressed the following questions:

- How have Member States organised exposure assessment for health risk assessment during acute chemical incidents?
- Which Member States have organised collaboration and interoperability on exposure assessment, nationally and across borders?
- Which good practices - technical or organisational - can be (further) developed?
- Will harmonisation and collaboration improve Member States' capabilities and capacities to respond to acute chemical incidents?

The project has identified and described the organisation of environmental modelling and monitoring for health risk assessment during acute chemical incidents in EU Member States. While there are common functions within exposure assessment, their organisation within Member States varies considerably and Member States have varying capacities for exposure assessment and different approaches to exposure assessment during incidents. Extensive information about Member State structures and organisations, and organisational roles and responsibilities, is provided in the Task B report (Appendix 2), building on previous work by DG ECHO to map civil protection structures within Member States. Further Member State-specific information, extending the information gathered in Task B, was captured by Tasks C and D, and is presented in those reports (Appendices 3-4).

The project has investigated which Member States have organised collaboration and interoperability on environmental modelling and monitoring for health risk assessment nationally and across national borders. International, multinational and bilateral agreements exist, but it is relatively rare for exposure assessment for chemical incidents to be considered in prescriptive or technical detail, and there is a need for detailed agreements regarding exposure and risk assessment to be formulated between responders at the local level. An overview of collaborative agreements and legislation is provided in the Task B report (Appendix 2) and Section 4.4.5 of this Task E report discusses mutual aid in more detail, giving examples of international mechanisms for mutual aid in Appendix 8.1. This gives an overview of current cross-border collaborations in chemical incident exposure assessment, and provides an insight into which Member States have organised interoperability of first responders and expert teams with regards to environmental modelling and monitoring in chemical incidents. Whilst a number of Member States have developed dedicated monitoring and modelling capabilities specifically for the protection of public health during chemical incidents, there are relatively few examples of integrated cross-border responses, and more needs to be done to address barriers to cross-border working and unmet needs in exposure assessment (which are listed in Section 4.6.1).

The project has identified good practices for environmental modelling and monitoring for health risk assessment during acute chemical incidents, both generic good practices and those related to specific functions of exposure assessment. These were developed throughout Tasks B and C and were validated during two international workshops that focussed on cross-border incident response in detail, described in the Task D report (Appendix 4). They are focussed on practical steps to improve communication and collaboration, many of which are non-technical and relate to the wider aims of emergency preparedness work: building a joined-up and effective multilateral response. Our description of guidelines and tools for exposure assessment in chemical emergencies is presented in Section 4.1, which also identifies which good practices can be applied to improve cross-border response.

CERACI proposes a self-assessment methodology in Section 4.2, which can be used to apply the good practices identified by the project and to develop them further, while steering emergency preparedness and cross-border collaboration in Member States. It incorporates an approach that accounts for the views of exposure assessors and risk assessors: it is of fundamental importance that exposure assessment informs risk assessment in a timely and adequate manner during acute incidents. CERACI's exposure assessment evaluation guidance can be used both within Member States and across local, regional and national geographical and organisational borders. The future application and development of good practices that is proposed by CERACI (in Section 4.2.4) will enhance the national and international interoperability for environmental modelling and monitoring for health risk assessment of chemical incidents across administrative boundaries and competencies. If used as part of a coordinated international multi-agency approach, it can improve emergency preparedness and response, while simultaneously building a directory of international experts in exposure assessment and eliciting new good practices beyond the initial framework developed by CERACI.

The project found that there are limitations in Member States' capabilities and that cross-border collaboration and mutual aid provision could be improved. There were gaps in the information that CERACI was able to reach from a European level without a detailed investigation being undertaken by each Member State: more detailed assessments of exposure assessment structures and capabilities could be developed because a large number of people across Europe are involved in different aspects of exposure assessment, which fall under different specialist fields. When a project wishes to examine exposure assessment as a whole, across these specialities, there is a loss of resolution associated with a broad approach that considers all functions. However, the technical detail of exposure assessment functions, such as monitoring and modelling, is very important. CERACI has considered the question of how to build from the overview of exposure assessment that is given by the project. The question that CERACI's work poses is 'how could future emergency preparedness work in Europe address broad aspects of cross-border emergency preparedness for chemical incident response, at the same time as addressing the different exposure assessment functions in sufficient technical detail?'

Harmonisation and collaboration in the fields of exposure and risk assessment has the potential to improve EU response capabilities and capacities to respond to acute chemical health threats. A number of expert-led harmonisation projects are underway within the EU that go into technical detail when considering harmonisation of specific areas within exposure assessment (e.g. laboratory analysis); what has become clear throughout the course of the project is that an overarching, cross-European, approach to emergency preparedness for exposure and risk assessment is also required. Coordination at the European and national levels is essential as it is the keystone of effective emergency preparedness and response, providing the requisite focus to drive both policy and operational practice. Emergency preparedness for chemical incidents requires a holistic focus on all phases of response (e.g. hazard identification, hazard characterisation, exposure assessment, risk assessment and risk management) and must address areas of universal importance such as roles and responsibilities and sharing of information. The use and further development of the overarching *information-sharing* and *decision-support* systems that go hand-in-hand with international coordination of incident preparedness and response are discussed in Section 4.4.5.3.

CERACI has considered obstacles for improving cross-border exposure assessment for health risk assessment of chemical incidents, and has concluded that the main obstacle is a fragmented approach to emergency preparedness and response to chemical incidents across the EU. There are a number of organisations and initiatives with an interest in chemical incident emergency preparedness. There are overlapping networks and work programmes that are related to emergency preparedness. This all needs to be drawn together.

The priority is to implement programmes that bring together first responders from across borders in different Member States and, at the same time, recognise that some functions of exposure assessment are carried out by specialists who are not at the scene and who may have a less clearly specified role in incident response, and use their professional bodies and expert networks to engage them in chemical incident emergency preparedness. There is a need for cross-European coordination of chemical incident emergency preparedness, in its widest sense, which links directly to Member State national, regional, and local levels where collaboration and cross-border work can be developed and implemented in a practical way. CERACI proposes the initiation of a network of experts in this field, led by public health risk assessors and informed by experts in exposure assessment. The structure, function and application of such a network is discussed within Section 4.5. The project has gathered information about existing networks of experts in exposure assessment; there are many and their interests and purposes are varied and divergent. There is a clear need for further mapping to exploit the potential of these expert-led groups in driving standardisation and harmonisation in the specialist disciplines within exposure assessment from the bottom-up. Some of this will be scoped through self-assessment of exposure assessment, but further targeted work is required in order to build up a better picture of all the various organisational, academic, research, and specialist networks and their remits. This work has wider uses, beyond chemical incident preparedness and response.

More technical work within functions of exposure assessments areas requires engagement of these expert networks and research groups. CERACI has collated many generic good practices, as noted at the Task D workshops: these include joint training and exercising, developing understanding between neighbours, and communicating and sharing of exposure assessment outputs; further function-specific good practices should be developed by the experts in those fields. Technical work on harmonisation and standards is already going on in many areas; international expert groups exist which transcend Member State borders, and they can facilitate emergency preparedness and response work if they are engaged.

The project makes a number of recommendations for actions to ensure effective emergency preparedness for chemical incident exposure and risk assessment. These are split into recommendations at European level, and recommendations for Member States. They can be found in Sections 4.6.2 and 4.6.3 respectively. Recommendations for future work are laid out in Section 4.6.4: together with the formation of an overarching cross-European network to coordinate chemical incident emergency preparedness, it is recommended to further develop CERACI's self-assessment methodology into an accessible tool that can be used to drive chemical incident emergency preparedness work in the future.

6 Dissemination of project outcomes

During the project, different avenues were used to inform interested parties about the project and to disseminate project outputs and interim reports. These are summarised below:

- Project website (www.rivm.nl/ceraci) with a summary of project tasks and links to project products and background information. Links to the project website can be found on the partner websites
- Project flyer
- Poster at Health Protection 2011 (Coventry, UK, September 2011)
- Paper in HPA Chemical Hazards and Poisons Report (issue 20)
- Presentation of the project at the Joint Meeting of the Bureau and Working Group on Implementation of the UNECE Convention on the Transboundary Effects of Industrial Accidents (Bonn, Germany, November 2011)
- Presentation of the project at a meeting of the EU working group on CBRN resilience in Civil Protection (Brussels, Belgium, March 2012)
- Presentations which included information on the project at the NBC 2012 Symposium (Tulku, Finland, June 2012) and a COST Action workshop on Local-Scale Airborne Hazards Modelling and Emergency (Hamburg, Germany, May 2012)
- Task D workshop delegates received interim results as background reading and an abridged report of the workshop

Furthermore, a contact list of ca. 400 professionals in all 27 Member States (developed during the project) was used to inform experts about the project and to invite them to participate in the Task C web-based survey and the Task D workshops. The project team also asked interested professionals and our Advisory Board to further disseminate project information and invitations within their own networks.

After the project has been approved by DG ECHO, it is important to ensure that the outcomes are in the public domain and that CERACI information and recommendations are specifically targeted at those who would benefit most from our findings. Although dissemination activities have not been allocated specific funding, after the project tasks have been completed the project team will endeavour to spread the outcomes as part of our organisations' ongoing work on chemical incident preparedness and response.

The following options for dissemination will be considered:

6.1 Target groups for dissemination of project outcomes

- EC: DG ECHO and DG SANCO
- Public health officials, first responders and civil protection officials
- European networks of chemical incident specialists from public health, civil protection and fire and rescue services, (mapped during Task D)

- Intergovernmental bodies such as the WHO, UNECE, Joint UNEP/OCHA Environment Unit, and OECD
- National poison centres
- Other relevant organisations such as the International Association of National Public Health Institutes (IANPHI), European Public Health Association (EUPHA), United States Environmental Protection Agency (US EPA), US Agency for Toxic Substances and Disease Registry (ATSDR), and US Centers for Disease Control (CDC)

6.2 Means to disseminate the project outcomes

6.2.1 UNECE Convention on the Transboundary Effects of Industrial Accidents

The Chair of the Conference of the Parties of the UNECE Convention on the Transboundary Effects of Industrial Accidents, who chaired the Task D workshops, is keen for the CERACI outputs to be disseminated amongst his constituency (the Parties to the aforementioned UNECE convention). He has invited the project manager to present the project outcomes at a side event on preparedness and response at the next Meeting of the Conference of the Parties in Stockholm in November 2012. He recognises that the good practices and success factors gathered by the project can help the parties implement and comply with a number of articles in the convention. Plans to roll-out parts of the CERACI methodology, in particular the survey and workshops, to the non-EU parties to the aforementioned convention will be included in the workplan for the biennium 2013–2014.

6.2.2 Conferences and meetings

Planned conferences and meetings:

- A poster will be presented at Health Protection 2012 (Coventry, UK, September 2012)
- The WHO European Centre for Environment and Health (ECEH) will hold a workshop on 'Health aspects of chemical safety' in October 2012 to discuss WHO EURO strategy for the next 5 years. Implementation of the Parma declaration and the International Health Regulations will be on the agenda as well as a proposed network of experts on chemical safety. The CERACI project manager has been invited to present at a special meeting on emergency preparedness and response.
- Interim results of the project were presented at a meeting of the EU working group on CBRN resilience in Civil Protection in March 2012. The working group invited the speaker to return for a presentation of the final project outcomes at the next meeting in Autumn 2012.
- The project outcomes will be presented to the DG ECHO Civil protection committee, which meets twice a year. In 2013, DG ECHO will hold a Civil Protection conference which will be used as a means to disseminate the outcomes.

Other upcoming conferences and meetings where CERACI results could be presented:

- 18th World Congress on Disaster and Emergency Medicine in May 2013, Manchester, UK
- 11th International Symposium on Protection against Chemical and Biological Warfare Agents in June 2013, Stockholm, Sweden

- The UK Health and Safety Executive chairs a group of emergency planners and responders that is due to meet in Autumn, 2012. They have expressed in interest in the project and this meeting is an opportunity to share project outcomes with this group.

6.2.3 Journals and newsletters

The following journals and newsletters will be considered for their suitability in disseminating project outcomes:

- Crisis Response http://crisis-response.com/
- Prehospital and disaster medicine http://pdm.medicine.wisc.edu/
- CBRNe world http://www.cbrneworld.com/magazine
- International Association of Emergency Managers http://www.iaem.com/ or the IAEM Bulletin
- Journal of Emergency Management http://www.pnpco.com/pn06001.html
- European Journal of Public Health http://eurpub.oxfordjournals.org/ or the EUPHA newsletter http://www.eupha.org/
- Risk Management http://www.palgrave-journals.com/rm/index.html
- Human and Ecological Risk Assessment http://www.tandfonline.com/loi/bher20
- Journal of Exposure Science and Environmental Epidemiology http://www.nature.com/jes/index.html
- International Journal of Environmental Research and Public Health http://www.mdpi.com/journal/ijerph
- Occupational and Environmental Medicine http://oem.bmj.com/content/current
- Chemicals Health Monitor http://www.chemicalshealthmonitor.org/
- Emergency Planning Societies' Resilience magazine https://www.the-eps.org/news/resilience-magazine-goes-digital
- ENDS (Environment Intelligence for Professionals) report http://www.endsreport.com/
- International Journal of Occupational Medicine and Environmental Health http://maneypublishing.com/index.php/journals/oeh/

Furthermore, the project group will consider writing an article for distribution amongst the workshop delegates and other interested parties for translation and inclusion in their own country's or organisations' magazines.

6.2.4 Electronic media

The final project report (including all previous task reports) will be available as a downloadable pdf-file from the project website. It will also be disseminated via email to the project's contact list of professionals.

6.2.5 Other activities

The project partners will ensure that the relevant officials and organisations in their own countries receive the project outcomes by the most appropriate means (e.g. via meetings, presentations, newsletters etc).

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8 Appendix 1 – Task E appendices

8.1 Existing mechanisms to facilitate mutual aid

Table 7. World-level & multi-lateral mechanisms / agreements

Mechanism	Preparedness	Field Aid	Risk Assessment & Expertise	Information exchange
World Health Organisation (WHO)	International Health Regulations (IHR) - Global legal framework for the detection of and response to international public health risks and potential public health emergencies of international concern. The WHO Assessment of health system crisis preparedness - In 2007, DG SANCO and WHO/Europe embarked on a joint project to "support health security, preparedness planning and crisis management in the European Union (EU), EU accession states and neighbouring (European Neighbourhood Policy) countries". The objectives of this project include the evaluation of the national health sector crisis preparedness and response capacities. To conduct the evaluation, a standardized comprehensive tool has been developed [15]. Although not specific to exposure assessment for cross border incidents such a system is useful for emergency preparedness.	Able to source field aid through agreements.	IHR - Coordination route for international response – information exchange and risk assessment. WHO Collaborating Centres.	IHR - Links to Member State focal points. Alerting of international incidents.

Table 8 continued. World-level & multi-lateral mechanisms / agreements

Mechanism	Preparedness	Field Aid	Risk Assessment & Expertise	Information exchange
United Nations Environment Programme (UNEP)	Following the signing of an informal cooperation paper (together with UN OCHA) in December 2005, there have been a number of emergencies where working together resulted in maximising the overall impact of the assistance provided to a disaster-stricken country [145].	Able to source field aid through agreements.	Joint UNEP / OCHA Environment Unit is the UN mechanism to mobilize and coordinate the international response to environmental emergencies (jointly with UN OCHA).	Sharing of expertise. Published guidelines for exposure assessment following chemical emergencies, to support mutual aid requests [57].
United Nations Office for Coordination of Humanitarian Affairs (UN OCHA)	As far as disaster preparedness is concerned, the European Commission works very closely with UN OCHA on the development of mutual training programmes in a spirit of pursuing complementarities. UN representatives are invited to the Commission's civil protection training courses and simulation exercises and vice versa. This is important to ensure that the experts can work well together, when called upon.		Joint UNEP / OCHA Environment Unit is the UN mechanism to mobilize and coordinate the international response to environmental emergencies (jointly with UNEP)	During the response to an emergency, information is exchanged both at headquarters level and in the field.

Table 9 continued. World-level & multi-lateral mechanisms / agreements

Mechanism	Preparedness	Field Aid	Risk Assessment & Expertise	Information exchange
The Organisation for Economic Co-operation and Development (OECD) – includes non-EU countries	Cross-border co-operation relating to hazardous installations near boundaries, as well as bilateral and multilateral assistance concerning chemical accident prevention, preparedness and response. They exchange good practice and advice and organise workshops [14].			
World Meteorological Organisation (WMO) - specialist agency of the United Nations, comprising 189 Member States		Role includes facilitating worldwide co-operation in the establishment and maintenance of observation networks.		Role includes promoting the establishment and maintenance of systems for the rapid exchange of meteorological and related information.
Volcanic Ash Advisory Centres (VAAC)	Provides information to prepare the Civil Aviation Authority though not public health.	Includes monitoring stations. London VAAC is the VAAC for Europe (operated by UK Met office).	Nine Volcanic Ash Advisory Centres around the world are responsible for advising international aviation of the location and movement of clouds of volcanic ash. However, they don't have a public health risk assessment role as such.	Communicates with public health organisations as required.
European Union and International Police Cooperation Directorate and ATLAS	Facilitates international collaboration including in large-scale or cross-boundary incidents. ATLAS provides cooperation within EU connected with police intervention abroad in case of crisis situation.			

Table 10. EU-level mechanisms / agreements

Mechanism	Preparation	Field Aid	Risk Assessment & Expertise	Information exchange
DG ECHO*	Information on what assistance is available and aspects of organising cooperation.	Civil Protection CBRN Module detection and sampling including monitoring and modelling.	Provides technical assistance and support during CBRN and other relevant 'Civil Protection Module' incidents.	Sharing lessons learnt post incident.
DG SANCO**	RAS BICHAT is a part of the Programme of cooperation on preparedness and response to biological and chemical agent attacks. Addresses and coordinates, together with the Commission, all preparedness and response issues in terms of public health threats related to attacks in which biological and chemical agents might be used. GHSI (Global Health Security Initiative) of G7 countries, Mexico, the EC and WHO – informal international partnership to strengthen health preparedness and response globally to threats of biological, chemical, radio-nuclear terrorism (CBRN) and pandemic influenza [3].		GHSI has agreed on an international collaboration on risk assessment and management. Data is shared on threats to food and water.	RAS CHEM is meant to link the poison centres in the European Union, national chemical agencies and the Ministries of Health for the exchange of information on incidents including chemical agents and coordination of counter-measures [61]. RAS BICHAT is the Rapid Alert System used for exchanging information on deliberate or suspected deliberate health threats involving biological and chemical agents. The system links the Commission with the designated competent authority and 24H operational contact points of each Member States [61]. GHSI shares information on risk mitigation strategies [3].

Table 11 continued. EU-level mechanisms / agreements

Mechanism	Preparation	Field Aid	Risk Assessment & Expertise	Information exchange
EU Civil Protection Mechanism – Monitoring and Information centre (MIC)***	The MIC coordinates and disseminates information on civil protection preparedness and response though relates to general disaster response and not exposure / risk assessment for chemical incidents specifically.	Sources practical aid via offers of assistance.	Sources experts to undertake risk assessment.	Focal point for the exchange of requests and offers of assistance. Disseminates early warning alerts (MIC Daily) on natural disasters and circulates the latest updates on ongoing emergencies [146]. Common Emergency Communication and Information System (CECIS) is a good practice for information sharing between Member States. CECIS is a secure EU Civil Protection system for alerting and communication between MIC national focal points [123]. The system facilitates communication between the MIC and National Authorities, making response to disasters faster and more effective.
United Nations Economic Committee for Europe (UNECE)	Convention on the Transboundary effects of industrial accidents - It promotes active international cooperation between the contracting parties, before, during and after an industrial accident [147].	Parties may request assistance from other parties.	e.g. Protocol on Water and Health and the Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention) - intended to strengthen national measures for the protection of transboundary surface waters and ground waters [148].	UNECE network of centres. IAN system is used for notifications of industrial accidents between national focal points [62].

Table 12 continued. EU-level mechanisms / agreements

Mechanism	Preparation	Field Aid	Risk Assessment & Expertise	Information exchange
The Major Accident Hazards Bureau (MAHB)	Provides research-based scientific support chiefly on the Seveso II-Directive, 96/82/EC [8], concerning the processing and storage of hazardous substances. Instrumental role in managing the European accidents database, analysing trends in accident occurrence and identifying and disseminating lessons learned in order to avoid recurrence of similar events.			EMARS – Major accident reporting system. Database of "major accidents" reported under Seveso Directive. Managed by the Major Accident Hazards Bureau (MAHB). Useful for lessons learnt, but not a tool for use during the response phase of incidents.
DG Environment and the Joint Research Centre (JRC)	Provide information on European forest fires and statistics to aid in response.	European Forest Fire Information System (EFFIS) was created in 1998 to support fire-fighting services in the Member States. Includes practical field support.		
ARGUS (Commission crisis coordination system for major multisectoral crises)			A new corporate coordination process will be established for cross-hazard threats and risk assessment [3].	ARGUS is the corporate alerting system of the EC including an information sharing network.
EU Fisheries Control Agency			Would assist with risk assessment in the case of an major incident with cross-boundary implications for fisheries contamination.	Would assist with communication in the case of an major incident with cross-boundary implications for fisheries contamination.

*** DG ECHO – Humanitarian Aid and Civil Protection***

A network of liaison officers from the Member States and the Commission was set up after a resolution in 1987 so that civil protection information collected by European resolutions would help to produce a clearer picture of the assistance available in each Member State in the event of a disaster, enabling such assistance to be better and more swiftly used [76]. The resolution sets out requirements for regular meetings to discuss the technical and operational aspects of organising cooperation and it requires reporting and discussion after incidents occur, which is a mechanism to share lessons learned.

The Commission has prepared a civil protection manual including, inter alia, a list of the means of intervention available in the Member States in the event of emergencies [76].

**** DG SANCO – Health and Consumers***

Has funded a number of projects that support mutual aid, such as the Alerting System for Chemical Health Threats (ASHT) and its phase two (ASHTII) [149], to improve detection and alerting of chemical incidents via an EU network of poison centres. Member States' syndromic surveillance (via poisons centres) overlaps with exposure assessment in the sense that reported health symptoms are an indication of chemical exposure. This illustrates how specialists (in this case poisons centres) can rapidly share exposure assessment information via a central EU system. It is important that such systems link with other exposure assessors and public health risk assessors.

RAS BICHAT is the Rapid Alert System used for exchanging information on health threats due to deliberate release of chemical and biological agents (notification of confirmed or suspected events, exchange of information and coordination of measures among partners). The system links the Commission with the designated competent authority and 24 hour operational contact points of each Member State. RAS BICHAT is a part of the Programme of cooperation on preparedness and response to biological and chemical agent attacks. It has been established to serve in particular the Health Security Committee members nominated by Health Ministers to address and coordinate, together with the Commission, all preparedness and response issues in terms of public health threats related to attacks in which biological and chemical agents might be used.

RAS CHEM is a rapid alert system that links the poison centres in the European Union, national chemical agencies and the Ministries of Health for the exchange of information on incidents, including chemical agents relevant to terrorism and other events leading to release of chemicals, and consultation and coordination of counter-measures.

***** Community Mechanism for Civil Protection- Monitoring and Information Centre (MIC)***

Situated within DG ECHO, the MIC gives countries access to the community civil protection platform. Any country affected by a major disaster, inside or outside the EU, can launch a request for assistance through the MIC. During emergencies the MIC plays three important roles:

- Communications hub: Being at the centre of an emergency relief operation, the MIC acts as a focal point for the exchange of requests and offers of assistance. This helps in cutting down on the 30 participating states' administrative burden in liaising with the affected country. It provides a central forum for participating states to access and share information about the available resources and the assistance offered at any given point in time [58].
- Information provision: The MIC disseminates information on civil protection preparedness and response to participating states as well as a wider audience of interested parties. As part of this role, the MIC disseminates early warning alerts (MIC Daily) on natural disasters and circulates the latest updates on ongoing emergencies and Mechanism interventions.
- Supports co-ordination: The MIC facilitates the provision of European assistance through the Mechanism. This takes place at two levels: at headquarters level, by matching offers to needs, identifying gaps in aid and searching for solutions, and facilitating the pooling of common resources where possible; and on the site of the disaster through the appointment of EU field experts, when required.

Since its creation in 2001, the Mechanism has been activated for over 150 disasters worldwide, including environmental incidents, floods, forest fires and earthquakes [150].

Table 13. Regional & bilateral mechanisms / agreements

Mechanism	Preparedness	Field Aid	Risk Assessment & Expertise	Information exchange
The Central European Initiative (CEI) – 5 EU countries [151]	An agreement on the forecast, prevention and mitigation of natural and technological disasters. Includes exchange of scientific and technical information, common research programmes and training of experts in order to set up common programmes on Civil Protection and disaster management. An operational manual comprising data for the five parties has been compiled for this purpose. Includes five EU Member States.			
EUR-OPA (Council of Europe) Major Hazards Agreement - European and Southern Mediterranean countries.	Promote co-operation between Member States in a multi-disciplinary context to ensure better prevention, protection against risks and better preparation in the event of major natural or technological disasters. It should be noted that not all EU Member States are parties to this agreement, while the Commission enjoys an observer status [152].			

Table 14 continued. Regional & bilateral mechanisms / agreements

Mechanism	Preparedness	Field Aid	Risk Assessment & Expertise	Information exchange
Organisation of the Black Sea Economic Cooperation (BSEC) – 12 countries including some EU Member States [153][152]	Agreement on collaboration in emergency assistance and emergency response to natural and man-made disasters.	Agreement on collaboration in emergency assistance and emergency response to natural and man-made disasters.		GIS and Information network.
Disaster Prevention and Preparedness Initiative for SEE (DPPI SEE) – south eastern EU countries	Framework to develop programs and projects leading to strengthened capabilities in preventing and responding to natural and man-made disasters. It also brings together donor countries and international governmental and non-governmental organisations.			
Euromed civil protection cooperation – Euro-Mediterranean Partner Countries	Contributes to the continuation of institutional cooperation both between the EU and the Mediterranean Partner Countries. As part of this the most recent programme is PPRD which contributes to the development of stronger prevention, preparedness and response capacities in civil protection at international, national and local level [154].			

Table 15 continued. Regional & bilateral mechanisms / agreements

Mechanism	Preparedness	Field Aid	Risk Assessment & Expertise	Information exchange
ICE (International Chemical Environment) - International Directory for Emergency Response Centres – 11 EU Member States	Network of national schemes, set up by the European Chemical Industry to provide information, advice and resources to the emergency authorities in case of land-based chemical transport accidents.	Contains a number of matrix templates detailing countries' capabilities to provide on-site international assistance in the areas of : • Expertise Response • Equipment Response • Operators of Equipment • Monitoring / Risk Evaluation	The National ICE Centre will provide, in the local language, initial telephone advice for the immediate control of the incident. It will promptly alert the producing company, obtain further information (possibly via other national ICE centres) or mobilise mutual assistance.	To do this, each Centre has at its disposal appropriate communication equipment, reference books or databases and up to date lists of telephone and fax numbers of contacts within the Chemical Industry. European support for on site assistance for monitoring and risk evaluation is provided in a series of matrices.

APPENDIX 2

Cross-border Exposure Characterisation for Risk Assessment of Chemical Incidents CERACI

Literature Review – TASK B Report

Main contributors:

HPA: Task manager

HPA: Define literature review strategy, produce deliverables.

RIVM (with sub-contractors) and NIOM: Support HPA in literature review and network building. Provide practical experience of cross-border collaboration.

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This report is a collation of the information made available via literature reviews, expert feedback and project surveys and workshops, within the resources available to the project. It does not represent the position of the European Commission, the National Institute for Public Health and the Environment, the Health Protection Agency or the Nofer Institute of Occupational Medicine.

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www.rivm.nl/ceraci

Contents

Glossary of acronyms and terms

ACUTEX	Methodology to Develop Acute Exposure Threshold Levels in case of Accidental Release
AEGLs	Acute Exposure Guideline Levels
AERVs	Acute Exposure Reference Values
AETLs	Acute Exposure Threshold Levels
AIR4EU	Optimising air quality information for policy-makers
ALOHA	Areal Locations of Hazardous Atmospheres
AQC	UK Air Quality Cell
AQUASENSE	Development of Novel Sensors for Contaminant Detection in Water using Near Infrared Light and Aquaphotomics
ASHT	Alerting System for Chemical Health Threats
ASHTII	Alerting System for Chemical Health Threats Phase II
ATLAS	Network of European police special intervention units
AURN	UK Automatic Urban Real-time Network
BERS	Bulgaria - Emergency Response System
BioCop	New Technologies to Screen Multiple Contaminants in Foods
BOT-mi	Netherlands Policy Support Team for environmental incidents
BRIDGE	Bridging resources and agencies in large-scale emergency management
CAMEO	Computer-Aided Management of Emergency Operations
CARIMEC	Chemical & radiation inventory of public health measures & medical countermeasures
CARRA-NET	Chemical and Radiation Risk Assessment Network
CASCADE	Chemicals as contaminants in the food chain: a Network of Excellence for research, risk assessment and education
CBRN	Chemical, Biological, Radiological and Nuclear
CBRNE	Chemical, Biological, Radiological, Nuclear and high- yield Explosives
CECIS	Common Emergency Communication and Information System
CERACI	Cross-border Exposure characterisation for Risk Assessment in Chemical Incidents
CHEMET	UK Met Office Chemical Meteorology
CHORIST	Integrating communications for enhanced environmental risk management and citizens safety
CIE TOOLKIT	Public Health Response to Chemical Incident Emergencies Toolkit
COCERSI	Contamination in drinking water distribution systems: Consumer exposure risks and source identification
CONffIDENCE	Contaminants in food and feed: Inexpensive detection for control of exposure
CONPRICI	Italian National consortium for the protection of industrial chemical risks
COST	European Cooperation in Science and Technology
CRCE	HPA Centre for Radiation, Chemical and Environmental Hazards
CREATIF	Network of Testing Facilities for CBRNE detection equipment
DATABASE	A Database for validation of models used in chemical risk assessment
DG ECHO	Directorate General for Humanitarian Aid and Civil Protection
DG SANCO	Directorate General for Health and Consumers
DHRS-CIM	Distributed Human-Robot System for Chemical Incident Management
DIM	Detection, Identification and Monitoring Equipment

DSTL	UK Defence Science and Technology Laboratory
DWDS	Drinking water distribution systems
EC	European Commission
EEA	European Economic Area
EFFIS	European Forest Fire Information System
EHE	UK HPA CRCE Environmental Hazards and Emergencies Department
EIG	Economic Interest Group
EMARC	UK Met Office Environmental Monitoring and Response Centre
ENHIS	European Environment and Health Information System
EnviRisk	Assessing the risks of environmental stressors: Contribution to the development of integrating methodology
EPA Network	European Network of the Heads of Environment Protection Agencies
ERA	European Research Area
ERA-ENVHEALTH	European Research Area – Environment and Health
ERA-NET	European Research Area Network
E-SPONDER	A holistic approach towards the development of the first responder of the future
ESS	Emergency support system
EU	European Union
EUMETNET	European National Meteorological Service
EUPC Forum	European Union Poisons Centres Forum
FIERS	Fire events risk assessment through remote sensing
FOOD-BIOSENS	New chemical and biochemical sensors for analysis of food, environmental and medical samples
FRS	Fire and Rescue Service
FTIR	Fourier transform infrared spectroscopy
GAGS	Netherlands public health hazmat advisors
GAP	Guard, anticipation and prediction. A new approach to health risk prediction
GCMS	Gas Chromatography–Mass Spectrometry
GIS	Geographical Information Systems
GSCT	Development of Generic Scenarios, alerting system and training modules relating to release of Chemicals by Terrorists
GUGIK	Polish NIOM Geodesy and Cartography system
HART	UK Ambulance Service Hazardous Area Response Teams
HAZMAT	Hazardous Materials
HEIMTSA	Health and environment integrated methodology and toolbox for scenario assessment
HENVINET	Health and ENVIronment NETwork
HEOF	Health Emergency Operations Facility
HMRT	Hazardous Material Response Team
HPA	Health Protection Agency
HSL	UK Health and Safety Laboratory
HydroNet	Floating Sensorised Networked Robots for Water Monitoring
ICE	Intervention in Chemical Transport Emergencies
ICT	Information Communication Technology
IEHIAS	Integrated Environmental Health Impact Assessment System
IFRC	International Federation of Red Cross and Red Crescent
IMPEL	European Union Network for the Implementation and Enforcement of

	Environmental Law
INDIGO	Innovative Training & Decision Support for Emergency operations
INTARESE	Integrated Assessment of Health Risks of Environmental Stressors in Europe
iNTegRisk	Early Recognition, Monitoring and Integrated Management of Emerging, New Technology Related Risks
INFRA	Innovative and novel first responders applications
IRRIS	New chemical sensors by combining IR absorption and reflectometric interference spectroscopy
IS	Information System
MASH	Mass casualties and Health Care following the release of toxic chemicals or radioactive material
MEMFIS	Ultrasmall MEMS FTIR Spectrometer
Met Office	UK Meteorological Office
MIC	DG ECHO Monitoring and Information Centre
MOBESENS	Mobile water quality sensor system
MOBILAB	Mobile Laboratory for Environmental Pollution Measurements and Emission Control Systems Evaluation
MS	Member State
MUG	Belgian Ambulance Service Mobil Urgence Group
NHS	UK National Health Service
NIOM	Nofer Institute of Occupational Medicine
NORMAN	Network of Reference Laboratories for Monitoring of Emerging Environmental Pollutants
OECD	Organisation for Economic Co-operation and Development
OpenTox	Open Toxicology
ORCHESTRA	Open Architecture and Spatial Data Infrastructure for Risk Management
OSIRIS	Open architecture for Smart and Interoperable networks in Risk management based on In-situ Sensors
PCT	English Primary Care Trusts
QA/QC	Quality Assurance/Quality Control
QSAFFE	Quality and Safety of Feeds and Food for Europe
RAS CHEM	Rapid Alerting System for Chemical Health Threats
REACH	Registration, Evaluation, Authorisation and Restriction of CHemical substances
RIMA	Risk Management and Remediation of Chemical Accidents
RISK ASSETs	Risk Assessment and Management - European Training Programme
RIVM	Netherlands National Institute for Public Health and the Environment
SAFER	Services and Applications For Emergency Response
SAMU	Service d'Aide Médicale Urgente
SAR	Search And Rescue
SIMIN	Romania - Integrated Meteorological Information System
SLAM	Standardisation of Laboratory Analytical Methods
SMEs	Small-Medium Enterprises
SOPs	Standard Operating Procedures
SPHERE	Strengthening Public Health Research in Europe
STAC	UK Science and Technical Advice Cell
STEPS	Strengthening Engagement in Public Health Research
UNIPHE	Use of Sub-National Indicators to Improve Public Health in Europe

UORECI	Italian Operational research unit for emergencies in industrial chemistry
USAR	Urban Search And Rescue
US EPA	United States Environmental Protection Agency
VAAC	Volcanic Ash Advisory Centre
WHO	World Health Organisation
WIOS	Polish Voivodship Inspectorates for Environmental Protection
WMO	World Meteorological Organisation

1 Executive Summary

This report summarises the exposure monitoring capability, capacity and organisation during the acute phase of chemical incidents in EU Member States, for health risk assessment purposes. It is the first of four reports (Tasks B-E) comprising the Cross-border Exposure characterisation for Risk Assessment in Chemical Incidents (CERACI) project. This report is primarily intended to gather and present preliminary information to inform further research, and it establishes an evidence-base with which to inform and direct subsequent CERACI task reports.

European Commission project databases have been used to identify **projects relevant to exposure assessment** in chemical incidents. Of principal interest were current guidelines and tools and practices for exposure assessment in acute chemical incidents – specifically those related to environmental modelling and monitoring (sampling and analysis) for health risk assessment.

By targeting key literature and information sources, a review was undertaken to identify **key organisations and agencies across Member States involved in exposure assessment** and the risk characterisation processes during acute chemical incidents. Extensive information about individual Member States is included in Appendices to this report. Information was refined by international experts in exposure assessment from Member States, who attended project workshops and were provided with an initial draft for comment as part of CERACI's Task D.

This report identifies **country-specific and generic good practices and guidelines** for environmental modelling and monitoring for health risk assessment during acute chemical incidents. The aims of modelling and monitoring are similar across Member States, but their approaches and good practices can differ for specific organisational, technical and historical reasons. Subsequent reports consider whether harmonisation and collaboration in this field has the potential to improve EU response capabilities and capacities to respond to acute chemical health threats.

This report also provides examples of **Member States that have organised collaboration in environmental modelling and monitoring** for health risk assessment nationally and across international borders. Full identification and characterisation of the information exchange between the various responsible agencies during chemical incidents was not available in the literature, but it is available from experts in Member States. The results of this review provide the basis on which a project survey questionnaire can be constructed: it provides suggested questions and considerations to be included in CERACI's Task C. The EU initiatives, arrangements and cross-border agreements highlighted throughout this report are to be used as reference material and extended by Tasks C-E.

As part of this phase of the CERACI project, a **network of experts on exposure assessment** has been established and it will be expanded in later project phases. This network has been used to review Member State-specific information within this report. Later reports (Tasks D & E) explore how such a network may contribute to European chemical incident emergency preparedness and response.

2 Introduction

2.1 Public health risk assessment for the acute phase of chemical incidents

Prevention or mitigation of human health effects is often the major determinant underlying emergency response decisions. Public health management, aimed at reducing the burden of disease of chemical incidents (either intentional or non-intentional) is therefore one of the most important and urgent response actions required.

Public health management is virtually impossible without health risk information. Irrespective of the scenario or its underlying cause (accidental, intentional, design, geographical situation) an accurate assessment of human health risks, resulting from acute releases, is at the core of chemical incident prevention, preparedness and response[1].

2.1.1 Exposure Assessment

2.1.1.1 WHO Human Health Risk Assessment Toolkit: Chemical Hazards[2]

Exposure assessment is used to determine whether people are in contact with a potentially hazardous chemical and, if so, by how much, by what route, through what media and for how long. Because hazard characterisation and risk characterisation are dependent upon the route (oral, inhalation, dermal) and duration (short-term, medium-term, long-term) of exposure, knowledge of how and when people may be exposed is relevant to the determination of an appropriate guidance or guideline value. When combined with information on hazard characterisation or a guidance or guideline value, exposure information is used to characterise health risks.

Human health risk assessments of chemicals can be performed to evaluate past, current and even future exposures to any chemical found in air, soil, water, food, consumer products or other materials. They can be quantitative or qualitative in nature. Risk assessments are often limited by a lack of information. To be protective of public health, risk assessments are typically performed in a manner that is unlikely to underestimate the actual risk. The scope of an exposure assessment can be narrowed with information about the chemical and its properties, from which the important exposure media and routes can be inferred.

The exposure assessor must determine the following parameters to initiate the exposure assessment portion of the risk evaluation:

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[1] WHO Manual Chemical Incidents
http://www.who.int/environmental_health_emergencies/publications/Manual_Chemical_Incidents/en/index.html

[2] WHO Human Health Risk Assessment Toolkit: Chemical Hazards
http://www.who.int/ipcs/publications/methods/harmonization/toolkit.pdf

- Rate of emission from the source
- The relevant routes and pathways of exposure; what ways could people come into contact with the chemical.
- The environmental media expected to contain the chemical; how much exposure is likely to occur?
- The appropriate duration of exposure. What metric of exposure is appropriate for characterising health risks? From the guidance or guideline value of whether an exposure concentration or exposure rate is needed to perform the risk characterisation.

As this information is not always available, many risk assessments require that estimates or judgements be made regarding some data inputs or characterisations. Consequently, risk assessment results have associated uncertainties, which should be characterised as much as possible.

2.2 Objectives

The objectives of CERACI are to:

- Strengthen the public health risk assessment undertaken for the acute phase of chemical incidents (including fires), by providing recommendations relating to the exposure assessment step of risk assessment process.
- Facilitate cooperation in the public health management of chemical incidents across administrative boundaries by improving interoperability of exposure assessment guidelines, tools and practices. Administrative boundaries can be within and between autonomous states, or across different authorities within an autonomous state.

The specific objectives of this report (Task B) are to:

- Obtain a preliminary understanding of exposure monitoring capability, capacity and organisation, during the acute phase of chemical incidents for health risk assessment purposes in Member States (Sections 3.2, 3.4, 3.5 & Appendix 2).
- Describe good practices in exposure assessment, any barriers to good practice, and key chemicals and incident scenarios (Section 3.8).
- Establish an initial network of contacts within a limited number of Member States as a starting point for an expert network (Section 3.3). This will be expanded in later project phases. This network will been used to review Member State information within this report. Later reports (Tasks D & E) will explore how such a network may contribute to European chemical incident emergency preparedness and response.

The project strategy identified the following aims for Task B:

- Identify relevant past projects focusing on exposure assessment in chemical incidents, in particular environmental modelling and monitoring (sampling and analysis) for health risk assessment (Section 3.1 & Appendix 2).

- Analyse and evaluate the organisational and technical arrangement of exposure assessment in chemical incidents in Member States (Sections 3.2, 3.4, 3.5 & Appendix 2). Identify good practices for country wide and cross-border collaboration and interoperability.

- Assess existing cross-border operational collaboration agreements for risk assessment of chemical emergencies at the first responder and governmental levels (Section 3.6).

- Identify key chemicals and incident scenarios (Section 3.7) and collect information from intergovernmental organisations (e.g. European Commission (EC), World Health Organisation (WHO)) and affiliations with associate and collaborative project partners regarding appropriate contacts (questionnaire recipients) in all Member States.

This report will form the basis on which a project survey questionnaire can be constructed as part of CERACI's subsequent Task C (Section 3.2.2). The EU initiatives, arrangements and cross-border agreements highlighted throughout this report, are to be used as reference material and extended by Tasks C-E.

3 Outcomes

3.1 Identification of relevant projects

European Commission project databases[3,4] were searched to identify projects relevant to exposure assessment in chemical incidents. Identification of relevant projects focusing on exposure assessment in chemical incidents, in particular environmental modelling and monitoring (sampling and analysis) for health risk assessment was undertaken. The following search criteria was specified to include the keywords: Chemical monitor*, Environment*, Monitor*, “Environment* Model*”, Exposure assess*, Epidemiology, Chemical incident*, Civil protect*, First respon*, Health Risk assess*, Chemical model*, and Emergency respon*.

Of principal interest were current guidelines, tools and practices for exposure assessment in acute chemical incidents – specifically those related to environmental modelling and monitoring (sampling and analysis), for health risk assessment. The review also identified projects that had established networks of experts employed in roles that encompass exposure assessment, together with those projects that have designed and run workshops using acute chemical incident scenarios to inform their work.

Projects of interest fall into a number of separate, but complementary, categories. Of primary interest are those which focus on monitoring, analysis, modelling, and collaboration. Projects in the fields of hazard identification, information communication technologies and risk assessment do not directly align with the focus of CERACI, but they include information that overlaps with the project’s aims (e.g. risk assessment projects which signpost exposure assessment guidelines). A general overview is provided in the section below.

Selected individual projects mentioned in the text below, and their relevance are summarised in Appendix 2. Projects were selected on the basis of a review of their project description and of the information publically available on their websites (where these existed and available in English). Where projects contained relevant information they are summarised within Appendix 2. Further information on relevant projects will be included in Task E.

3.1.1 Hazard identification

The REACH European Community Regulation on chemicals and their safe use (EC 1907/2006[5]) deals with the Registration, Evaluation, Authorisation and Restriction of Chemical substances. The aim of REACH is to improve the protection of human health and the environment through better and earlier identification of the intrinsic properties of

[3] Community Research and Development Information Service (CORDIS). http://cordis.europa.eu/newsearch/index.cfm?page=advSearch

[4] Executive Agency for Health and Consumers (EAHC): Projects database. http://ec.europa.eu/eahc/projects/database.html

[5] REACH http://ec.europa.eu/environment/chemicals/reach/reach_intro.htm

chemical substances. Many REACH-focussed projects (such as the FP7-funded projects ORCHESTRA (Open Architecture and Spatial Data Infrastructure for Risk Management) and OpenTox (Open Toxicology); and the FP6-funded project OSIRIS (Open architecture for Smart and Interoperable networks in Risk management based on In-situ Sensors) generally focus on methods to evaluate the toxicity of chemicals and disseminate toxicological data rather than on environmental monitoring and modelling.

3.1.2 Monitoring

The Commission has funded, and continues to fund, projects that aim to develop chemical detection technologies. These encompass the detection of contaminants in food, water and air (such as the FP7-funded projects CONFFIDENCE (Contaminants in food and feed: Inexpensive detection for control of exposure), MEMFIS (Ultrasmall MEMS FTIR Spectrometer), HYDRONET (Floating Sensorised Networked Robots for Water Monitoring), QSAFFE (Quality and Safety of Feeds and Food for Europe), AQUASENSE (Development of Novel Sensors for Contaminant Detection in Water using Near Infrared Light and Aquaphotomics), and MOBESENS (Mobile water quality sensor system); and the FP6-funded projects FOOD BIOSENS (New chemical and biochemical sensors for analysis of food, environmental and medical samples), BioCop (New Technologies to Screen Multiple Contaminants in Foods), IRRIS (New chemical sensors by combining IR absorption and reflectometric interference spectroscopy), and COCERSI (Contamination in drinking water distribution systems: Consumer exposure risks and source identification)). The detailed aspects of such work is beyond the remit of this review but it is important to mention, as technological advances in field and laboratory monitoring (and in information communication technologies linked to monitoring and modelling) have the potential to improve the European capacity for exposure assessment, particularly where validated methodologies are developed that are simple, inexpensive and rapid. Sensor networks and mobile monitors capable of providing real-time monitoring data can facilitate timely dynamic modelling of chemicals in the environment.

3.1.3 Analysis

The Commission has funded (and continues to fund) projects that seek to establish networks of laboratories and related organisations, to enable and improve European Union (EU) capabilities for monitoring pollutants (such as the network created by the FP6-funded project NORMAN (Network of Reference Laboratories for Monitoring of Emerging Environmental Pollutants)). These are important in developing standardised approaches to monitoring and analyses. Other technical projects have sought to improve the international comparability of chemical measurements. SLAM is currently being funded which aims at setting Standardised Laboratory Analytical Methods

The role of National Air Quality Reference Laboratories has been formally established: they are legally responsible for the quality assurance of air pollutant measurements in their Member State, which implies the organisation of national Quality Assurance/Quality Control (QA/QC) programmes and the participation in European QA/QC programmes[6].

[6] Association of National Air Quality Reference Laboratories (AQUILA) Network. http://ies.jrc.ec.europa.eu/aquila-homepage.html

There are a wide range of EU-funded projects dealing specifically with ambient air quality monitoring; these involve capabilities and stakeholders relevant to CERACI (an example being the FP6-funded AIR4EU (Optimising air quality information for policy-makers) project). Networks of Excellence, such as that formed by the FP6-funded project CASCADE (Chemicals as contaminants in the food chain: a Network of Excellence for research, risk assessment and education), have been established to harmonise the European approach in more specific areas such as exposure to endocrine disrupting chemicals in food.

3.1.4 Modelling

Several projects include work packages which evaluate European monitoring and modelling capabilities to various degrees (such as the FP7-funded iNTeg-Risk and FP6-funded INTERASE (Integrated Assessment of Health Risks of Environmental Stressors in Europe) projects). These provide extremely useful information regarding European capabilities; however, no predecessor project provides an entirely comprehensive review of monitoring and modelling for chemical incidents; therefore it is timely to undertake this review as part of CERACI. This report identifies that there is currently no harmonised approach to modelling within or between Member States. There are, however, projects which seek to encourage harmonisation, and there are a number of completed and ongoing COST (European Cooperation in Science and Technology) Actions related to harmonisation and standardisation of modelling approaches.

3.1.5 Information communication technologies (ICT)

There are projects seeking to improve incident management through the development of decision support systems for responding organisations (such as the FP7-funded projects DHRS-CIM (Distributed Human-Robot System for Chemical Incident Management), GAP (Guard, anticipation and prediction. A new approach to health risk prediction), BRIDGE (Bridging resources and agencies in large-scale emergency management), INDIGO (Innovative Training & Decision Support for Emergency operations), and ESS (Emergency support system)). These include standalone ICT initiatives and projects integrating ICT and monitoring, which are of particular relevance.

The majority of these ‘decision support’ projects focus on remote coordination, but there are projects that are specifically tailored for first-responders at the scene of an incident (such as the FP7-funded projects INFRA (Innovative and novel first responders applications), and E-SPONDER (A holistic approach towards the development of the first responder of the future)). Together with improving information provision and information sharing during the acute phase of an incident, their development has the potential to improve interoperability and collaboration between those organisations that respond to acute chemical incidents, both within and between Member States. Projects such as the FP-6 funded CHORIST (Integrating communications for enhanced environmental risk management and citizens safety) project focus on linking monitoring and alerting with public communication using ICT solutions.

3.1.6 Risk assessment

Projects such as the FP6-funded INTERASE, HEIMTSA (Health and environment integrated methodology and toolbox for scenario assessment), and ENVIRISK (Assessing the risks of environmental stressors: Contribution to the development of integrating methodology) and the DG SANCO-funded (Directorate General for Health and Consumers) ENHIS (European Environment and Health Information System) and UNIPHE[7] (Use of Sub-National Indicators to Improve Public Health in Europe), aim to provide methods and tools to enable integrated assessment of environmental health risks. Their scope is broader than exposure assessment alone, but exposure assessment is part of the risk assessment process and hence their project stakeholders and outcomes are relevant, as is the evidence-base supporting the development of their methods and tools.

A number of related European resources that include lists of models and data for exposure assessment exist (such as the Integrated Environmental Health Impact Assessment System (IEHIAS[8])). These are relevant to CERACI but again their focus is generally wider than monitoring and dispersion modelling during acute incidents, and they are most applicable to chronic exposures and policy analyses. Release emission factors and scenarios and climate/meteorology data sources, listed by IEHIAS, are relevant to dispersion modelling during acute releases and IEHIAS provides limited information on air pollution models that may have both acute and chronic applications.

As a product of EnvRisk and other related projects, a Platform for Exposure Assessment[9] has been developed, which aggregates databases, modelling tools and information related to the field of exposure assessment. It also contains pages with links and short descriptions to external sources related to the field of exposure assessment[10]. The FP6-funded HENVINET (Health and ENVIronment NETwork) project provides a database[11] of decision support tools and environment and health projects; these include US initiatives (e.g. the CAMEO[12] (Computer-Aided Management of Emergency Operations) system which integrates a chemical database and a method to manage data, an air dispersion model, and a mapping capability).

3.1.7 Collaboration

DG SANCO has funded projects to improve the detection and alerting of, and response to, chemical incidents (such as ASHT (Alerting System for Chemical Health Threats) and ASHTII (Alerting System for Chemical Health Threats Phase II)). These are generally linked to syndromic surveillance and are focussed on public health organisations and risk assessment (rather than exposure assessment as such); however, the health networks and European cooperation that they entail are of relevance to CERACI. Other DG SANCO-funded projects (such as GSCT (Development of Generic Scenarios, alerting system and training modules relating to release of Chemicals by Terrorists), CIE TOOLKIT (Public Health Response to Chemical Incident Emergencies Toolkit), RISK ASSETs (Risk Assessment and Management - European Training Programme), and MASH (Mass casualties and Health Care following the release of toxic chemicals or radioactive material)) have developed training materials and protocols related to the preparedness

[7] UNIPHE http://www.uniphe.eu/

[8] IEHIAS. http://www.integrated-assessment.eu/

[9] Platform For Exposure Assessment. http://www.ktl.fi/expoplatform/home_ui/

[10] ExpoPlatform external sources. http://en.opasnet.org/w/ExpoPlatform_external_sources

[11] HENVINET databases. http://henv.nilu.no/Tools/DecisionSupportTools/SearchDSTs/tabid/3058/Default.aspx

[12] CAMEO. http://www.epa.gov/oem/content/cameo/what.htm

and response to acute chemical incidents and there are ongoing projects intended to improve provision of information and mutual sharing of information between risk assessors within Member States (such as CARRA-NET (Chemical and Radiation Risk Assessment Network) and CARIMEC (Chemical & radiation inventory of public health measures & medical countermeasures)). Project outcomes are not always publicly available, as some projects are the result of service-level contracts for the EC. Further discussion of these resources is provided in the CERACI Task E report.

Projects such as the FP7-funded ERA-NET (European Research Area Network) aim to enhance coordination of environment and health research. Commission-funded environment and health research projects are listed in the ERA-ENVHEALTH (European Research Area – Environment and Health) Research Database[13] and identify potential research partners and specialist expertise.

3.1.8 First Conclusions/Observations

European project databases contain information on projects that provide technical information, guidelines, and contacts of relevance to CERACI. The projects identified by this initial review will be explored in further detail, as part of subsequent CERACI reports, to consider synergies between CERACI and other projects and possible future work areas. Task E, Sections 4.1.3-10 summarise resources for different functions of exposure assessment.

Collaborative projects have produced workshop exercises using chemical incident scenarios and it is advisable that these are used to inform the exercise workshop that will be designed and run in a later CERACI work package (Task D).

To date, the predominant focus of EC-funded projects that include exposure assessment outputs (such as tools, databases, and guidance) is on chronic exposure and only a subset is also relevant to acute exposure assessment. It is recommended that the applicability of tools and models in acute scenarios are assessed as part of future CERACI reports and that all existing material is collated.

3.2 Analysis and evaluation of the organisational and technical arrangements for exposure assessment during chemical incidents in Member States

3.2.1 Methodology

An EU-wide review was undertaken to determine which institutions and organisations are responsible for undertaking or contributing towards the exposure assessment and risk characterisation processes during acute chemical incidents. A search for publicly available information was conducted for each Member State; the search focussed upon organisational roles in exposure assessment. Such roles may involve qualifying or quantifying a chemical release using field monitoring or laboratory analysis; or estimating its concentration and dispersion using meteorological or chemical modelling;

[13] ERA-ENVHEALTH Research Database. http://era-envhealth.stis.belspo.be/

Geographical Information Systems (GIS) may be employed to locate sensitive receptors and facilities; and organisations may undertake scene observations of the exposure effects in humans or the environment. Being able to clearly identify, quantify and characterise a chemical and its potential impact in the early stages of an incident can help facilitate the determination of any likely adverse health effects on the population and thus provide key criteria for input into the risk assessment process.

Methods of exposure assessment can vary significantly and may comprise simple on scene observations, such as: plume or wind direction; distance of receptors from source; exposure duration or observed or self-reported adverse health effects; to more sophisticated analytical assessment, such as: monitoring for single or multiple chemical parameters using mobile laboratories at the scene; or collection of samples for subsequent analysis at reference laboratories. As such, the nature and quality of data collected from chemical incidents can also vary significantly dependent upon the techniques employed or the organisation or agency undertaking the key elements of information gathering: it may be simple qualitative, or complex quantitative information.

For each Member State a matrix was created to capture information relating to each organisation's responsibility and exposure assessment capability (see Appendix 3 of this report). As there are administrative and organisational differences between and within countries (e.g. regionally), it was accepted that there would naturally be differences between the nature and responsibility of different agencies and organisations between and within the Member States also. The matrix was employed to support the collation of information and allow for simple comparisons across each country. The initial review of Member State capability and responsibilities, during acute chemical incident response, captures evidence and supports inferences relating to identified good practices for cross-border collaboration and interoperability.

The Health Protection Agency (HPA) completed exposure matrices for Austria, Bulgaria, Cyprus, Denmark, Estonia, Finland, France, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Portugal, Romania, Slovenia, Spain, Sweden and the United Kingdom; RIVM (Netherlands National Institute for Public Health and the Environment) completed matrices for Belgium, Germany and the Netherlands; whilst NIOM (Nofer Institute of Occupational Medicine) completed the matrices for the Czech Republic, Poland and Slovakia.

3.2.2 Questions and considerations for Task C

A series of questions was developed to aid completion of the exposure matrices through future telephone surveys of experts in exposure assessment, as it is not possible to obtain this detailed information through a review of readily available information alone. These questions will become a starting framework for the survey developed and presented in the Task C report – they are presented throughout the section below in *italic* font. These questions have been specifically derived to identify the information supporting the project objectives across all Member States. To ensure that double meanings or misunderstanding are reduced in the language of the questions the use of terminology, definitions and phrases will be audited. It is recommended that the

CREATIF[14] (Network of Testing Facilities for CBRNE detection equipment) glossary to define common language and delimitations for testing, evaluation and certification of CBRNE (Chemical, Biological, Radiological, Nuclear and high- yield Explosives) detection equipment be consulted to support this purpose.

See Appendix 6, Section 10.2 for a full set of questions and considerations for Task C.

3.2.2.1 Exposure assessment and risk characterisation matrix.

An 'exposure assessment and risk characterisation matrix template' was created for recording information. The matrix was divided into organisation type e.g. Government, Military, Emergency Services, Health and Environmental Protection and considered responsible organisations responding to chemical incidents related to air, land, water and food.

Dependent on national governmental administrations, some organisations fall into one or more category within the matrix; for example, some could be categorised under government or military, notwithstanding that their primary role is emergency response. Where possible, to allow for suitable comparisons between the capabilities of Member States, these organisations were also listed under the other appropriate category. An exposure spreadsheet for each Member State can be found in Appendix 3.

The primary goal of exposure assessment (taking place during the first hours of an incident) is usually to assess the initial situation, to inform decisions on the appropriate measures that should be put in place to control, and minimise, potential health risks, including advice on evacuation and shelter in place. Both the risk assessment during a chemical incident and the epidemiological health study that may follow afterward need data on exposure, but data collected for one purpose may not be suitable for the other. For example, environmental sampling for risk assessment often takes place close to the source to estimate worst case scenarios, and these measurements may not accurately represent the exposure of (different) populations[15].

Questions and considerations for Task C Survey Questionnaire:

- *The survey should seek to establish the rationale for monitoring and how data is subsequently used i.e. for risk assessment, occupational exposure, identification etc.*

For an individual to be exposed to a substance there must be a pathway through which a chemical source can move to reach that individual: for example, pathways can be through the movement of chemicals through air before they are inhaled, or water before they are ingested. This is sometimes referred to as the source-pathway-receptor model. This model concept was adopted within the exposure matrix to identify the exposure assessment actions and capability for each element of the risk assessment model (i.e.

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[14] CREATIF http://www.creatif-network.eu/docs/D.1.1_rev1_glossary_final.pdf

[15] Bongers SB et al, (2008) *Challenges of exposure assessment for health studies in the aftermath of chemical incidents and disasters*, Journal of Exposure Science and Environmental Epidemiology 18, 341–359

source, pathway and receptor). The capability and contribution of identified organisations was categorised using the following criteria: observations; field monitoring; laboratory analysis; emergency plans; modelling; Geographical Information Systems; and risk communication, as these were determined to be the primary / common methods for collection of information to contribute to the risk assessment model; an additional category of risk characterisation was also identified in order to record those organisations which may use the exposure assessment information to characterise risk.

An example of how the exposure matrix was approached and initially populated is presented in Appendix 1 using the United Kingdom as an example.

3.2.3 First Conclusions/Observations:

The exposure matrices have identified areas where it is not possible to draw reliable conclusions based solely upon published information.

Whilst the literature review was able to broadly identify responsible organisations and agencies involved in acute chemical incident response and partially identify organisational exposure assessment capabilities, it was generally unable to characterise information exchange between the various responsible agencies during an acute chemical incident. Project partners identified that even within their own countries these information mechanisms can be complex and/or ad hoc, with information flowing across multiple agencies and response levels. Furthermore, the acute phase of a major chemical incident can present complex and dynamic situations which can put strain on coordination / information sharing mechanisms. Therefore, identifying those who are the responsible agencies and organisations within Member States for monitoring, exposure assessment, risk characterisation and communication may only be obtainable by means of a more detailed questionnaire (Task C).

Questions and considerations for Task C Survey Questionnaire:

The survey should seek to present questions which enable reliable conclusions to be drawn about all aspects of exposure assessment for accurate completion of the exposure matrices; particularly where it has not been possible to draw conclusions from a review of readily available information. The UK example (see table 7.1.28 in Appendix 3 of this report) and selective country profiles provided in Appendix 4 should assist the construction of appropriate questions.

The INTARESE project[16] noted that, to a large extent, environmental monitoring and modelling within Member States is not carried out specifically for reasons of human health. Sampling strategies, instrumentation, choice of determinant and scale of analysis, therefore, may all be sub-optimal in terms of health risk assessment. For example urban air quality monitoring is instigated primarily to assess compliance with existing legislation, and so is not designed to provide information on patterns of exposure across

[16] INTARESE. *http://www.intarese.org/*

the population. In all these situations, the relevance of these data to health risk assessment is limited[17].

Research into a number of well-known chemical incidents was undertaken during a review considering the challenges of exposure assessment for health studies in the aftermath of chemical incidents and disasters[18]. Whilst the review centred on informing subsequent health studies, the reviewers have captured information useful to CERACI relating to the exposure assessment methods and techniques, used in each of the incident scenarios. Twenty eight incidents were identified in the study from which selected incidents were chosen for more detailed review. Incidents included: accidental industrial chemical releases or spills, chemical fires, oil tanker spills, collisions or derailments of chemical freight trains, explosions in a warehouse or depot, plane crashes. Well known chemical incidents such as Bhopal, Seveso and Enschede were included in the review. The review categorised the incidents into four types according to early phase risk assessment and late phase exposure estimates. For each incident type, scenario risk assessment and exposure assessment criteria were recorded based upon actual events and used to comment on what justified the subsequent health study.

3.3 Initial contact: network of experts

Project partners are most familiar with the structures and contacts within their own countries and, in some cases, also with that of their neighbouring countries. The responsible bodies and institutes, which undertake exposure assessments for acute chemical incidents, vary greatly within the different European countries. Therefore, each project partner was asked to source contact details for professionals in their own country, as well as for neighbouring countries. A spreadsheet was created (not shown in this report, but available electronically) to allow for the entry of suitable contacts and was made available to project partners through the project information platform.

The contact network was subsequently expanded throughout the project by partners, advisory board members and relevant project reports and contacts.

3.4 Summary of initial findings for Member States

3.4.1 EU Member States' civil protection institutions

Main findings:

- The targeted literature review broadly identified responsible organisations and agencies involved in acute chemical incident response.
- It was not possible to draw reliable conclusions based solely upon readily available published information. This report's findings were refined using feedback from the experts in exposure assessment who attended CERACI's international workshops (as part of Task D of the project).
- The results provide a good basis on which to prepare the project survey questionnaire and incorporate suggested notes and questions to be included in the project survey.

[17] INTARESE Environmental Monitoring and Modelling: Data Review. http://www.intarese.org/files/D8%20Data%20Review.pdf

[18] S Bongers (SB) et al, (2008) *Challenges of exposure assessment for health studies in the aftermath of chemical incidents and disasters*, Journal of Exposure Science and Environmental Epidemiology 18, 341–359

The targeted literature review has identified that Member States have a wide range of organisations and coordinating structures involved in exposure assessment for acute chemical incidents. Responsibilities range from establishing emergency plans and strategies to undertaking analytical monitoring, modelling, interpretation and risk assessment, which extend across several organisations, or sub-groups within these organisations.

The exposure matrix has been completed based on published literature for each Member State and broadly identifies key organisations and agencies who undertake exposure assessment. The project literature list can be found in Appendix 5. The results have highlighted a number of good practices within Member State which are provided in the greyed boxes below.

Questions and considerations for Task C Survey Questionnaire:

- *The survey should seek to address areas not covered by published information i.e. where information identifying the responsible organisations, agencies and communication channels relating to exposure assessment in acute chemical incidents could not be identified in the exposure matrix.*
- *The survey should also seek to identify the rationale behind exposure assessments undertaken by each responsible organisation. For example, for what purpose are exposure assessments undertaken: risk assessment, risk characterisation, incident response, fire fighting etc?*
- *What monitoring / analysis equipment is used or commissioned?*
    - o *Is the data used / shared to inform public health risk assessment?*

3.4.1.1 EU Member State Institutional bodies

Within the EU, Member States civil protection is under the responsibility of national governmental administrations. The framework under which it operates varies from country to country depending on which ministry has the lead, for example Ministry of Interior or Ministry of Defence. The detailed operational arrangements vary significantly between agencies and organisations. Brief overviews of Member States' civil protection institutes and ministries, along with bilateral and multilateral agreements, can be found on the Europa.ec DG ECHO (Directorate General for Humanitarian Aid and Civil Protection) website: Humanitarian and Civil Protection Vademecum[19], the International CEP Handbook 2009 published by the Swedish Civil Contingencies Agency[20] and the European Commission Red Cross/European Union Office Project website: Informed, Prepared, Together[21]. However the information provided on all these platforms is inconsistent, in need of updating and with several noted gaps regarding chemical incident exposure assessment, which are addressed in this, and subsequent reports.

[19] EU DG ECHO Vademecum *http://ec.europa.eu/echo/civil_protection/civil/vademecum/menu/2.html*

[20] International CEP Handbook 2009 *http://www.msb.se/en/Products--services/Publications/Publikationer-fran-MSB/International-CEP-Handbook-2009/*

[21] Informed, Prepared, Together Project *http://www.informedprepared.eu/index.aspx*

The European Commission operates the Monitoring and Information Centre (MIC), in Brussels. It provides countries with access to the community civil protection platform whereby any country affected by a major disaster, inside or outside the EU, can request assistance through the MIC. It is available on a 24/7 basis and is staffed by duty officers working on a shift basis. Being at the centre of an emergency relief operation, the MIC acts as a focal point for the exchange of requests and offers of assistance. This helps in cutting down on the 30 participating states' administrative burden in liaising with the affected country. It provides a central forum for participating states to access and share information about the available resources and the assistance offered at any given point in time. The MIC disseminates information on civil protection preparedness and response to participating states as well as a wider audience of interested parties. As part of this role, the MIC disseminates early warning alerts (MIC Daily) on natural disasters and circulates the latest updates on ongoing emergencies and mechanism interventions. The MIC facilitates the provision of European assistance through the Civil Protection Mechanism. This takes place at two levels: at headquarters level, by matching offers of assistance to need; identifying gaps in aid and searching for solutions; facilitating the pooling of common resources where possible; and on the site of the disaster through the appointment of EU field experts, when required[22] (see also Section 9.1)

DG Environment and the Joint Research Centre created the European Forest Fire Information System (EFFIS) in 1998 to support fire fighting services in the Member States and to provide services and Parliament with information on European forest fires and statistics to aid in response[23]. EFFIS conducts scientific and technical research on forest fires and issues annual reports. It also maintains a large database which records the occurrence of fires within Europe. EFFIS is supported by a team of experts from 22 EU Member States that meets regularly[24].

Good Practice examples:

- All Member States have been identified as having emergency management centres, for example:
- Belgium has the General Directorate Crisis Centre
- Bulgaria Ministry of Emergency Situations
- Estonia Rescue and Crisis Management Board
- Netherlands National Crisis Centre
- Romania National Committee for Emergency Situations
- Finland uses voluntary and civilian assistance for incident and crisis management (Civilian Crisis Management), which includes surge capacity voluntary fire fighting and recruitment of local people to perform a specified role in their homes, towns or workplaces.
- Greece has a Directorate for International Relations and Volunteerism, which similarly recruits volunteers to assist local and national government in the event of a major incident.
- The majority of countries have Environmental and Civil cooperation arrangements with other Member States, to be used in the event of major incidents, for example:
- Greece / Turkey Joint Standby Disaster Response Unit (UN agreement).

[22] Monitoring and Information Centre (MIC) http://ec.europa.eu/echo/civil_protection/civil/prote/mic.htm

[23] More information on EFFIS is available at: http://effis.jrc.ec.europa.eu/.

[24] Analysis of Law in the European Union pertaining to Cross-Border Disaster Relief, Annex III Bilateral agreements http://www.ifrc.org/PageFiles/41191/193300-Analysis-of-law-in-EU-EN.pdf

Main findings:

- All Member States have different administrative and governmental organisation, for example:
- A number of countries are split into regions or municipalities for which each has a local government or mayor, who is directly responsible for the organisation of the local services including fire, ambulance, police and environmental health.
- Some countries rely upon the military to provide a response, which could restrict communication between Member States.

Questions and considerations for Task C Survey Questionnaire:

- *At national level some Member States' civil protection responsibilities fall under their Ministry of Defence and as such, their functions are delivered by military personnel. There could be administrative and political implications restricting military personnel crossing Member State's borders to provide exposure monitoring and interoperability assistance.*

3.4.2 Emergency services

3.4.2.1 Fire and rescue services

Main findings:

- The Fire and Rescue Service (FRS) is the primary agency for responding to a chemical incident;
- No European organisation for Fire Services was identified;
- There are no EU-guidelines for exposure assessment for Fire Services;
- Some countries rely upon voluntary fire services: particularly the Red Cross;
- FRS is privatised in some countries;
- FRS is managed at a municipality or regional level in a number of Member States and there is also a reliance on voluntary services; therefore there may be a variability in the capabilities and organisation between service within and between Member States; some examples of fire service arrangements include:
- Spain - has separate brigades in all the municipalities and major cities;
- Austria - relies heavily on the Austrian Red Cross;
- Portugal - uses the Portuguese Red Cross in addition to the National Fire Service;
- Denmark uses two private companies (Frederikssund-Halsnæs and Falck).

Within EU Member States the Fire and Rescue service is the primary agency for responding to a chemical incident, albeit in some countries they may be supported or substituted by specialist or voluntary units. Fire and Rescue services differ across Member States with regard to their alignment under national civil protection functions. For example, within Sweden the Fire and Rescue service is under the Ministry of Defence, whilst in Finland it is under the Ministry of the Interior, in Denmark the Fire and Rescue service is privatised and in the Netherlands the mayor is in charge.

Fire and Rescue services generally carry out on-scene visual observations, although in some Member States they have additional field monitoring capability which is used to characterise the risks from the incident and also provide information to the general public.

Some countries have specialist hazardous materials units (HAZMAT) which can be directly deployed or used in support of local or regional services in responding to chemical incidents and some of these are specifically tasked to perform exposure assessment. These units usually have detection, identification and monitoring (DIM) capability. A number of countries maintain private fire brigades on high risk industrial premises, for example, all French industrial areas have a fire department with a hazardous material response team (HMRT) stationed in that area[25].

Good Practice examples:

The Netherlands has a quick response Hazmat team service (the Environmental Incident Service/Environmental Assessment Module) which was set up to co-ordinate environmental monitoring in major chemical incidents in order to conduct exposure assessment. This service undertakes sampling and testing of material collected by the teams deployed. It has hand-held equipment and analytical (field) laboratory capability. Furthermore, it can model the distribution of hazardous substances. During a chemical incident, this service advises the Fire Service on request on the nature of the pollution, the threat it poses to public health and the environment[26] and the consequences. The Netherlands has a national information centre for Hazmat incidents. This centre provides advice by telephone to the Hazmat advisors of the Fire Service in support of exposure assessment.

A number of examples of fire fighting cooperation arrangements have been identified between Member States, including:

- Greece - SAR (Search and Rescue) Greek / Turkish International Cooperation Section organised with the assistance of the UN to allow for cross-boundary assistance in the event of a major incident.
- Spain created Bomberos Sin Fronteras, which assists in disaster response worldwide.

A number of Member States were identified as having specialist chemically trained fires services, including:

- Austrian Fire Brigade Association Urban Search & Rescue (USAR) CBRN - trained to respond to chemical incidents;
- France HMRT (Hazardous Materials Response Teams);
- UK HAZMAT (Hazardous Materials Officers and Hazardous Environmental Protection Officers);
- Italy CBRN Department within the fire service;
- Netherlands HAZMAT advisors;
- Slovakia – Anti-Gaz Service DIM.

Questions and considerations for Task C Survey Questionnaire

  - *Does your country have national hazmat teams in support of exposure assessment?*
  - *Does your country have information services for Hazmat advisors of the Fire Service in support of exposure assessment?*
  - *What kind of guidelines do these services work with?*
  - *What are the capabilities and outputs of these assessments?*
  - *Who do they share theses outputs with?*
- *The survey should identify the exposure assessment capability within Member States Fire and Rescue service functions. It should seek to determine:*
  - *type of monitoring equipment used;*
  - *output / time zones (as some equipment can produce outputs with timestamps for different time zones);*
  - *criteria / rationale for monitoring (i.e. occupational, public health, incident response);*

[25] GESRET S., (2008) *Hazardous Materials Incident Response in France, lieutenant-colonel and the operation chief of the Moselle Fire and Rescue Service*, Jul 1, Fire Engineering

[26] rivm/organization/mev/imd/running_environmental_accident_service.jsp *www.rivm.nl/en/about*

- *How the rationale for monitoring has been translated in specifications of the output (guidance values?);*
- *Does the capability support a cross-border impact of chemical incidents? If so, in what way?*
- *How is data/information provided to the health risk assessor and which organisation undertakes this role?*

3.4.2.2 Ambulance services

Main findings:

- No European organisation for Ambulance Services was identified.
- No EU guidelines for exposure assessment for Ambulance Services were identified;
- The responsibility for the provision and the funding of ambulance services varies significantly between Member States; in particular it was identified that some ambulance services are privately financed or financed through health insurance; many operated on a local or regional level and a number of Member States rely heavily on voluntary services, particularly provided by the Red Cross. This variability in organisation could result in complications for the management of casualties etc. in the event of cross-boundary incidents. Some examples include:

- Austria – the service is primarily financed by Austrian health insurance companies. Most areas rely upon the Austrian Red Cross.
- Denmark – the service is provided by a single private company (Falck).
- Italy – the service is provided by local hospitals or voluntary organisations (primarily the Italian Red Cross).
- Latvia - rely heavily on the Latvian Red Cross.
- Slovenia – Counties finance the ambulance service primarily through the Health Insurance Institute of Slovenia.
- Spain – the service is operated as part of regional public health services. There are two ambulance service emergency numbers in use in the country.

Within Member States the Ambulance service is usually provided within the national civil protection framework. In some Member States, such as Denmark, the Ambulance service is privatised and in Cyprus there is a combination of regional and private services.

Whilst the Ambulance service generally undertakes on scene health observations, there are a number of Member States who have specially recruited and trained personnel who provide the ambulance response to major incidents involving hazardous materials, or which present hazardous environments. Within the UK these units are known as Hazardous Area Response Teams[27] (HART). There are similar Ambulance teams in Romania (SMURD/SIAMUD[28]).

Good Practice examples:

Specialist chemically trained first responders:

- Organisations / teams comprising ambulance first responder who have been specially trained to respond to incidents where hazardous substances may be present were identified in a number of Member States, for example:

- UK - Hazardous Area Response Teams (HART);
- Belgium – MUG (Mobil Urgence Group) teams;

[27] Hazardous Area Response Teams (HART) http://www.ambulancehart.org.uk/

[28] SMURD http://www.smurd.ro/

- Netherlands - GAGS – public health hazmat advisors;
- Romania – SMURD / SIAMUD specialist units with rescue capability and can deal with hazardous substances.
- Portugal, Spain and France use an international ambulance service coordination organisation called SAMU (in French: Service d'Aide Médicale Urgente[29]).

3.4.2.3 Police services

Main findings:

- No EU-guidelines for exposure assessment for Police were identified.
- Police services are organised differently in each Member State, largely depending upon the local and governmental administrative organisation of the country. For example, resourcing and management of police forces may be undertaken at a municipality, regional, county or national level.

Within the EU Member States, Police services are generally responsible for maintaining civil order and establishing incident cordons. They are usually responsible for issuing and generally implementing any shelter and evacuation advice. Within a number of Member States the Police take a lead role for responding to terrorist related chemical incidents for example UK, Greece and Slovakia.

Good Practice example:

The ATLAS[30] network is an informal cooperation structure between special intervention Police units in the European Union. Although the current primary aim of the ATLAS network is mutual training for counter terrorism to a common standard, the network would be a means of communicating between Police in EU Member States, particularly in the event of an intentional cross-boundary incident.

3.4.2.4 Environment and health institutions

Main findings:

- A wide variation of environmental and health institutions provide risk assessment advice.
- It is unclear which organisations within Member States' health institutions take the lead for exposure assessment.
- Some Member States do not have national environment or public health organisations, which could make communication between public and environmental health professionals difficult, in the event of cross boundary incidents.

The majority of Member States have environmental health or health related institutions, which are able to respond during acute chemical incidents although the detail of such response and provision of risk assessment advice was not clearly identified. A number of health institutions have their own sampling and analytical laboratory capability or access to such facilities through other agencies or private or government supported laboratories. There is however, wide variation of health institutions and capabilities in this area, which could make communication between public and environmental professionals difficult in the event of cross boundary incidents.

[29] SAMU http://www.samu-de-france.fr/en

[30] ATLAS http://www.jamestown.org/programs/gta/single/?tx_ttnews%5Btt_news%5D=1044&tx_ttnews%5BbackPid%5D=182&no_cache=1

There is an informal grouping bringing together the directors of environment protection agencies and similar bodies across Europe. The EPA Network[31] (European Network of the Heads of Environment Protection Agencies) exchanges views and experiences on issues of common interest to organisations involved in the practical day-to-day implementation of environmental policy however there is variation between these bodies relating to their involvement in acute chemical incident response and exposure assessment.

Good Practice examples:

A number of Member States have specialist teams or organisations that provide health risk assessment and risk characterisation advice, based upon collated exposure assessment information, in the event of an incident, for example:

- Netherlands - To ensure timely coordinated scientific and technical advice during the response to an emergency, the Netherlands has established the Policy Support Team for environmental incidents (BOT-mi)[32]. This team, comprising of 8 government institutes and services, advises the local health community, police and fire service during a chemical incident.
- UK – The Centre for Radiation Chemical and Environmental Hazards (CRCE) within the HPA provides advice to members of the public, emergency services, local and national government and health authorities (and to the EU through service contracts provided to DG SANCO).
- Belgium – National Cell Environment and Health /centre for Public Health and Environment undertakes national health impact assessment in the event of disasters.
- Poland – Nofer Institute of Occupational Medicine (NIOM) undertakes health risk assessment in the event of an incident.

Descriptions of the public health research systems and health institutions for European countries can be located in the “Strengthening Engagement in Public Health Research” (STEPS)[33] a project funded by the European Commission Seventh Framework Research Programme, which aims to bring together public organisations and public health researchers for the development of European strategy for public health research. It builds on the country profiles and reports from Ministries of Health and Ministries of Science that were created previously for SPHERE[34] (Strengthening Public Health Research in Europe).

It is important that exposure assessment outputs are able to adequately inform risk assessors. Where Member States use differing standards to compare monitored and/or modelled chemical concentrations, then there is an inherent barrier to cross-border collaboration, risk assessment, and risk communication. The selection of appropriate exposure standards has implications for monitoring (such as the acceptable level of detection of monitoring equipment and sampling timeframes) and for modelling (such as how outputs are presented graphically). Standards must be accepted or ratified by risk assessor organisations and the exposure assessment standards used should be communicated with the assessment.

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[31] EPA Network http://epanet.ew.eea.europa.eu/

[32] www.rijksoverheid.nl/onderwerpen/crises-en-nationale-veiligheid/documenten-en-publicaties/brochures/2010/07/22/folder-nationale-netwerken-voor-crisismanagement.html

[33] Strengthening Engagement in Public Health Research Project www.steps-ph.eu

[34] SPHERE http://www.ucl.ac.uk/public-health/sphere/sphereprofiles

It is unclear if and which organisations within Member States' health institutions take the lead for exposure assessment and risk characterisation during acute chemical incidents or what guidance or trigger values they use during decision making. Öberg *et al*[35] noted that, during emergencies, there is an urgent need for responsible agencies to quickly decide which actions to take; in such situations, Acute Exposure Reference Values (AERVs) have been useful. However, these values are developed for once-in-a-lifetime, short term exposure to airborne substances. Being based on toxicological health risk assessments, the guidance values give a rapid indication of potential health consequences of specific chemical exposures in the population. At present, several sets of acute guidance values are available in the global arena. However, there is no internationally accepted set of values and comparative analyses of the alternative AERVs are absent. The FP7-funded iNTegRisk (Early Recognition, Monitoring and Integrated Management of Emerging, New Technology Related Risks) and FP6-funded INTERASE projects, previously highlighted in this report, have focussed on this area in detail.

Questions and considerations for Task C Survey Questionnaire

- *When exposure assessment is performed are the sampling/analytical procedures adjusted to be appropriate to guidance values? If so, to what guidance levels?*

A number of Member States have dedicated chemical and poisons advisory services that provide chemical risk assessment and advice during chemical incidents. The Alerting System for Chemical Health Threats (ASHT phase I and II) projects[36] considered the feasibility of using poisons centres across Europe as a front line resource to detect sentinel events and to harmonise case reports, thereby acting as a syndromic surveillance system to monitor covert deliberate release of chemicals; and also to develop an alerting system whereby EU Member States can be notified of the possibility of a deliberate chemical threat. There is overlap between the response to chemical poisonings and the response to acute chemical incidents in terms of the organisations responsible for health risk assessment; sources of expert chemical advice; and interaction and liaison between health organisations, first responders, and government. The concept is the development of a rapid alerting system for chemical threats (RAS-CHEM (Rapid Alerting System for Chemical Health Threats)) (see also Appendix 2).

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[35] Öberg M. et al, (2010) *Discrepancy among acute guideline levels for emergency response*, Journal of Hazardous Materials, 2010.08.054 *www.elsevier.com/locate/jhazmat*

[36] Development of an Alerting System for Chemical Health Threats (ASHT), Phase I. *www.hpa.org.uk*

3.4.3 Meteorological chemical models

Main findings:

- A number of international meteorological organisations have been identified across Member States that provide meteorological services during acute chemical incidents.
- A number of chemical models used by Fire and Rescue services have been identified across Member States.

On scene observations undertaken by the Fire and Rescue services may be supported with modelling information from meteorological or chemical models provided by meteorological agencies. The iNTeg-Risk project survey report (in draft) has identified a number of chemical models used by Fire and Rescue services across Member States[37] such as the ALOHA (Areal Locations of Hazardous Atmospheres) chemical model provided by US EPA[38] (United States Environmental Protection Agency), which has also been noted in the survey results of Task C.

In Bulgaria the Aerospace Monitoring Centre has installed the country's first software system for locating fires based on satellite data in near real time; automatically detecting fires; the information is distributed by e-mail. Detected fires are accompanied by precise geographical coordinates, information about the affected area, and the intensity of the fire. The software can graphically present data on atmospheric pressure, direction and wind speed and is able to integrate data from numerical models for weather forecasting[39].

Good Practice examples:

A number of international meteorological organisations have been identified:

- The Network of European Meteorological Services, Economic Interest Group (EUMETNET EIG) - comprises 26 European national meteorological services with the aim to become more efficient in delivering meteorological services in Europe by sharing costs and knowledge and by pooling resources.
- World Meteorological Organisation (WMO) – specialist agency of the United Nations, comprising 189 Member States. Its role includes facilitating worldwide co-operation in the establishment and maintenance of observation networks and promoting the establishment and maintenance of systems for the rapid exchange of meteorological and related information.
- Volcanic Ash Advisory Centres (VAAC) - Nine Volcanic Ash Advisory Centres around the world are responsible for advising international aviation of the location and movement of clouds of volcanic ash; but they also communicate with public health organisations as required.
- European Forest Fire Information System (EFFIS) supports the services in charge of the protection of forests against fires in EU countries and provides the European Commission services and the European Parliament with updated and reliable information on wild fires in Europe.

A number of specialist environmental meteorological sections and organisations have been identified within Member States, whom have the capability to examine the transport and deposition of pollutants, including:

- Austria - Department of Environmental Meteorology.
- UK – Environmental Monitoring and Response Centre (EMARC).
- Bulgaria - Emergency Response System (BERS).
- Romania - SIMIN - Integrated Meteorological Information System.

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37 iNTeg-Risk http://www.integrisk.eu-vri.eu/

38 ALOHA http://www.epa.gov/emergencies/content/cameo/index.htm

39 Antoanetta Fratzova (AF) et al, *Aerospace Monitoring Center at the Civil Protection* Directorate General, Ministry of Interior, Sofia, BULGARIA

- A number of countries have satellite software systems for automatic detection of forest fires, for example the Bulgaria Aerospace Monitoring Centre.

3.4.3.1 Field monitoring

Main findings:

The agencies who undertake field monitoring vary considerably between different Member States; this could suggest that there may be restrictions on the use and comparability of field technique and results, in the event of cross-boundary exposure assessment. Some examples of organisations who undertake field monitoring (often in addition to the Fire and Rescue Service) include:

- Czech Republic - Regional Environmental Inspectorates under the Ministry of the Environment.
- UK - Environment Agency under national Air Quality Cell (AQC) arrangements for certain major chemical indents.
- Hungary - specialist teams (VFSZ and VFCS) under the Directorate General for Disaster Management.
- Italy - UORECI (Operational research unit for emergencies in industrial chemistry) and CONPRICI (National consortium for the protection of industrial chemical risks).
- Poland - Voivodship Inspectorates for Environmental Protection (WIOS).
- Slovakia - District and Regional Offices of Slovak Environmental Inspection and Nuclear, chemical and biological protection corps.

Field monitoring or field laboratories have been identified in a number of Member States. They are typically linked to emergency services, military or specialist chemical response units. The agencies who undertake field monitoring vary considerably between different Member States which could suggest that there may be restrictions on the use and comparability of field techniques and results in the event of cross-boundary exposure assessment.

Good Practice examples:

- All Member States have been identified as maintaining fixed air quality monitoring stations. However, it has not been possible to ascertain the number, spread or capabilities of these stations for the majority of Member States.
- Most Member States have been identified as having a capability within their Fire and Rescue Services to undertake analysis at the scene of an incident, using Detection, Identification and Monitoring (DIM) equipment.
- In Sweden and the Netherlands mobile field laboratories are used both domestically and internationally. They respond as required in the event of major accidents and disasters and in humanitarian operations. They are intended to be placed near the accident area, where they can receive samples for rapid chemical analysis.

Questions and considerations for Task C Survey Questionnaire:

- *Does your country have mobile laboratories?*
- *Which organisations support these or coordinate their deployment?*
- *What is the deployment strategy and expected data?*
- *Do their functions support exposure assessment for public health? If so, in what way?*
- *Do their functions support a cross-border impact of chemical incidents? If so, in what way?*

3.4.3.2 Analytical laboratories

Most Member States have nationally recognised reference laboratories with the capability of analysing chemical samples and testing for chemical contamination in defined matrices, (e.g. air, water, food, soil). A number of Member States have laboratories with direct access to emergency services or national civil responders to provide laboratory services during a major chemical incident. For example within the UK the Health & Safety Laboratory (HSL) undertakes risk characterisation and civil response decisions for high impact and cross-border incidents. HSL can undertake laboratory analysis for speciation and identification of chemicals.

Questions and considerations for Task C Survey Questionnaire

- *Does your country have national laboratory network dedicated to respond to chemical incidents?*
- *Which organisations support these or coordinate their operation?*
- *How do these support operational incident response?*
- *Do their functions support exposure assessment for public health? If so, in what way?*
- *Do their functions support a cross-border impact of chemical incidents? If so, in what way?*

Projects such as the NORMAN[40] project (Now established as a permanent self-sustaining network – see Appendix 2) and the SLAM projct, to harmonise Member State laboratory approaches to CBRN materials, are important in developing standardised approaches to monitoring and analyses. It aims to improve the exchange of information and data on emerging environmental contaminants between monitoring institutes, research centres and end-users (modelling experts, risk assessors and risk managers). It encourages the validation and harmonisation of common measurement methods and monitoring tools so that the demands of risk assessors and risk managers can be better met.

Such a network should facilitate the production of good quality data on emerging substances which are comparable across Europe, thus providing the basis for further identification of newly emerging pollutants and assessment of their potential risks to humans and ecosystems.

A number of Member State laboratory capabilities are linked to environmental protection agencies that undertake sampling and analysis of air, water, land or food primarily for pollution and regulatory purposes.

Good Practice examples:

- All Member States have national reference laboratories, the majority of which are maintained by the relevant Environment Agency or governmental Department of Environment.
- National centres providing advice on poisons have been identified in the majority of Member States. These centres are generally accessible by health services and public health professionals.

[40] NORMAN project *http://www.norman-network.net/index_php.php*

3.4.3.3 Geographical information systems

Little evidence was found of the formal use of Geographical Information Systems (GIS) by Member States when responding to acute chemical incidents. The main users of GIS systems appear to be meteorological agencies. In addition GIS systems have also been identified as being used for exposure assessment in support of risk characterisation, specifically to identify and plot vulnerable receptors (i.e. susceptible populations and facilities) and hazard locations.

Good Practice examples:

The Environmental Hazards and Emergencies Department (EHE) of the HPA in the UK uses ArcGIS to produce mapping to assist risk characterisation, through identification of sensitive receptors in relation to the acute hazard. The GIS is also used to plot Met Office predictions of plume movement.

Other identified examples of GIS use include:

- Czech Republic – Central Data Warehouse (GIS) operated by the Population Protection Institute.
- Poland - NIOM Geodesy and Cartography system (GUGIK).
- Slovakia - Central GIS comprising the Environmental Information System (EIS), Monitoring IS (MIS), Territory IS (TIS).

3.5 Summary sheets for selective Member States

It was envisaged that the exposure spreadsheet would provide a preliminary understanding of exposure monitoring capability, capacity and organisation within Member States for health risk assessment in acute chemical incidents. However, the matrix was not designed to fully address the responsibility of each organisation and agency involved in exposure assessment, nor does it present the flow of information between responsible organisations, since such information is not available from a literature search.

Summary sheets were created to provide more detailed information relating to each responsible institution within a selected number of Member States, where information was well understood. It was proposed that presenting information for a few well understood Member States could inform the construction of appropriate questions for the Task C survey in order to seek similar information from Member States less well understood. Detailed summary sheets were produced for the following Member States: United Kingdom, Ireland, Poland, the Netherlands and Bulgaria (see Appendix 4). Bulgaria was provided as an example of typical information found using the 'Exposure assessment and risk characterisation matrix' where there was no prior knowledge of the country and information was sourced exclusively from the literature review.

3.6 Assess existing cross-border operational collaboration agreements.

Main findings:

- There are a number of overarching European cross-border initiatives and arrangements being administrated at national level within Member States; including the exchange of scientific and technical information, training, common research, logistical support and exchange of relevant data on a regular basis.
- From 27 EU Member States, 23 are party to at least one bilateral or multilateral agreement on mutual assistance in civil protection or disaster and accident operations on EU territory.
- Bilateral and multilateral agreements range from general declarations to more detailed treaties.

A targeted literature review was undertaken to explore cross-border operational agreements throughout the EU and Member States. There are a number of overarching European cross-border initiatives and arrangements being administrated at national level within Member States. A list of initiatives and arrangement are presented in Section 9.1. It includes the exchange of scientific and technical information and relevant data on a regular basis; logistical support through equipment or personnel; common research programmes; and training of experts, in order to set up common programmes on civil protection and disaster management. A number of bilateral and multilateral agreements for each Member State are listed on the Europa.ec DG ECHO website: Humanitarian and Civil Protection Vademecum webpage[41].

The International Federation of Red Cross and Red Crescent (IFRC) Societies of Austria, Bulgaria, France, Germany, the Netherlands and the United Kingdom have commissioned a report on the Analysis of Law in the European Union pertaining to Cross-Border Disaster Relief[42]. It is one element of a broader project being undertaken by the International Federation to study EU and Member States' regulations for cross-border disaster assistance within Europe. In this report, a broad overview of the treaties that were publicly available and accessible to the researchers is presented.

From 27 EU Member States, 23 were found to be party to at least one bilateral or multilateral agreement on mutual assistance in civil protection or disaster and accident operations on EU territory. Exceptions are Cyprus, Malta[43], Ireland and the United Kingdom. The post Cold War era has resulted in several bilateral disaster relief agreements in Central and Eastern Europe. Austria, Belgium, France and Germany have concluded agreements with all their European neighbours.

The IFRC research covered 33 bilateral agreements concluded between 1973 and 2002. The instruments range from general declarations on good neighbourly relations training and data exchange; to detailed treaties regulating the crossing of common borders of personnel and material, data protection, exemption of taxes and customs duties and the repatriation of evacuees. Most of them regulate the compensation of costs as well as death, injury and damage claims[44]. The report provides a summary of the agreements and appends them in an annex at the end of the report[45]. This report provides an index of bilateral agreements across all Member States and is complementary to the DG ECHO

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41 EU DG ECHO Vademecum http://ec.europa.eu/echo/civil_protection/civil/vademecum/menu/2.html

42 International Federation of Red Cross and Red Crescent Societies http://www.ifrc.org/PageFiles/41191/193300-Analysis-of-law-in-EU-EN.pdf

43 Cyprus and Malta are part of the Co-operation group for the Prevention of, Protection Against, and Organisation of Relief in Major Natural and Technological Disasters of the European Council (status as of 24 June 2009), see www.conventions.coe.int ; see also Council of Europe Resolution (87)2 as of 20 March 1987.

44 Bochum University for the IFRC, 'A Preliminary Overview and Analysis of Existing Treaty Law: Summary of the report conducted by Professor Horst Fischer', January 2003, http://www.ifrc.org/docs/pubs/disasters/idrl_lawtreaty.pdf.

45 Analysis of Law in the European Union pertaining to Cross-Border Disaster Relief, Annex III Bilateral agreements http://www.ifrc.org/PageFiles/41191/193300-Analysis-of-law-in-EU-EN.pdf

Humanitarian and Civil Protection Vademecum site.

Questions and considerations for Task C Survey Questionnaire

- *It is important that the survey for Task C seeks to identify the relevant aspects of bilateral, multilateral agreements which will inform the main objectives of the project.*

The Organisation for Economic Co-operation and Development (OECD) meets with the European Commission to co-ordinate and harmonise policies, discuss issues of mutual interest, and to work together to respond to international concerns. They have produced guidance which addresses a number of issues concerning the relationship between different countries including, for example, cross-border co-operation relating to hazardous installations near boundaries, as well as bilateral and multilateral assistance concerning chemical accident prevention, preparedness and response and as such should provide a useful reference to the CERACI project[46].

Good practice example:

- The Organisation for Economic Co-operation and Development (OECD) have produced guidance which addresses a number of issues concerning the relationship between different countries including, for example, cross-border co-operation relating to hazardous installations near boundaries. Relevant areas should be considered in subsequent tasks.

3.7 Identify key chemicals and incident scenarios

Key exemplar scenarios were selected and included in the project strategy document. The CERACI project's Advisory Board agreed that, because of their rapid impacts and ability to affect a wide geographic area, the initial focus should be on a major air quality incident for the workshops (to be held as part of CERACI's Task D), whilst not neglecting water, land and food in the survey questions within Task C.

3.7.1 The European Union Network for the Implementation and Enforcement of Environmental Law (IMPEL)[47]

IMPEL is an international non-profit association of the environmental authorities of the EU Member States, acceding and candidate countries of the European Union and EEA (European Economic Area) countries. The core of the IMPEL activities concerns awareness raising, capacity building and exchange of information and experiences on: implementation, enforcement and international enforcement collaboration; as well as promoting and supporting the practicability and enforceability of European environmental legislation. Projects within the IMPEL annual programme are co-financed by the European Commission. The collection of the accidents which include: accidents in refineries; a major release of oil in a tank farm in Ambes in 2007 in France; a major mercury release in Belgium in 2008; a fire at an ethylene pipeline and a nearby acrylonitrile tank in Germany in 2008; a fire and explosion of ammonia synthesis gas in 2006 in the UK; transboundary pollution in Latvia; and leakage of a hydrogen-pipeline in the Netherlands.

[46] The Organisation for Economic Co-operation and Development (OECD) http://www.oecd.org/dataoecd/10/37/2789820.pdf

[47] The European Union Network for the Implementation and Enforcement of Environmental Law http://impel.eu/

Their analysis is necessary in order to minimise recurrence. A final project report on lessons learnt from a collection of industrial accidents presents what actually happened and what measures were finally taken in such situations. The report provides lessons learnt from real scenario data and examples which could be adopted for the project workshops[48].

3.8 Key success factors for exposure assessment

In considering key success factors for exposure assessment, public health risk assessors would need the following information listed in Appendix 6 available in a timely manner. The WHO Human Health Risk Assessment Toolkit: Chemical Hazards also considers the criteria required for undertaking appropriate exposure assessments and presents a generic road map for use in the exposure assessment process[49].

The summary of information which will inform a successful exposure assessment and ultimately risk characterisation was used to inform subsequent project tasks.

[48] Project report - Lessons learnt from Industrial Accidents (IV) *http://impel.eu/projects/lessons-learnt-from-industrial-accidents-2009*

[49] WHO Human Health Risk Assessment Toolkit: Chemical Hazards *http://www.who.int/ipcs/publications/methods/harmonization/toolkit.pdf*

4 Conclusions

This report is the first phase of the CERACI project, and was primarily intended to gather preliminary information to inform further research, to be undertaken by subsequent CERACI tasks. European Commission project databases were searched to identify projects relevant to exposure assessment in chemical incidents. Of principal interest were current guidelines and tools and practices for exposure assessment in acute chemical incidents – specifically those related to environmental modelling and monitoring (sampling and analysis) for health risk assessment. Work undertaken by existing projects overlaps with CERACI's focus on exposure assessment, yet there is no existing work focussing specifically on exposure assessment and exposure assessment collaboration between organisations or Member States during acute incidents. Likewise, although existing projects have provided a number of useful contacts, there is no one master list of Member State organisations and contacts in the field of acute exposure assessment. This demonstrates a gap in the available information. Relevant projects are summarised, and used to inform and direct subsequent project tasks (Tasks C-E).

The literature review, which was refined by experts in exposure assessment who attended international workshops held as part of CERACI's Task D, identifies exposure monitoring capacity and key organisations involved during the acute phase of chemical incidents for public health risk assessment purposes in the Member States. Good practices, and barriers to good practice, in exposure assessment and cross-border collaboration are identified. Further questions are raised, to be addressed by the subsequent survey of Member State experts in CERACI's Task C. Key chemicals and incident scenarios and resources were identified to inform later tasks. Subsequent task reports will explore whether harmonisation and collaboration in this field has the potential to improve EU response capabilities and capacities to respond to acute chemical health threats.

This report summarises examples of Member States which have organised collaboration and interoperability on environmental modelling and monitoring for health risk assessment nationally and across national borders. Full identification and characterisation of the information exchange between the various responsible agencies during chemical incidents was not available in the literature, but was available from the experts from each Member State. The results of this review provide a good basis on which the project survey questionnaire can be constructed and provides suggested questions and considerations to be included in the Task C survey.

A range of EU initiatives, arrangements and cross-border agreements are highlighted throughout the report, which provide suitable reference material to be expanded within subsequent CERACI work programme tasks.

Through the compilation of this report and utilising existing project partner contacts a network of experts on exposure assessment was formed which was expanded in later project phases, and has been used to validate the information within this report.

This report completes the project strategy objectives for Task B (literature review) and is used to inform the subsequent project tasks.

5 Appendix 1

5.1 Exemplar input criteria used to populate the UK Exposure Assessment and Risk Characterisation matrix template.

Source

Qualitative (e.g. Identification)

- Typically the operator will identify a release and activate Seveso plans, contact Health and Safety Executive / Environment Agency and inform other listed agencies.
- Otherwise: Hazmat teams can identify the material at source using FTIR (Fourier transform infrared spectroscopy) or GC-MS (Gas Chromatography–Mass Spectrometry) etc.
- Other information from: release appearance and dispersion (air or water), effects noted by Emergency services, calls to National Health Service direct.
- Operator for source term - release flux (release per unit time) and duration estimation for release.
- Fire Service for estimation of burn rate / source term.

Quantification:

- Environment Agency or Health and Safety Laboratories analyse for releases to water or air and produce a better model of source term.
- To support Air Quality Cells (AQC) the Environment Agency can deploy continuous monitoring capability for releases to air at sensitive receptor locations (i.e. schools, hospitals, nursing homes) - typical deployment is 6 hours - for monitoring of particulate matter (Osiris) and gaseous substances by FTIR[50].
- Nationally maintained Automatic Urban Real-time Network (AURN) stations for monitoring ambient air quality at fixed locations (often for road / city centre) if relevant - typically particulate matter (PM_{10}), sulphur dioxide (SO_2), nitrogen dioxide (NO_2) and occasionally volatile organic compounds (VOCs). Local authorities may also have their own air monitoring equipment.
- Primary Care Trusts (PCT) reports of health effects reported to National Health Service Direct (NHSD) and ambulance services.

Pathway

Qualification:

- Local authority (via air quality monitoring stations AURN) or others on scene might make observations of pathway.

[50] Quantitech Air Quality Cell Instrumentation http://www.quantitech.co.uk/entity162-Quantitech-Instruments-Chosen-for-new-Multi-Agency-Air-quality-unit-.aspx

Quantification:

- Dispersion modelling via CHEMET (Chemical Meteorology) service from UK Met Office EMARC.
- Environment Agency may undertake analysis of chemicals along pathways.

Receptor

Identification of those at risk:

- Initial emergency services establishment of cordons and shelter areas.
- Use of emergency plans and local knowledge to identify affected populations and infrastructure.
- Local Authority and Health Protection Agency use of Geographical Information Systems (GIS) to identify affected populations and infrastructure.
- PCT reports of health effects reported to NHS direct and Ambulance services.

Risk Characterisation

- Science and Technical Advice Cell (STAC) to coordinate a scientific response including public health to overall incident command.
- Air Quality Cell (AQC) coordinates and provides an agreed assessment for STAC of air borne release potential impacts.

Risk Communication

- Risk communication to responders or receptors.

6 Appendix 2

6.1 Relevant projects

6.1.1 EU Seventh Framework Programme

6.1.1.1 Coordination of national environment and health research programmes - environment and health (ERA-NET)[51]

6.1.1.1.1 Project description

Ongoing: September 2008 – September 2012

"It is estimated that around 20% of the burden of disease in industrialised countries can be attributed to environmental factors, and the magnitude of the problem is perceived by the majority of Europeans. The assessment of health impacts is based mostly on scarce exposure data and limited information on the relationship between exposure and health. There is, therefore, a need to strengthen research in this area and to develop methods and tools which will improve the comparability of data. Member States have developed skills and expertise using different mechanisms to fund environment and health research.

The scientific boundaries created by the remits of different funding organisations have frequently acted as a disincentive to collaborative working. Although aims are towards relevance and efficiency, the results remain dispersed and not of actual support for policy-making. Therefore, results of the studies in ERA-ENVHEALTH will lead to the proposal of a coherent set of proposed priorities, implementation of joint activities, and common calls. ERA-ENVHEALTH, by bringing together 16 participants from 10 countries, will contribute to establish collaboration among the different funding organisations of environmental and public health research communities."

6.1.1.1.2 Relevance

The ERA-ENVHEALTH Research Database[52] contains details of current and past funding programmes in Europe. Albeit not an exhaustive review of environment and health research in Europe, the database provides a source of material for environment and health scientists and policy-makers to access data on current environment and health research projects, identify potential research partners and modes of specialist expertise. The database provides Member State contacts in the areas of environmental protection and air quality.

6.1.1.2 Emergency Support System (ESS) [53]

6.1.1.2.1 Project description

Ongoing: June 2009 – May 2013

"The Emergency Support System (ESS) is a suite of real-time data-centric technologies which will provide actionable information to crisis managers during abnormal events. This

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[51] ERA-ENVHEALTH. http://www.era-envhealth.eu/servlet/KBaseShow?sort=-1&cid=23174&m=3&catid=23175

[52] ERA-ENVHEALTH Research Database. http://era-envhealth.stis.belspo.be/

[53] The Emergency Support System. http://www.ess-project.eu/

information will enable improved control and management, resulting in real-time synchronisation between forces on the ground (police, rescue, fire fighters etc) and out-of-theatre command and control centres (C&C). The approach guiding the ESS project is based on the fusion of variable forms of field-derived data within a central system which will then provide information analysis and decision support applications at designated C&C locations.

To do this, ESS will achieve the following objectives:

- Improvement of front end data collection technologies (radioactivity, bio-chemical, audio-visual, etc.) installed both on portable and fixed platforms, providing a flexible yet comprehensive coverage of the affected area;
- this data will then be fused and analyzed to provide real-time decision support;
- ESS will make these resources readily available to commanders through the use of easily accessible web-portals.

Thus, ESS will minimise the uncertainty that characterises crisis events, thereby limiting their scope. The ESS will then be field tested at three different scenarios, including a stadium evacuation, a forest fire and toxic waste dump accidents.

The ESS consortium consists of 19 partners that will bring together a wide spectrum of European SMEs (Small-Medium Enterprises), industrial and academic partners from a variety of fields, ranging from sensor design and electronic communications to civil protection. The resulting cooperation will help provide an added measure of security to European citizens. Crisis situations are characterised by partial information according to which commanders need to make life and death decisions. By helping decision makers make decisions based on better and more complete data, ESS will help limit the scope of crises, ultimately saving precious lives."

6.1.1.2.2 Relevance

This project is included as an example of a decision support project that will have implications for the management of, and response to, acute chemical incidents. It includes a work package on sensors (including chemical sensors), illustrating the relevance of monitoring and exposure assessment. Information provided through systems such as this can facilitate improved control and management, with real-time synchronisation between forces on the ground (police, rescue, fire-fighters) and out-of-theatre command and control centres. This has the potential to improve collaboration and interoperability at the local and international scales.

6.1.1.3 Services and applications for emergency response (SAFER) [54]

6.1.1.3.1 Project description

Ongoing: 2008 onwards

"SAFER aims at implementing preoperational versions of the Emergency Response Core Service. SAFER will reinforce European capacity to respond to emergency situations: fires, floods, earthquakes, volcanic eruptions, landslides, humanitarian crisis. The main

[54] SAFER. http://safer.emergencyresponse.eu/site/FO/scripts/myFO_accueil.php?lang=EN

goal is the upgrade of the core service and the validation of its performance with 2 priorities: First priority is the short term improvement of response when crisis occurs, with the rapid mapping capacity after disastrous events, including the relevant preparatory services (reference maps). For validation purposes, the project will deliver as from 2008 services at full scale for real events or during specific exercises.

The main performance criterion is the response time. RTD work addresses technical, operational and organisational issues. The content of this first action is consistent with the definition of the preparatory action recently decided. The second priority is the extension to core service components before and after the crisis. It targets the longer term service evolution, through the provision of thematic products, to be added in the portfolio of services. The main performance criterion is the added-value of products with risk-specific information. In SAFER, thematic products will cover mainly the meteorological and geophysical risks. SAFER includes also some transverse RDT actions, with the objective to increase added-value of the overall service chain.

Users' involvement is a key driver and a specific task addresses the federation of the key users, both for interventions in Europe and outside Europe. The emphasis put on quality assurance and validation methodology is reflected in the work plan. The consortium is built around a core team of European service providers, already involved in the former or ongoing projects, in the frame of FP6 or ESA programmes. A wide network of scientific partners and service providers will extend the European dimension, in particular in the new Member States."

6.1.1.3.2 Relevance

One aspect of the SAFER project of particular interest is the provision of thematic products during incidents, including those dealing with meteorological risks. This is potentially of use to organisations that carry out modelling of chemical releases. The latest events featured on the project website include fires in the Netherlands, Belgium, and Bulgaria and recent activations include a number of flood events.

6.1.1.4 Survey on European methodologies in the risk assessment of chemical exposures in emergency response situations (iNTeg-Risk)

6.1.1.4.1 Project description

Ongoing: December 2008 – May 2013

"Objective: iNTeg-Risk[55] is a large-scale integrating project aimed at improving the management of emerging risks in the innovative industry. This will be achieved by building a new risk management paradigm for emerging risks, which is a set of principles supported by a common language, commonly agreed tools & methods and Key Performance Indicators integrated into a single framework. As main impact, it will reduce time-to-market for the lead market EU technologies and promote safety, security, environmental friendliness and social responsibility as a trade-mark of the advanced EU technologies.

[55] iNTeg-Risk. *http://www.integrisk.eu-vri.eu/*

The project will improve early recognition and monitoring of emerging risks, seek to reduce accidents caused by them (estimated 75 billion €/year EU27) and decrease reaction times if major accidents involving emerging risks happen. iNTeg-risk will reach its goals by promoting an EU-wide cross-sectorial life-cycle-based integration across all major disciplines, methods and tools as well as through integration of all relevant stakeholders. The project will be initiated from an empirical basis of 17 individual emerging risk issues (Emerging Risk Representative industrial Applications), and generalise their solutions addressing new technologies, products/materials, production and policies.

The solutions will be validated in a second application cycle, and the overall solution made available to stakeholders in the form of the iNTeg-Risk platform: a one-stop shop for EU solutions addressing emerging risks. It will feature issues of early recognition and monitoring of emerging risks, communication, governance, pre-standardisation, education & training, dissemination, as well as new tools such as Safetypedia, Atlas of Emerging Risks and Reference Library. The project has a solid industry leadership and involves the leading EU R&D institutions. It is coordinated by the European Virtual Institute for Integrated Risk Management, the EEIG guaranteeing the sustainability of the results after the project."

6.1.1.4.2 Relevance

The iNTeg-Risk project has a broad remit and aims to coordinate research and development to improve the management of emerging risks related to new materials and technologies (such as nanotechnology, industrial hazards triggered by natural accidents, carbon dioxide storage and capture). Under the auspices of the project a report has been prepared that explores the use of exposure and dispersion models and exposure measuring devices available to Member States during acute incidents (Survey on European methodologies in the risk assessment of chemical exposures in emergency response situations, Heinälä *et al* 2011, awaiting publication) and this aspect is entirely relevant to CERACI. Whilst the report is still draft it is noted that it found that there appeared to be no harmonised approach as to which methods and models should be used in given situations. The required accuracy, chemical specificity, and portability may play a role in selection of monitoring and modelling.

6.1.2 EU Sixth Framework Programme

6.1.2.1 Network of reference laboratories and related organisations for monitoring and bio-monitoring of emerging environmental pollutants (NORMAN) [56]

6.1.2.1.1 Project description

Completed. September 2005 – November 2008. Now established as a permanent self-sustaining network.

"NORMAN co-ordination action will develop and implement a methodology within a network of reference laboratories and related organisations (including standardisation bodies) to enable and improve EU capabilities for monitoring emerging pollutants,

[56] NORMAN. http://www.norman-network.net/index_php.php

thereby ensuring the production of data that are valid, comparable and fit for purpose across EU25.

The project will align the activities of the network with the requirements of organisations / stakeholders in charge of risk assessment and management. It will organise, via workshops, the EU-wide exchange of information between monitoring experts, environmental agencies and standardisation and regulatory bodies. NORMAN will facilitate access to existing data / information from research programmes by developing a database of:

- leading European experts, organisations and projects dealing with emerging pollutants;
- geo-referenced monitoring data;
- mass spectrometric information on provisionally identified and unknown substances.

Particular effort will be made to enable the final user to interpret the data and judge their representativeness, quality and comparability. Moreover, protocols for validation, harmonisation and dissemination of chemical and biological monitoring methods (including sampling methodology) will be provided. These protocols will be developed into technical guidelines / reports (e.g. CEN TR).

To test these protocols and the ability of the network to meet EU demands for monitoring emerging pollutants, three case studies will be undertaken, involving partners from a wide selection of Member States, including New Member States. This will enable benchmarking of the competencies and expertise and foster the transfer of knowledge and techniques. The final goal of the project is the implementation of a network operating after the end of the project. The organisation of the follow-up of the network will therefore be one of the main tasks of the project."

6.1.2.1.2 Relevance

The NORMAN project maintains a database of contacts and relevant research[57]. The project focuses on emerging substances (i.e. those for which no standardised guidelines may exist), yet NORMAN project stakeholders are relevant contacts as they represent organisations that are responsible for risk assessment and management. The NORMAN European network of reference laboratories can be used as a contact point to obtain further information regarding Member States monitoring capabilities. One of the network's aims is to promote consistent practice across Member States and harmonised standards and guidelines propagated through the network are relevant when considering European practice in exposure assessment.

6.1.2.2 Contamination in drinking water distribution systems: Consumer exposure risks and source identification (COCERSI)

6.1.2.2.1 Project description

Completed. April 2005 – April 2007.

[57] NORMAN databases. http://www.norman-network.net/index_php.php?module=public/databases/databasex&menu2=public/databases/databases

“There is a growing debate among research and practice communities on adequate strategies that reduce consumer exposure to accidental microbial contaminations or deliberate attacks in drinking water distribution systems (DWDS). To limit the spread of disease in a contamination event, effective strategies are multi-barrier approaches that include prevention, detection, mitigation and source elimination.

Typically, early public health protection relies on the passive efficacy of a disinfectant residual. However, little is known on its real ability to successfully inactivate intruding pathogens in the DWDS before water reaches consumers. A second barrier is provided by rapid and adequate response to emergency scenarios.

To this aim, an automatic sensor system to continuously monitor water quality in DWDS would be very important as an early detection system and for contamination source location identification to eliminate or isolate the source problems. First preliminary objective is the development of a general method that, through the use of water quality modelling, systematically and quantitatively measures the ability of a particular system operation design to reduce consumer exposure to hazardous contaminations in DWDS.

Second objective is to explicitly use the vulnerability assessment scheme to compare and select alternative system operation designs that may preventively provide an improved barrier to protect consumers until a contamination event is detected and consequent action is taken. This scheme will al so allow for the evaluation of adequate mitigation strategies to be adopted once water quality problems have been detected.

Finally, a methodology and tool set will be developed to identify the optimal sensor layout that, from the one hand reduces consumer exposure risks to contaminations and from the other hand is able to provide valuable information to identify, at least statistically, network zones that may be the cause of water quality problems.”

6.1.2.2.2 Relevance

This project is included as an example of one of the many EU-funded sensor projects that have implications for exposure assessment and the management of, and response to, acute chemical incidents.

6.1.2.3 Integrated Assessment of Health Risks from Environmental Stressors in Europe (INTARESE)[58]

6.1.2.3.1 Project description

Completed November 2005 – January 2011.

“This study is designed to support implementation of the European Environment and Health Action Plan, by providing the methods and tools that are essential to enable integrated assessment of environmental health risks. Drawing upon the large range of studies carried out in Europe over recent years (many led by the study partners) and the advances made in specific areas of toxicology and epidemiology (especially air pollution), and in close collaboration with users, it will develop a methodological framework and set

[58] INTARESE. http://www.intarese.org/

of tools and indicators for integrated assessment that can be applied across different environmental stressors (including pollutants and physical hazards), exposure pathways (air, water, soil, food) and policy areas.

It will review, bring together and enhance the monitoring systems needed to support such analyses, including routine environmental monitoring (ground-based and Earth observation), biomonitoring and health surveillance. The framework, tools and data will be tested and demonstrated through integrated assessments of exposures and health risks in a number of specific policy areas, including transport, housing, agriculture, water, wastes, household chemicals and climate. Results from these will be used both to refine the assessment methods and to provide specific information on health implications of current, and potential future, policies.

Based on the results, a toolbox for integrated environmental health risk assessment will be developed, which will be further tested and demonstrated through a series of higher-level policy analyses. Particular attention will be given throughout to issues of uncertainty, sensitive or susceptible groups, and possible interactive and cumulative effects of different stressors. Deliverables will include new, integrated methods and indicators for environmental health risk assessment and monitoring, an operational assessment toolbox, and a set of validated assessments that can directly inform policy."

6.1.2.3.2 Relevance

The INTERASE project is primarily focussed on environmental policy and the overarching European perspective (rather than providing information regarding individual Member States). However, it includes pertinent reviews of monitoring and modelling data-sources[59]. European and International information sources are listed and gaps are discussed. Of particular relevance are the reviews of: climate and meteorology, air, water, chemicals, emissions, and exposure factors. A list of the European national weather services members of WMO is presented together with an explanation of how data is collected and presented. Air and water data sources are related to routine data collection and reporting and are less relevant to acute incidents, although useful information is provided regarding National Focal Points and QA/QC protocols are given. The water chapter includes an overview of a limited number of Member States' national water databases and explains how national water quality monitoring results are collected. The data-sources and their allied organisations are useful for the identification of Member State organisations with an exposure assessment role.

Two of the INTERASE Work Packages (2.1 and 2.4) are especially relevant as they aim to review and enhance systems for environmental monitoring in order to support integrated environment and health risk assessment. The project also includes a draft paper on inter-comparison of GIS-based and dispersion modelling technique. Further liaison with INTERASE partners is advisable, in order to obtain information of relevance to the CERACI project aims.

[59] INTARESE Environmental Monitoring and Modelling: Data Review. http://www.intarese.org/files/D8%20Data%20Review.pdf

6.1.3 EU Fifth Framework Programme

6.1.3.1 Methodology to Develop Acute Exposure Threshold Levels in case of Accidental Release (ACUTEX)

6.1.3.1.1 Project Description

Completed. December 2002 – November 2005.

ACUTEX[60] aimed at the development of innovative approaches to derive Acute Exposure Threshold Levels (AETLs) that could be used for emergency planning and land-use planning under the Seveso II Directive (96/82/EC) addressing the prevention and limitation of the effects of major accident hazards.

The project aimed to benefit the control of major hazards in European Union Member States in a number of ways. In particular, the project aimed to foster long-term and sustainable collaboration across the European Union in the establishment of acute exposure levels and development of supporting scientific information. It also proposed to provide greater consistency and transparency in implementation of the Seveso II Directive across the Member States. Specifically it aimed to contribute to the development of common scientific bases for assessing risks and making risk management decisions.

ACUTEX intended to develop a methodology and guidelines for establishing European acute exposure levels that allows for sharing of common scientific data and common principles of extrapolation among Member States. It expected to create a complementary system to the US AEGLs (Acute Exposure Guideline Levels) programme that met the needs specific to European users although it. Despite the significant progress on many scientific issues, a number of technical and methodological issues appeared to remain unresolved and it was recommended to resolve those in a follow-on project.

6.1.3.1.2 Relevance

ACUTEX has similarities with aspects of the INTeg-risk project in the area of European harmonisation of methodologies in the risk assessment of chemical exposures.

6.1.4 DG SANCO

6.1.4.1 European Environment and Health Information System (ENHIS)[61]

6.1.4.1.1 Project description

Completed July 2004 – November 2005.

"Information about the links between environmental conditions and public health is crucial for policy-making on health and environment. In many European countries, methods and standards to assess the impact of environmental hazards on human health still need to be established or improved. Internationally comparable data are needed as a basis for European policies and strategies.

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[60] ACUTEX Acute Exposure Project. http://www.acutex.eu/

[61] ENHIS. *http://www.enhis.org/*

WHO/Europe established and runs ENHIS, a harmonised and evidence-based information system on environment and health to support public health and environmental policies in the WHO European Region. First released in 2007 and updated at the end of 2009, ENHIS enables users:

- o to use scientific information on public health and the environmental conditions in countries;
- o to monitor the health and environment trends in countries and evaluate the effectiveness of relevant policies;
- o to make comparisons of countries' progress towards the targets set in the Europe-wide action programmes;
- o to exchange knowledge and good practices to benefit public health and the environment.
- o To expand ENHIS and establish a comprehensive Region-wide database, WHO/Europe also assists countries in building their capacity to operate and upgrade existing national monitoring systems, and fosters participation in international networks to better integrate health aspects in other policy areas."

6.1.4.1.2 Relevance

ENHIS has similarities with INTERASE and its focus is on effective environmental health policy. The project has produced an inventory of selected environmental health policies in 18 European countries[62]. This provides an overview of the responsible authorities within Member States, in relation to environmental legislation, and their roles. It is a useful resource for building up a picture of the exposure assessment capabilities across Europe and Member State contacts.

6.1.4.2 Development of an Alerting System for Chemical Health Threats (ASHT), Phase I[63]

6.1.4.2.1 Project description

Completed October 2005 – June 2008.

The Alerting System for Chemical Health Threats (ASHT) project is composed of three phases, two of which are now completed. ASHT was funded from 2005–2008 and ASHT Phase II from 2008–2011. Phase III begins in 2012. The initial aim of ASHT was to determine the feasibility of using poisons centres across Europe as a front line resource to detect sentinel events and to harmonise case reports, thereby acting as a syndromic surveillance system to monitor covert deliberate release of chemicals; and also to develop an alerting system whereby EU Member States can be notified of the possibility of a deliberate chemical threat. The concept of a developmental rapid alerting system for chemical threats (RAS-CHEM) was developed and thoroughly tested by project partners.

6.1.4.2.2 Relevance

Poisons centres, their stakeholders, and the associated alerting and liaison arrangements for responding to chemical poisonings (which may themselves be due to acute chemical incidents) are relevant to the CERACI project. There is overlap between the response to chemical poisonings and the response to acute chemical incidents in terms of the

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[62] ENHIS database. *http://www.ktl.fi/attachments/database_eh_policy_information_ndt_ek.xls*

[63] Development of an Alerting System for Chemical Health Threats (ASHT), Phase I. *http://www.hpa.org.uk/web/HPAweb&HPAwebStandard/HPAweb_C/1217490135828*

organisations responsible for health risk assessment, sources of expert chemical advice, and interaction and liaison between health organisations, first responders, and Government.

6.1.4.3 Development of Generic Scenarios, Alerting System and Training Modules relating to Release of Chemicals by Terrorists (GSCT)[64]

6.1.4.3.1 Project description

Completed. November 2003 – August 2007.

The Development of Generic Scenarios, Alerting System and Training Modules relating to Release of Chemicals by Terrorists (GSCT) project involved setting up a platform to enhance cooperation and preparedness on public health threats from chemical agents, including deliberate release threats, across Europe. The project included the development of:

- Generic scenarios describing the release of chemicals agents by terrorists with the ultimate aim of using these to predict risks posed by such events
- A pilot alert system for the rapid identification of deliberate releases of chemicals within a country and the notification of that release in a form that enables other countries in the EU to gear up their public health systems
- Core teaching modules for public health management of terrorist chemical releases, using the material derived from this project

6.1.4.3.2 Relevance

The project stakeholders are potential CERACI contacts. The GSCT scenarios are relevant to the CERACI work package to develop incident exercises. Chemical incident alerting and liaison arrangements are relevant to the CERACI project.

6.1.4.4 Development of an Alerting System for Chemical Health Threats, Phase II (ASHTII)[65]

6.1.4.4.1 Project description

Ongoing October 2008 - September 2011.

Poisons centres provide an important public health service and resource; however, there are no formal arrangements for poisons centres across Europe to notify the public health authorities, Alerting System for Chemical Health Threats (ASHT) Phase II aims to explore ways of addressing this issue.

The main objective of this project is to improve the response of national and international (EU) public health authorities and health services in the event of a chemical health threat or incident in Europe (including deliberate releases). This will involve developing a strategy for improved information exchange and response to health threats, specifically

[64] Development of Generic Scenarios, Alerting System and Training Modules relating to Release of Chemicals by Terrorists. http://www.hpa.org.uk/web/HPAweb&HPAwebStandard/HPAweb_C/1217490107824

[65] Development of an Alerting System for Chemical Health Threats (ASHT), Phase II. http://www.hpa.org.uk/web/HPAweb&HPAwebStandard/Page/1267550490484

the further development of an early warning system on non-communicable disease threats (e.g. chemical agents).

IT systems such as the Rapid Alert System for Chemical Health Threats (RAS-CHEM) and the European Union Poisons Centres Forum (EUPC forum) will be developed and hosted by the EU Health and Consumer Protection Directorate-General as part of the Health Emergency Operations Facility (HEOF). HEOF was developed to support EU countries to react to situations where cross-border coordination and information sharing is justified.

6.1.4.4.2 Relevance

ASHT Phase II focussed on collaboration across Member States and the protocols and systems for cross-border alerting and response are relevant to acute chemical incident response. Information sharing between Member States and cross-border coordination is of particular interest to CERACI project objectives.

6.1.4.5 The Public Health Response to Chemical Incident Emergencies Toolkit (CIE TOOLKIT)[66]

6.1.4.5.1 Project description

Completed March 2008 – March 2011.

The Public Health Response to Chemical Incident Emergencies Toolkit (CIE Toolkit) is a collaborative project involving partners from across Europe. This project aims to develop guidance and training material for public health officials to facilitate rapid and effective responses to acute chemical incidents or emergencies. In addition, a network of experts will be established to provide ongoing training and guidance from within a centre of excellence. The training manual and toolkit will address the environmental epidemiology and monitoring follow-up, risk and crisis communication, and psychosocial consequences and care following a chemical incident or emergency. Exercise cards for chemical incident scenario training will be developed and guidelines will be produced for conducting international exercises involving major chemical incidents.

6.1.4.5.2 Relevance

The project stakeholders are potential CERACI contacts; the project has also developed a network of experts, consisting of a variety of public health experts with specialist knowledge of chemical incident emergency planning, preparedness, response and recovery. The CIE Toolkit is focussed on training, and its guidance is relevant to the CERACI work package to develop incident exercise workshops. Chemical incident alerting and liaison arrangements are relevant to the CERACI project.

6.1.4.6 Risk Assessment and Management – European Training Programme (Risk ASSETs)[67]

6.1.4.6.1 Project description

Completed May 2009 – Apr 2011.

[66] The Public Health Response to Chemical Incident Emergencies Toolkit. http://www.hpa.org.uk/web/HPAweb&HPAwebStandard/Page/1267550490613

[67] Risk Assessment and Management – European Training Programme. http://www.hpa.org.uk/web/HPAweb&HPAwebStandard/Page/1267550490634

The EU has identified as a priority the need to improve the availability of trained risk assessors for conducting consistent, high quality assessments of health risks in accordance with EU policies and legislation, and to serve on EU risk assessment committees.

The Risk Assessment and Management – European Training Programme (Risk ASSETs) project aims to provide a comprehensive and concise training programme to address gaps in risk assessment training and to ensure consistency in the level of competency required, module content, form of delivery and qualifications to be obtained for risk assessors. The project also proposes to undertake a review of existing training schemes and identify the needs of stakeholders and course participants. Specific attention will be paid to toxicology, exposure assessment to chemicals, environmental epidemiology and biomonitoring, substances in cosmetics and electromagnetic fields.

This will include developing:

- A foundation course to provide a comprehensive understanding of the fundamental aspects of risk assessment and risk management
- Course content for an intermediate and advance level training on risk assessment
- A proposed structure to enable the administration and coordination of the training programme

6.1.4.6.2 Relevance

The project stakeholders and target audience are potential CERACI contacts. The Risk ASSETs project is focussed on training; content dealing with exposure assessment is of relevance to CERACI.

6.1.4.7 Chemicals and Radiation Risk Assessment Network (CARRA-NET)[68]

6.1.4.7.1 Project description

Completed. Oct 2010 - Dec 2011.

The purpose of the CARRA-NET service contract is to facilitate effective mutual sharing of information among EU Member States (MS) notably risk assessors and risk managers, in respect of the impact on public health caused by acute events (incidents) caused by chemical or radio nuclear agents. The scope is to build on the existing expertise at national level in order to provide rapid and appropriate evidence-based assessment to the National Authorities responsible for planning and execution of measures to protect the health of citizens following chemical and radio nuclear incidents with cross-border impact. The main objective is to consolidate risk assessment networks for toxic industrial chemicals and radioactive threats and risks.

The operational objectives are:

- The identification and the creation of a database of correspondents in the MSs to implement threat assessment activities following chemical or radio nuclear events.
- The development of standard operational procedures (SOPs), protocols, criteria and guidelines to:

[68] Chemicals and Radiation Risk Assessment Network (CARRA-NET). *www.hpa.org.uk*

- trigger the threat assessment in case of an incident;
- share information within the appropriate Network(s) of Public Health Authority responsible for the public health response to chemical and radio nuclear events;
- trigger the risk management process by activating the appropriate authorities.

- The integration of the tools and deliverables provided by the contractor in the existing EU mechanism(s) to coordinate the response to the chemical and radio nuclear threats of cross-border relevance.

6.1.4.7.2 Relevance

The project stakeholders and database of correspondents are potential CERACI contacts. CARRA-NET is focussed on collaboration across Member States and the protocols and systems for cross-border alerting and response are relevant to acute chemical incident response. Information sharing between Member States and cross-border coordination is of particular interest to CERACI project objectives.

6.1.4.8 Chemicals and Radiation Inventory of Medical Countermeasures (CARIMEC)[69]

6.1.4.8.1 Project description

Completed. Jan 2010 – 2011.

The European Commission has acknowledged that there is a need to develop a coordinated and robust preparedness and response capacity within the EU Member States (MS) in order to effectively respond to chemical and radiation and nuclear incidents, especially those of cross-border significance. They have emphasised the need to strengthen a shared approach to both chemical and radiation and nuclear incidents at EU level, in order that capacity in the EU can reach the highest standards, especially in the field of public health management and to strengthen response capacities and coordination so that cross-border events are communicated and managed effectively across the EU.

The scope of the CARIMEC project is to build on the existing expertise at national level in order to provide rapid and appropriate evidence-based information to the National Authorities responsible to plan and take public health measures and medical countermeasures to protect the health of citizens following chemical and radio nuclear incidents, in particular those which have a cross-border impact.

The main objective of CARIMEC is to help and consolidate the capacity to respond to toxic industrial chemicals and radioactive threats and risks. The CARIMEC project aims to provide a package of materials in order to allow public health authorities in Member States to take stock of the existing situation and to allow the activities in the following areas:

- Immediate actions after an incident;
- Decontamination procedures;

69 Chemicals and Radiation Inventory of Medical Countermeasures (CARIMEC). www.hpa.org.uk

- Monitoring for people/ patients assessment purposes;
- Public health response;
- EU coordination and international liaison
- Integration of the mentioned actions in the existing context of chemical and radiation and nuclear health threats assessment and response developed by the Commission with Member States.

6.1.4.8.2 Relevance

The project stakeholders are potential CERACI contacts. Materials related to exposure assessment and EU coordination and international liaison are particularly relevant to CERACI.

6.1.4.9 Mass casualties and Health care following the release of toxic chemicals and radioactive material (MASH)[70]

6.1.4.9.1 Project description

Completed: April 2008 - September 2010

“Project summary

Mass emergencies following the exposure to toxic chemicals and/or radioactive material, may develop at a quick rate and reach a magnitude sufficient to impose a major crisis upon society. MASH adheres to the idea expressed by the Commission, COM(2005), that general preparedness planning and interoperability are key elements in mitigating the impact of mass emergencies.

Objective

To contribute by improving today’s competence and capability to deal with exposed patients and also to define the level of knowledge about preparedness and treatment in the Member States.

In a foresight study, critical developments will be incorporated within biotechnology and ICT, suggesting tomorrow’s improvements to the primary medical care process.

Appropriate choice of methods and the application of sound scientific standards will be ensured through an internal system for evaluation.

Target groups

Health planners of the Commission, health planners of the Member States and within each Member State, the local planners and operative medical personnel.”

6.1.4.9.2 Relevance

The project stakeholders and target groups are potential CERACI contacts.

[70] MASH. http://www.mashproject.com/

6.1.5 Other EU funding frameworks

6.1.5.1 Risk Management and Remediation of Chemical Accidents (RIMA)[71]

6.1.5.1.1 Project description

Ongoing. January 2011 – December 2013.

"Objectives of the project

To improve risk management actions related to chemical accidents especially accidents related to chemical transportations on land. Finland and Estonia are located in the edge of EU and therefore the challenges related to high volumes of Russian transit traffic are similar.

To increase the use of new, innovative remediation techniques, which are used to clean contaminated soils and groundwater. At the moment many innovative and cost effective techniques have been developed, but they are rarely used in Finland or Estonia.

To increase the knowledge and cross-border operation in the field of chemical risk management and remediation services. Cross-national co-operation plays a key role in minimising the risks caused by the transportation of dangerous goods. Transmission of new knowledge to authorities is needed to improve accessibility of innovative remediation techniques.

The horizontal objective of the project is to increase the quality of the environment."

6.1.5.1.2 Relevance

Cross-border operation in the field of chemical risk management is relevant to CERACI. Of particular interest are work packages on risk management (including monitoring and modelling) and communication.

6.1.5.2 Enhancing Mesoscale Meteorological Modelling Capabilities for Air Pollution and Dispersion Applications[72]

6.1.5.2.1 Project description

Completed May 2004 – February 2010.

"The COST Action was approved in May 2004 and launched in December. The Action addresses key issues concerning the development of mesoscale modelling capability for air pollution and dispersion applications. The Action encourages the advancement of science in terms of parameterisation schemes, integration methodologies/strategies, air pollution and other dispersion applications, development of model evaluation methods and the investigation of meteorological influences on atmospheric chemistry and emissions. Where appropriate, this Action welcomes interaction and coordination with other scientific groups."

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[71] RIMA. http://www.rimaproject.eu/

[72] Enhancing Mesoscale Meteorological Modelling Capabilities for Air Pollution and Dispersion Applications. http://www.cost728.org

6.1.5.2.2 Relevance

One aim of the project is to identify the requirements for the unification of Meteorology (MetM) and Atmospheric Chemical Transport (CTM) modelling systems and to propose recommendations for a European strategy for integrated mesoscale modelling capability. The project has identified a number of Member State meteorological institutions, contacts and the models used and being developed within these Member States. Two meta databases exist: the first is an inventory of models[73], and the second is for model evaluation.

6.1.5.3 European Forest Fire Monitoring using Information Systems (EFFMIS)[74]

6.1.5.3.1 Project description

Ongoing November 2011 – October 2012.

This project aims to pool good practices (GPs) on exploitation of the usage of information systems in order to early detect, efficiently manage and handle forest fires and assess the damage caused and ways for regeneration. It aims to exchange good practices between the participating regions, so as to strengthen their position and capacities to respond better to the Lisbon and Gothenburg agendas on protection of the environment and the decreasing of CO_2 (carbon dioxide) emissions. Forest fires are a major problem for many European societies threatening human lives and property with disastrous impacts particularly at the wildland-urban interface. The only effective way to minimise damage caused by forest fires is their early detection and fast reaction, apart from preventive measures. Great efforts are therefore made to achieve early forest fire detection, which is traditionally based on human surveillance. However, in recent years, a more advanced approach to human forest fire surveillance has been utilised, which is based on the usage of information systems.

The project will focus on the exchange of good practices between the regions and will seek to develop regional action plans for how each region can position itself better in using information systems to protect its natural resources against fire and how each region can align its national policy with the EU legislation related to forest fires. The project will use tested tools and methodologies to bring the transfer of good practices from the stronger standing regions to the weaker ones – namely site visits, taking stock of existing situations (environmental, meteorological, geographical) as well as potentials, piloting actions, outlining good practice catalogues and proposing concrete action plans.

The project will use the principle of equal participation of all financing partners, and it will work concretely via the setting up of transnational (interregional) working groups that will take responsibility for the proper transfer of know-how on good practices according to "field of expertise". Besides the exchange of knowledge and good practices, the project will envisage the implementation of targeted dissemination actions in key areas for forest fire detection and management. Namely, the project will examine how the transfer of specific expertise on these areas from some of the participating regions could benefit other participating "donor-regions". In this way "donor-regions" will be offered

[73] Model Inventory. http://www.mi.uni-hamburg.de/index.php?id=539

[74] EFFMIS. http://i4c.eu/showProject.html?ID=40523

the possibility to adopt more efficient methodologies and technologies in order to protect their natural resources against forest fires. Targeted dissemination will contribute to the project gaining wider acceptance, and it will actively involve relevant stakeholders."

6.1.5.3.2 Relevance

The facility for detection and mapping of fires is of relevance to CERACI and this capability, where present within Member States, relates to chemical incident civil protection and incident response functions. Cross-border cooperation is of particular relevance to CERACI.

6.1.5.4 Mobile Laboratory for Environmental Pollution Measurements and Emission Control Systems Evaluation (MOBILAB)[75]

6.1.5.4.1 Project description

Completed June 2006 – December 2007.

"Description:

The project MOBILAB aims at the development of a mobile continuous urban air pollution monitoring system, capable of collecting and analyzing pollution data in real-time mode. Hazardous airborne pollutants (emissions) consist of a large group of potentially toxic compounds emitted from a variety of mobile and stationary sources. Among them, in urban areas, automotive emissions are claimed to have a major contribution. Although engine emissions per vehicle have been reduced for twenty years with technical developments in the fields of engine, after-treatment technologies and fuels (i.e. catalytic converters, diesel particulate filters, unleaded gasoline, low fuel sulphur content the urban air pollution problem still exists in many cities around the world. Forthcoming European emission regulations (EURO V) will require further development of new complex technologies to reach low emissions standards (Particulate Matter, Nitrogen Oxides, Hydrocarbons and Carbon Monoxide). Real vehicle drive assessment of such technologies offers significant advantages in the development phase of novel emission reduction systems as valuable conclusions can be extracted regarding their performance and durability.

The project aims to the development of a mobile laboratory with two-fold capabilities: On the one hand it will be able to monitor urban air pollution by measuring the concentration of the major gaseous and particulate pollutants concentration in the urban environment and on the other hand it will be able to act as a mobile automotive emissions reduction systems' test centre (i.e. able to measure the engine exhaust gaseous and particulate pollutants concentration) for the assessment of future exhaust after-treatment technologies under real drive conditions. A committed van-type vehicle will be equipped with all instruments (HCs, CO, NOx analyzers, particulate matter (PM) sensors, PM concentration and size distribution analyzers etc).

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[75] MOBILAB. http://www.territorialcooperation.eu/frontpage/show/3269?ss=12860f018d92e856abc5523ac5675d732d96eab32276edf3daefd0a19e6a0cc1#bb

The multinational partner consortium consists of three organisations with extensive experience in emissions and emissions measurements and the development and assessment of innovative engine exhaust after-treatment technologies.

The project will take advantage of recent developments made in the context of European research projects in which the partners have participated e.g. advances in the use of emission measurements technologies, real-time particulate sensors etc. Initially the measurement protocols of each pollutant will be defined. The necessary measuring instruments will be defined and acquired/developed. Necessary arrangements will be made to facilitate the measuring instruments operation on vehicle under on-road conditions. The “mobile laboratory” will then be calibrated against state-of-the-art laboratory instruments and its performance will be evaluated. It will be then ready to be used for field measurements for either urban pollution monitoring or the testing of innovative exhaust after-treatment systems. There are certain advantages in the concept of the creation of a pollution map via this mobile laboratory as fixed monitoring stations are usually most costly and the possibility of introducing them in the desired areas does not always exist. Moreover by tracking the position of the vehicle (e.g. via a GPS system) the pollution map created will be near-real time in contrast to the reports over standard time intervals of the fixed air pollution monitoring stations. As far as the capability of the mobile laboratory to test the engine out emissions of a vehicle is concerned, the advantage of it over fixed testing stations is more than obvious.

Direct beneficiaries of the project outcome will be the municipal and traffic control authorities who based on the information the mobile laboratory, will create on the pollution situation will be able to take corrective measures to avoid undesired air pollution incidents. In addition, this mobile laboratory will benefit the owner organisations with the ability for real-life testing and evaluation of exhaust after-treatment technologies under development.”

6.1.5.4.2 Relevance

The development of mobile laboratory capabilities and their testing and review is of relevance to CERACI, although in this case the MOBILAB project focuses on urban air pollution monitoring rather than that during acute incidents.

6.1.5.5 Fire events risk assessment through remote sensing (FIERS)

6.1.5.5.1 Project description

Completed March 1998 – December 1999.

“The project submitted attempts at demonstrating the usefulness and cost-effectiveness of Earth Observation satellite data in the assessment of forest fire risk over the Mediterranean area for better organisation and coordination of air intervention during forest fire control and extinction operations by National Civil Protection bodies. A "prototype" information system will be developed, containing enhanced earth observation products, to be integrated to the Civil Protection decision-making process.

In the Mediterranean Countries millions of hectares of forest areas burned in the last years. This causes huge human life and property losses and strong environmental degradation.

The operational problems tackled in the project are the following. The Civil Protections have the need to optimise the surveillance operations strategy of air means available for forest fire fighting and extinction, using reliable indications about the maximum fire risk areas. Up to now the only indications are provided by a fire risk index based on weather variables measured mainly at point locations.

The FIERS project has the aim to assess the operational feasibility of computation, dissemination and use of a real time forest fire risk index generated from daily AVHRR data (Vegetation Indexes and Surface Temperature) at 1x1 km resolution.
The methodology at hand is quite consolidated, having being tested in many research activities and in particular in the EC MINERVE project (IV RTD Framework Programme-Environment and Climate) where three of the participants to the present proposal were present.

The measurable objectives and deliverables of the system will be: - preoperational systems to generate and disseminate to Civil Protection National organisations a daily forest fire risk index derived from AVHRR data enabling them to better plan surveillance and extinction activities, which includes the following components:

- satellite data acquisition and processing
- risk index computation
- index maps dissemination
- GIS for integrated analysis and generation of operational decision support information
- elements of cost-effectiveness of the method

French and Italian Civil Protection Organisations will be both customers of the project and partners. As a consequence they will participate in all the stages of the project and in particular in the initial definition of the information requirements, the specification of the product, its validation, and the evaluation of the reliability and potential cost effectiveness of the use of Earth Observation in this application.

Through its interaction with the CEO enabling service, information on a regular basis will be provided. In particular, CEO enabling services will be used to: - state of the art information search (methodology + other experiences) - make available catalogue of data and products generated by the project - project results advertising”

6.1.5.5.2 Relevance

The FIERS project does not focus specifically on chemical releases but the facility for satellite detection and mapping of fires is of relevance to CERACI and this capability, where present within Member States, relates to chemical incident civil protection and incident response functions.

6.1.5.6 A Database for validation of models used in chemical risk assessment (DATABASE)

6.1.5.6.1 Project description

Completed January 1993 – March 1996.

"Objective:

To collect data on source term, dispersion, complex terrain experiments to a database for model validation and modelling purposes.

General information:

In the field of consequence/risk analysis a lot of work has been carried out: many experiments have been carried out; data has been collected from the experiments; and there exists a variety of mathematical and physical models. However, the linkage and quality requirements between these three areas are very poor. The main research areas in experimental work are concentrated on getting more information about source terms, dispersion and complex terrain experiments.

The usefulness of model evaluation depend upon the existence and extensiveness of appropriate databases and the accessibility of the databases. Thus, there exists a great demand to build up a good database to satisfy the validation and quality requirements of models.

In model validation, there will be uncertainties associated with the stochastic nature of the problem and with data errors. The comparison of model and experiments will include these effects in addition to the inaccuracy of the model itself. Stochastic effects and data errors will place a restriction on what quantitative results can be deduced from a model validation. This can be avoided by using fuzzy mathematics in constructing a database.

The project brings a basis for construction of a database in order to obtain data to a database for evaluating and developing the quality and validity of the consequence models used in risk assessment."

6.1.5.6.2 Relevance

The database produced by the project is of relevance to modelling for exposure assessment. It is advisable to determine whether this project (which ended in 1996) has outputs which remain valid as there may be information of relevance to CERACI. The work is summarised in two published journal articles (Kakko et al, 1996[76]; and Kakko, Länsipuro, and Kujansuu, 1996).

[76] CRAMD—A database for the validation of models used in chemical risk assessment. http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6TGH-3WFNNG6-5&_user=8810565&_coverDate=11%2F30%2F1996&_rdoc=1&_fmt=high&_orig=gateway&_origin=gateway&_sort=d&_docanchor=&view=c&_searchStrId=1749890460&_rerunOrigin=google&_acct=C000046143&_version=1&_urlVersion=0&_userid=8810565&md5=40ba429701e711dc32a76642215cec29&searchtype=a

6.1.6 World Health Organisation (WHO)

6.1.6.1 Improving Environmental Health in Emergency and Crisis Settings: Roster of Experts, Toolbox and Stockpiles

6.1.6.1.1 Project description

Date to be confirmed.

The purpose of this work was to develop a toolkit, supplies list and training package for a roster of experts in chemical emergencies. One of the roles of the WHO is to provide appropriate technical assistance and, in emergencies, the necessary aid upon the request or acceptance of governments. In the event that a country requests technical assistance following a chemical incident, WHO will assist that country by: (i) undertake a rapid assessment of the situation, including the identification of needs and gaps (this involves also the assessment of health impacts and risks); (ii) coordinate the international health response; and (iii) fill urgent gaps, e.g. by providing antidotes or other medicine; decontamination or other equipment; or training.

The project prepared a report to provide guidance for chemical incident management in developing counties. This included establishing a roster of experts for the health response to chemical incidents and compiling a set of protocols and guidelines to be used in a chemical emergency situation to ensure an effective and efficient health response.

6.1.6.1.2 Relevance

The project stakeholders and members of the expert roster are potential CERACI contacts.

7 Appendix 3

7.1 Matrices capturing information on responding organisation's responsibility and exposure assessment capability for each Member State.

Fig. 7.0 List of EU Member States and Links

1. Austria	2. Belgium	3. Bulgaria	4. Cyprus	5.Czech Republic	6. Denmark	7. Estonia	8. Finland	9. France
10. Germany	11. Greece	12. Hungary	13. Ireland	14. Italy	15. Latvia	16. Lithuania	17.Luxembourg	18. Malta
19. Netherlands	20. Poland	21. Portugal	22. Romania	23. Slovakia	24. Slovenia	25. Spain	26. Sweden	27.United Kingdom

Key to Exposure Matrix:

O – Observations
F – Field Monitoring
L – Laboratory Analysis
E – Emergency Plans
Quan – Quantitative
ID – Identification of receptors
RC – Risk Characterisation

M – Modelling
GIS - Geographical Information System
Comm. – Risk Communication
RC – Risk Characterisation
Qual – Qualitative
Comms – Provide communication
? - Evidence not substantial

7.1.1 Austria Exposure Assessment and Risk Characterisation Matrix

Category	**Agencies**		**Source**		**Pathway**		**Receptor**		**RC**	**Comments**
Sector	Organisation	Group / Arrangement	Qual.	Quan.	Qual.	Quan.	ID	Comm. Y/N	Y / N	Specifics of role in exposure assessment and or risk characterisation.
Government	Ministry of the Interior	Austrian Council of Research and Technology								Created by the Austrian government, advises the federal government, the ministers and the federal states (*Länder*) in all matters related to research, technology and innovation; defines and monitors a long-term national research technology development strategy.
		Department II/4 – Civil Protection, Crisis and Disaster Protection Management (SKKM)					GIS?	N	Y	Responsible for civil protection, crisis and disaster management. The Department consists of two units: 'International Civil Protection and Disaster Relief Affairs' and 'National Crisis and Disaster Protection Management'. Would coordinate large or cross-boundary incidents. In the event of such an incident this body has the power to call upon rescue services, fire brigades, the Austrian Media and other authorities as required.
		National Air Quality Reference Laboratories (AQUILA) for upper Austria (Oberösterreichische Landesregierung)		L, F			GIS?	N	Y	Legally responsible for the quality assurance of air pollutant measurements, which implies the organisation of national QA/QC programmes and the participation to European QA/QC programmes. In addition they may be actively involved in standardisation activities, in the validation of measurement methods and the type approval of instruments. Second AQUILA laboratory is operated by the Environment Agency.
		Federal and Provincial alarm Centres						N	N	Permanently staffed head quarters for emergency response at short notice and makes arrangements for longer term strategy at all levels.

	Federal Ministry of Science & Research	Austrian Academy of Science		L?				N	N	FWF is the central funding agency for health and environmental research and may be involved in the case of a large scale or cross boundary incident.
	Federal Ministry of Agriculture, Forestry, Environment & Water Management			E	E		E	N	N	Seveso II competent authority. May assist federal authorities in the event of a major incident.
	Local Government	Provincial and Regional Operations Command	O	F	O		GIS? / O	Y	Y	Austria is a federal republic, composed of nine constituent federal states. In the event of a large scale incident the federal authorities would support the provinces. Operationally the provinces rely chiefly on voluntary relief organisations. Local authorities have a responsibility for monitoring local air quality.
Military	Federal Armed Forces							Y	N	Will be employed where an incident cannot be dealt with by the civilian organisations alone. The military units will then report to the civilian authorities.
Emergency Services	Fire Service	Austrian Fire Brigade; Austrian Red Cross; Austrian Fire Brigade Association USAR CBRN module.	O	F	O		O	Y	Y	The emergency services have liaison officers in the event of major incidents. The fire and rescue services Civil Protection and Disaster Response are mainly voluntarily based (85%, except major cities). The two leading organisations are: Austrian Fire Brigade and Austrian Red Cross. There are umbrella organisations at district, state and federal levels. The organisation at the federal level is the Österreichischer Bundesfeuerwehrverband (Austrian Federal Fire-Brigade Federation), the state level organisations are called Landesfeuerwehrverband (State Fire-Brigade Federation). The Austrian Fire Brigade Association USAR CBRN module is trained to respond to CBRN type incidents and has on-scene monitoring capabilities.

	Ambulance Service	Austrian Red Cross and others	O		O		O	Y	N	Rettung (the Emergency Medical Service) is Austria's pre-hospital emergency health service and includes the ambulance service, which is provided by individual Austrian municipalities, cities and counties and is primarily financed by Austrian health insurance companies. Most areas primarily rely upon the Austrian Red Cross for this service. The fire service receives significant support from volunteers, particularly in rural areas. Specialist industrial fire services may have more specialised equipment and be called up to assist outside services the event of a major incident.
	Austrian Red Cross		O		O		O	Y	N	The major emergency ambulance service in Austria, which also supports the fire service as required.
	Police	Public Security Directorates; Federal Police Directorates	O		O		O	Y	N	Will perform civil and community protection roles, including alerting, investigation, issuing shelter and evacuation advice, maintaining cordons and communicating with other agencies involved.
Health	Federal Ministry of Health	Health Austria GmbH - GOG								The Health Austria GmbH, GÖG (Gesundheit Osterreich GMBH) was established in 2006 on the basis of a federal statute, as a national research and planning institute for health care and a competence and funding centre of health promotion. It includes three organisations: Austrian Federal Institute for Health Care (ÖBIG), Healthy Austria (FGÖ) and the Federal Institute for Quality Health (BIQG). GÖG has one shareholder: the Austrian Federal Government, represented by the Federal Minister of Health. Austria does not currently have a strong Public Health agency and most functions are undertaken by federal or local authorities.
Environmental Protection	Environmental Agency of Austria (Umweltbundesamt)	Including a National Air Quality Reference Lab (AQUILA)	O?	F? / L	O?		GIS	N	Y	Environmental consultancy services across a number of areas, mainly in the fields of climate change, air quality and emissions, water resources, biodiversity, waste and resource management, chemicals and institution and capacity building. Special treaties on cooperation are in place for cooperation in the field of environmental protection (such as industrial accidents) between Austria and the

										Czech Republic, Hungary and Poland. The Agency is involved in a number of air monitoring projects including cross-boundary EU projects. Includes one of the two National Reference Laboratories.
	Central Institute for Meteorology and Geodynamics (ZAMG)	Department of Environmental Meteorology				M	GIS	N	Y	Emergency response modelling capability. The Department of Environmental Meteorology examines the spread of pollutants in the atmosphere in crisis situations (e.g. leakage of radioactivity into the atmosphere) and directs information from the federal warning centre.
	Austrian Academy of Science									The leading organisation promoting non-university academic research institutions in Austria. The fields of research comprehend: Biology & Medicine; Earth Sciences; Mathematics, Simulation and Metrology; Physics & Materials Sciences; Environmental Research; Space Research. Research of the Austrian Academy of Sciences is carried out in institutes, research units and departments (commissions) located all over Austria.

7.1.2 Belgium Exposure Assessment and Risk Characterisation Matrix

Category	Agencies		Source		Pathway		Receptor		RC	Comments
Sector	Organisation	Group / Arrangement	Qual.	Quan.	Qual.	Quan.	ID	Comm. Y/N	Y / N	Specifics of role in exposure assessment and or risk characterisation.
Government	Federal State	Federal Government Home Affairs (binnenlandse zaken): among others: General Directorate Crisis Centre and General Directorate Civil Safety						Y	N	The Federal State is responsible for the centralised coordination of order and safety measures. Both the Federal Government HA and the Federal Government PH, S and E play a key part in the fulfilment of this responsibility. It arranges the information supply between the various administrative layers and, if other countries are also involved, it makes contact with the countries involved. The Federal Government Home Affairs is responsible for crisis management. The General Directorate Crisis Centre coordinates crisis management on the national level and supports the local and regional level. The General Directorate of Civil Safety is responsible for the reinforcement of the Fire Department, the fight against CBRN and the communication with the population.
		Federal Government Public Health, Safety of Food Chain and Environment: General Directorate Environment								The General Directorate for the Environment is responsible for the coordination between parties: goal is to fit the separate policies of Environment and Health: National Actieplan Leefmilieu-Gezondheid (NEHAP)
	Flemish Community, French Community and the German speaking community							Y	N	The important responsibilities regarding the Environment are organised on the Regional and Community Level

	Flemish Community	Flemish Agency Care and Health								Started in 2002 the Flemish Human Bio monitoring program. The goal of this program is to develop a monitoring network that collects information on the exposure to polluting substance in the human being and the possible health effects.
Military	CBRN Task Force		O	F,L	O	F,L	O	N	N	
Emergency Services	Fire and rescue Services	Hazmat advisor (AGS)	O	F,E	O	F,E	O	Y	Y	
	Civil Protection	Operational unit Crisnée								The Operation unit Crisnée is one out of six units, it services the province of Liege and is specialised in chemical and nuclear decontamination on a large scale.
	MUG (Mobil Urgence Group)		O		O		O	Y	Y	First responder health assessment during hazmat incidents
Health	Medical services	Hospitals, Ambulances								
	LOGO (Local Health Council)	Public Health Environmental Advice (MMK)	O		O		O	Y	Y	Answering questions, signalling involuntary exposure of risk groups to environmental factors, risk communication
	National Cell Environment and Health (NEHAP)	centre for Public Health and Environment (cGM)	O		O		O	N	Y	Supports and gives advice on Health Impact Assessment of disasters including chemical disasters
	Poison Centre		O		O		O	N	Y	Identical to poison centre - RIVM /NL
Environmental Protection	Vlaamse Milieumaatschappij		O		O					The 'Vlaamse Milieumaatschappij' measures and controls the quantity and quality of water and monitors the air quality. It makes the 'Milieurapport Vlaanderen (MIRA) and participates in the international environmental policy.
	Intergewestelijke Cel voor het Leefmilieu (IRCEL-CELINE)	Air Quality Cell			O	F		N	N	Fixed location monitoring, particulate matter, O3, NOx

7.1.3 Bulgaria Exposure Assessment and Risk Characterisation Matrix

Category	**Agencies**		**Source**		**Pathway**		**Receptor**		**RC**	**Comments**
Sector	Organisation	Group / Arrangement	Qual.	Quan.	Qual.	Quan.	ID	Comm. Y/N	Y / N	Specifics of role in exposure assessment and or risk characterisation.
Government	Ministry of Interior	National Public Safety Office								
	Security Council at the Bulgarian Council of Ministers		O	O	O	O	Y	Y	Y	For major incidents where numbers of individuals are exposed, crisis management becomes a more complex task that requires participation of many government organisations and is managed by the Security Council at the Bulgarian Council of Ministers
	General Directorate for Civil Protection	National Office of Civil Defence	O, F,	O,F	O,F	O,F	Y			Specialised rescue vehicle for responding to incidents involving radiological, chemical and biological contamination. and accidents involving dangerous substances and materials;
	Ministry of Emergency Management (Situations)	National Civil Protection Service	O,E	O,E	O,E	O,E	Y	Y		Ministry of Emergency Situations (MES) undertakes the activities of civil protection in the event of disasters, based on a policy for prevention, control and overcoming of the consequences of disasters and accidents; National Civil Protection Service General Directorate is a structure under MES. It conducts life-saving and urgent emergency-reconstruction activities in case of disasters, as well as protection both in peace and war;
		National Centre of Public Health Protection	F,L,O,M	F,L,O,M	F,L,O,M	F,L,O,M	Y		Y	Evaluate the situation and the symptoms of a chemical incident; determine the causes and sources of the chemical incident; forecast the rate of progress of the chemical incident; outline the contaminated geographic area; provide immediate medical assistance to exposed individuals; perform decontamination activities on people and equipment that were present at the contamination site; monitor for chemical contamination; and, determine the result from the executed complex restrictive, restoration, rescue and other efforts undertaken by the ministry of Emergency Management and the Ministry of Health.

		Regional Inspectorate of Protection								
		Control of Public Health								
		Aerospace Monitoring Centre (Modelling)	F,O,M	F,O,M	F,O,M	F,O,M	Y	N	Y	The centre has installed the country's first software system for locating fires based on satellite data in near real time. Automatically detect fires and their information is distributed via e-mail. Detected fires are accompanied by precise geographical coordinates, information about the affected area, the intensity of the fire. Graphically present data on atmospheric pressure, direction and wind speed. The software is able to integrate data from numerical models for weather forecasting
		National Situations Centre	O,M	O,M	O,M	O,M	Y			A national situation centre is part of MES activates local, municipal or regional crisis staff to coordinate and manage relief operations and provide information to other agencies Collects, processes, and analyses data for spread of radiation, chemical biological, hydro-meteorological , road and fire
	Ministry of Agriculture and Food	National Agricultural Advisory Service								
Military	Ministry of Defence	National Military command centre	F,L,O,	F,L,O,	F,L,O,	F,L,O,				The main tasks for the Ministry of Defence during chemical incidents are to provide assistance in establishing the causes and sources of chemical damage and provide assistance in identification of the hazardous chemical.
		National Security System								
		Military Medical Academy Toxic Chemicals Laboratory	L		L					
		Research Institute for Radiological,								

		Biological and Chemical Protection								
Emergency Services	Aerospace Monitoring Centre		F,L,O,M, GIS	F,L,O,M	F,L,O,M	F,L,O,M	Y	N	Y	The Aerospace Monitoring Centre was established in 2007. It's task includes supporting operational and management units in the detection, identification, monitoring, risk management and assessment of natural and manmade disasters.
	National Centre for Radiobiology and Radiation Protection (NCRRP)									health-research institution dealing with the matters of the public health. Its main goal is the protection of Bulgarian population from the harmful influence of the ionising radiation.
	Situations Centre		O,M	O,M	O,M	O,M	Y			Collects, processes, ad analyses data for spread of radiation, chemical biological, hydro-meteorological , road and fire
	Directorate of General Police	Police	O	O	O	O				
		Fire Rescue service	O,F	O	O,F	O				Civil defence have specialist chemical vehicles
		Ambulance Service	O	O	O	O				On scene health observations
Health	Ministry of Health	National Medical Co-ordination Centre	L,O	L	L,O	L	N	N	N	Join effort with the National Office of Civil Defence to identify the hazardous chemical.
		Centre for Military Epidemiology and Hygiene	F, L, O	F,L,O,	F, L, O	F, L, O	Y	N	N	Field identification teams and laboratories are mobile and could reach the affected area, if required

		Poison Information Centres	O	O	O	O		Y	Y	A 24-hour emergency and information hotline service for public and health care professionals. Calls are directly answered by a poison information specialist who trained in clinical toxicology. Poison information centres play a key role in chemical disaster response planning and can be a great resource for response providers when establishing plans and responding to disasters. The poison centre is one of several critical components of a regional counterterrorism response force. PIC may be one of the first agencies notified of a chemical emergency, probably by a call from a concerned citizen, it will be responsible for notifying the proper response agencies. PICs play an important role in disseminating basic and clinical toxicology information during a chemical attack to public and medical professionals
Environmental Protection	National Institute of meteorology and Hydrology		M	M	M	M				The Bulgarian Emergency Response System (BERS) is being developed in the Bulgarian National Institute of Meteorology and Hydrology since 1994. BERS is based on numerical weather forecast meteorological information and a numerical long-range dispersion model accounting for the transport, dispersion, chemical and radioactive transformations of pollutants

7.1.4 Czech Republic Exposure Assessment and Risk Characterisation Matrix

Category	Agencies		Source		Pathway		Receptor		RC	Comments
Sector	Organisation	Group / Arrangement	Qual.	Quan.	Qual.	Quan.	ID	Comm. Y/N	Y / N	Specifics of role in exposure assessment and or risk characterisation.
Government	Ministry of Interior,	General Directorate of Fire Rescue Service of the Czech Republic		E		E	GIS (O)	Y	Y	Rescue Procedures Approval; Emergency Plans; Analysis etc.
		Operational and Information Centre(OIC)					GIS	Y	Y	OIC receives and analyses information about emergency events, in the case of need informs Integrated Rescue System (IRS) and notifies National Competent Authority; IRS-procedure for facing emergency events and crisis situations, coordinated by OIC (of regional FRS and General Directorate of FRS); determined for co-ordination of rescue and clean-up operations in case, where a situation requires operation of forces and means of several bodies, e.g. fire-fighters, police, medical rescue service and other bodies, or in case, where the rescue and clean-up operation is necessary to be co-ordinated from the Ministry of Interior or by a leader of region's level, or by mayors of municipalities with extended responsibilities
		Population Protection Institute					GIS			Ensures education, scientific research, informative, and advisory business in areas of civil emergency planning, emergency management, and the Integrated Rescue System and population protection; central data warehouse (GIS)
	Ministry of the Environment	Czech Environmental Inspectorate		M		M		Y	Y(env)	Observational air quality data from network of fixed air quality monitoring equipment. Emergency plans; Involved in dealing with accidents in the environmental sector (SEVESO II)
		Regional Environmental Inspectorates	O	F, L, E	O	F, L, E	O	Y	Y	Hand held and vehicle based monitoring equipment. Emergency plans; Involved in dealing with accidents in the environmental sector

Military	structure formed by 10 NATO countries, located in Czech Rep	Joint Chemical, Biological, Radiological and Nuclear Defence Center of Excellence (JCBRN Defence COE)			M	M	GIS	N	Y	Advisory body in CBRN defence related areas; Main goals: develop CBRN defence doctrines, standards, knowledge to support improvement of interoperability and capabilities; promote interoperability and standardisation; promote relationships among related CBRN bodies.
Emergency Services	Fire Rescue Service (FRS)	Regional Fire Rescue Services	O	F, E	O		O	Y	N (Y ad hoc)	Scene observations. Establishing cordon. Issuing shelter and evacuation advice on-scene. Analysis at the scene.
		Emergency Unit of FRS CR	O	F, E	O		O	Y	N (Y ad hoc)	Scene observations. Establishing cordon. Issuing shelter and evacuation advice on-scene. Analysis at the scene. Radiation and chemical recognition
	Ambulance		O		O		O	Y	N	Scene observations. On-scene health effects observations. Emergency plans.
	Police							Y	N	Establishing cordons. Issuing shelter and evacuation advice on-scene.
Health	Health Care System	Poisons Information Centre					O	Y	N	Information support for preventive and emergency action in case of poisoning. Provide medical advice by phone in case of intoxication.
		Hospitals					O	Y	N	Health effects observations.
		GPs (General Practitioners = Family Doctors)					O	Y	N	Health effects observations.
Environmental Protection	CENIA, Czech Environmental Information Agency			M, F	O	M, F	O	Y	Y	Advisory body on environmental pollution matters; carries on Integrated Pollution Register (IPR)

7.1.5 Cyprus Exposure Assessment and Risk Characterisation Matrix

Category	Agencies		Source		Pathway		Receptor		RC	Comments
Sector	Organisation	Group / Arrangement	Qual.	Quan.	Qual.	Quan.	ID	Comm. Y/N	Y / N	Specifics of role in exposure assessment and or risk characterisation.
Government	Ministry of Agriculture, Natural Resources and Environment	Committee for the Protection of the Environment						Y	N	To ensure public participation in decision-making relating to the protection of the environment. The committee may have a part to play in a protracted incident where shelter or evacuation is required. They may also assist with communication.
		Veterinary Public Health Division	O	L		L	O	Y	Y	Responsible for public health in relation to animal health. Would test animals where contamination occurs.
		Department of Geological Survey		F, L	GIS	M	GIS	N	Y?	Soil Strategy. Chemical laboratories, cartographical and GIS capabilities. Responsible for groundwater. Contaminant modelling.
		Central Commission for Beaches					E	N	N	Responsible for cleanliness of beaches for public and environmental protection.
		Meteorological Service / Remote Sensing Service				M	O	N	N	Network of Stations; provision of services for civil aviation and shipping; Publication of reports on weather and climate and supply of meteorological information and consultative services for the needs of the Cyprus community and in particular for applications to agriculture, conservation and management of water resources, engineering studies and constructions, tourism and industry, renewable energy sources, environmental studies. GIS has remote sensing and mapping capabilities
		Integrated Coastal Area Management					O	N	N	Responsibility for overall management of the coastal area, including control of pollution.
		Water Development Department		L	O		GIS	N	Y	Control of Pollution of Waters and Soils; design and maintenance of sewers; protection of water resources from pollution; GIS
		Department of Fisheries and Marine Research		F, L	O			N	N	Analysis of contaminant concentrations in fish and sea water. Maintains oil anti-pollution equipment and vessels;

	Local Authorities	Environmental and Public Health	O	L?	O		O	Y	Y	Health Inspectors - Official control of foodstuffs; monitoring and control of drinking water; supervising and monitoring the quality of seawater and swimming pools; international exchange
			O		O		O	Y	N	Local air quality obligations. Monitoring equipment? Likely to be on scene observations only.
			O		O		O	Y	N	There appears to be a contaminated land responsibility for Cyprus local authorities, but these details are not clear.
	Ministry of Labour and Social Insurance	Department of Labour Inspection	E	E, F, L	E		E	N	Y	Responsible for air quality, chemicals and radiation protection. The Department maintains a network of nine monitoring stations and is responsible for operating the network and implementing abatement measures. It is also the responsible authority under Seveso II and maintains emergency plans, which it also shares with the fire service.
	Ministry of the Interior	Civil Defence					O	Y	N	Advice on preparation for disasters including chemical, biological, radiation and warfare agents.
Military										
Emergency Services	Police	Emergency Response Unit (ERU)			O		O	Y	N	Cordons; shelter and evacuation facilitation where support is requested from District Departments and where an incident may effect a number of regions etc.
		European Union and International Police Cooperation Directorate			O		O	N	N	Cyprus uses the directorate to facilitate international collaboration and may rely up these connections in the event of large scale or cross-boundary incidents.
		District Departments			O		O	Y	N	Respond to local incidents affecting their relevant region. May require assistance of the ERU depending upon nature and scale of incident.
			O		O		O	Y	N	On scene observations; establish cordon; communicating with the public; administering shelter and evacuation advice.
	Ambulance & A&E	Regional and private	O		O		O	Y	N	On scene observations; casualty observations.
	Fire	Cyprus Fire Service	O	F?	O		O	Y	Y	Responds to incidents including chemical and environmental incidents. Establishing cordon and communicating with the public. Field Monitoring capability?
	Coast Guard	Regional Coast Guards	O		O		O	Y	N	Responsible for search and rescue, pollution control and emergency response.
Health	Ministry of Health of the Republic of	Public Health Services		L	O		O	N	Y	Inspection of foodstuffs; epidemiology and food; environmental health. Where support required by local authority or incident effects more than one region / cross boundary. Includes State General Laboratory.

	Cyprus	Hellenic Food Authority (EFET)		L	O			Y	Y	EFET was established by Law 2741/FEK 199/28-09-1999. It is a Public Corporation and it is supervised by the Ministry of Health and Social Solidarity. The responsibilities of HFO are to define quality standards. Overall responsibility for food safety.
		Environmental Health and Public Health Services						Y	N	Responsibilities for monitoring of potable water quality, solid and liquid waste, investigation of potential public health issues and to support local authorities to fulfil their environmental and public health obligations.
		Public Health Services - under the Department of Medical and Public Health Services		F, L			O		N	Monitoring the quality of potable water; chemical and microbiological sampling; supervises the appropriate management of solid and liquid waste to prevent environmental contamination. Includes State General Laboratory.
	Cyprus International Institute of Environmental and Public Health				O		O	Y	N	May provide advice in cross boundary incidents and assist with communication between country organisations.
	Environment and Public Health professional and research body	The Association of Health Inspectors Cyprus (APHIC)						Y	N	Set up with the collaboration of Harvard School of Public Health (HSPH) and the Government of Cyprus. May provide advice in cross boundary incidents and assist with communication between country organisations. Associated with the IFEH. Includes State General Laboratory.
Environmental Protection	Ministry of Agriculture, Natural Resources and Environment	Environmental Services						Y	N	Responsibility for hazardous waste, waste discharge, pollution. May provide advice and assistance to responding agencies in a major incident.

7.1.6 Denmark Exposure Assessment and Risk Characterisation Matrix

Category	Agencies		Source		Pathway		Receptor		RC	Comments
Sector	Organisation	Group / Arrangement	Qual.	Quan.	Qual.	Quan.	ID	Comm. Y/N	Y / N	Specifics of role in exposure assessment and or risk characterisation.
Government	Danish Emergency Management Agency (DEMA)	Chemical Division/ DEMA rescue centres	O	E,L	O	L, M, GIS		Y	Y	Governmental agency operating under the Ministry of Defence. Responsibilities include Analytical chemical investigations of unknown substances, Advisory services, including the National Chemical Response Centre. Also undertakes emergency planning includes supervision of other government, regional or municipal agencies and private companies on preparedness planning. Operational centres can provide support for HAZMAT incidents. Use ARGOS software for modelling, GIS and Risk Characterisation.
	Municipalities		O	E	O		O	Y		The municipalities must prepare a contingency plan for all assignments that the municipalities are responsible for, in peacetime or in periods of crisis and war. The Municipalities are responsible for all local Fire and Rescue Service.
	Ministry of Food, Agriculture and Fisheries	Danish Veterinary and Food Administration				L		N	N	The Danish Veterinary and Food Administration (DVFA) is responsible for food safety and health from farm to fork.
	Danish Meteorological institute (DMI)					M		N	N	Meteorological data and predictions. DERMA, ARGOS
Military	Ministry of Defence									See DEMA above
Emergency Services	Police	The National Police/ Local police force	O		O		O	N	N	National police are responsible for high level activities such as terrorism. Local police and sometime national police (depending of scale of incident) provide support in the event of a chemical incident in the form of ensuring public safety
	Fire and Rescue Service	Subject to municipal arrangements	O		O		O	N	N	In Denmark the fire and rescue services are subject to municipality arrangements: the overall responsibility for FRS is with the local municipality. Composition may be Public; Private; Public/Private; volunteer. Frederikssund-Halsnæs Fire and Rescue Service is a private company that provides fire and rescue services to the municipalities of Frederikssund and Halsnæs in the centre of the

										island of Seeland, in Denmark. Frederikssund-Halsnæs is a municipal fire and rescue service and its activities, like all fire and rescue services in Denmark, are overseen at the national level by the Ministry of Defence.
	Fire/ambulance	Subject to municipality arrangements.	O		O		O	N	N	There are a number of ambulance providers. Falck are one private company who provide fire and rescue and ambulance services.
Health	National Board of Health (Sundhedsstyrelsen)	Acute Medical Coordination Centre (AMK) / Public Health Medical Officers	O		O		O	Y	Y	The National Board of Health is a governmental agency under the Ministry of Health. Overall responsibility for health emergency management in the regional health service. The Public Health Medical Officers provide risk communication during and after chemical incidents.
	Faculty of Health Sciences, University of Southern Denmark.	National Institute of Public Health	O		O		O			Formerly housed by the Danish Ministry of the Interior and Health, the NIPH currently resides under the Faculty of Health Sciences, University of Southern Denmark. The research at NIPH is organised in the research programmes: Child health, Health promotion and prevention, Lifestyle and health, Public health in Denmark, Public health in Greenland and Register-based research. Exact role in risk communications in chemical incidents in unclear.
Environmental Protection	Danish Ministry of the Environment.	Environmental Protection Agency				L		Y		The Danish EPA is a part of the Ministry of the Environment. The Danish EPA has the responsibility to serve and advise the Minister of the Environment, within the areas reflected by the 6 organisational divisions. The Ministry performs administrative and advisory functions, as well as licensing. In some cases the EPA will initiate laboratory analysis after a chemical incident.

7.1.7 Estonia Exposure Assessment and Risk Characterisation Matrix

Category	Agencies		Source		Pathway		Receptor		RC	Comments
Sector	Organisation	Group / Arrangement	Qual.	Quan.	Qual.	Quan.	ID	Comm. Y/N	Y / N	Specifics of role in exposure assessment and or risk characterisation.
Government	Local Government	227 local governments (municipalities) in Estonia								33 municipalities are urban and 193 are rural. Each municipality is a unit of self-government with its representative and executive bodies. The municipalities in Estonia cover the entire territory of the country.
	Ministry of the Interior	Local Government Council	O,E	O,E	O,E	O, E	O,E	Y	Y	Overall co-ordinating responsibility for civil protection in Estonia. At the local level, the local Government Council is the highest civil protection authority. The head of the local government crisis management committee is the rural municipality mayor or the city mayor. Local responsibilities are to: Examine and analyse the national crisis management system, including preparedness for emergencies and resolving emergencies while also controlling the functioning of vital (essential) services in local government. Analyse and define possible emergencies, and the possibilities of preventing them or minimising their consequences in local government. Review the risk analysis of an emergency of a certain region. Assist the person responsible for the emergency and obey his orders. Assist all local government agencies, which are responsible for responding to emergencies, in terms of communication systems and coordination of emergencies. Provide training in crisis prevention, preparedness and response for local government Inform the public about the emergency.
	Governmental Crisis Committee									Established in a crisis to manage an incident.
Military										
Emergency Services	Estonian Rescue Board	Ministry of the Interior	E	E	E	E	E		Y	The Estonian Rescue Board has a leading role in planning preparedness for emergencies and the operational management of four Regional Rescue Centres. It is also responsible for the development and implementation of national rescue policies. Civil protection operational resources in the four Regional Rescue Centres belong to the Estonian Rescue Board.

	Rescue and Crisis Management Board									The Rescue Board also represents Estonia in bilateral and multilateral relations in terms of to civil protection and cooperates with the emergency management and civil protection bodies of UN, EU, NATO, and other relevant organisations. Rescue services are divided into four Regional Rescue Centres. The Estonian Rescue Board is a government institution under the jurisdiction of the Ministry of the Interior, which has the leading role in planning preparedness for emergencies and the operational management of Regional Rescue Centres. It is also responsible for the development and implementation of national rescue policies. The main areas of activity for the Estonian Rescue Service are: Rescue Works, National Fire Safety Supervision, Crisis Management, Emergency Prevention, Explosive Ordinance Disposal, Handling Emergency Calls. The Rescue Board represents Estonia in bilateral and multilateral relations related to civil protection and cooperates with the emergency management and civil protection bodies of UN, EU, NATO, and other relevant organisations.
Health	Ministry of Social Affairs									The Ministry of Social Affairs is responsible for health, labour policy and social affairs.
	National Institute for Health Development									
	Health Protection Inspectorate	Ministry of social affairs								HPI is a governmental public health institute under the Ministry of Social Affairs with main responsibility on communicable disease surveillance and control and environmental health control. HPI has 15 county public health offices with one public health officer / epidemiologist in each. Local outbreaks are handled at county level with active support from HPI department of epidemiology. Activity of the epidemiology service is supported by HPI Central Lab for Microbiology and four small regional microbiology labs and Central Lab for Virology. Infrastructure of the department of epidemiology (sub-units);
Environmental Protection	Ministry of the Environment		O,E	O,E	O,E	O, E	O,E			The area of government of the Ministry of the Environment includes: the management of national environmental and nature protection, the performance of tasks relating to land and databases containing spatial data, the management of the use, protection, recycling and registration of natural resources, the radiation protection, the environmental supervision, the management of meteorological observation, nature and marine research, geological, cartographic and geodetic operations, the maintenance of the environmental register and the land cadastre, the management of the use of external funds of environmental protection and the preparation of corresponding strategic documents and draft legislation.

7.1.8 Finland Exposure Assessment and Risk Characterisation Matrix

Category	Agencies		Source		Pathway		Receptor		RC	Comments
Sector	Organisation	Group / Arrangement	Qual.	Quan.	Qual.	Quan.	ID	Comm. Y/N	Y / N	Specifics of role in exposure assessment and or risk characterisation.
Government	Ministry of the Interior	Civil Defence			O		O	Y	N	The civil defence rescue services comprise professional and voluntary fire fighters and other relevant authorities and also local people who have been given a role to specifically assist civil defence where they live or in their place of employment. Services would include facilitating shelter and evacuation; this includes the development of shelter areas within new developments where there is considered to be a shortage.
		Crisis Management Centre Finland			O		O	Y	N	Governmental institution for Civilian Crisis Management. The main tasks of CMC Finland are to Train and recruit experts for International Civilian Crisis Management and Peace-building missions as well as conduct research. CMC may be involved in an incident with cross-boundary implications.
		State Provincial Office					O	Y	N	Oversees the implementation of Environmental Health Legislation within provincial regions. Local authorities oversee the same work within their municipalities.
		Coast Guard under Frontier Guard	O	F	O		O	Y	Y	Search and Rescue, Maritime Safety, Pollution investigation and prevention. Works in collaboration with the Finnish Maritime Administration and the environmental agencies. Maintains appliances and equipment to respond to an incident. The authority also assists with international collaboration in the case of a cross-boundary incident.
	Municipalities	Local Authorities	O		O		O	Y	N	Oversee the implementation of Environmental Health Legislation within their municipality and may assist with the response to incidents, which may comprise requesting assistance from the State Provincial Office, Civil Defence and other agencies as relevant.
			O	L, F	O		O	Y	Y	Local authority food safety inspections. Have access to laboratories to test food stuffs etc. Undertake local scale risk assessment.

			O		O		O	Y	N	Oversee the implementation of Environmental Health Legislation within their municipality and may assist with the response to incidents, which may comprise requesting assistance from the State Provincial Office, Civil Defence and other agencies as relevant. Have specific responsibilities in relation to contaminated land.
			O		O		O	Y	N	Oversee the implementation of Environmental Health Legislation within their municipality and may assist with the response to incidents, which may comprise requesting assistance from the State Provincial Office, Civil Defence and other agencies as relevant. Have specific responsibilities in relation to contaminated land.
	Several Government Ministries (see comments)	The Finnish Safety and Chemicals Agency (Tukes)	E	E	E		E	N	N	Emergency plans; chemical safety; chemicals transportation. TUKES must be informed by Seveso II sites when an incident occurs. TUKES maintain plans in consultation with other authorities. Operates under several Government ministries, with the Ministry of Employment and the Economy in charge of Tukes's administrative steering and supervision and the Ministries of Employment and the Economy, Transport and Communications, Agriculture and Forestry, the Interior, Social Affairs and Health, and the Environment collaborating in and contributing to the agency's steering in their respective branches.
	Ministry of Transport and Communications	Finnish Meteorological Institute		L, F	GIS	M	GIS	N	N	The official expert authority on air quality for Finland, undertaking research, testing and development of air quality measuring methods and equipment, emission inventories, dispersion models and the chemical analyses of air quality. Equipment may be used by companies and municipal local authorities. Air quality and emergency modelling system, SILAM.
	Ministry of Agriculture and Forestry	Provincial and Municipal veterinary officers			O		F,L	N	N	Local animal health issues. The municipalities are also responsible for practical control and veterinary measures in the field of environmental health care in their territories. May observe contamination.
	The Department of Food and Health	The Finnish Food Safety Authority Evira	O	L, F	O	M?	O	Y	Y	The Department is the supreme authority responsible for the safety of food stuffs, the health and welfare of animals and plants. The Finnish Food Safety Authority was set up in 2006 to be responsible for control and inspection in the sectors for which the department of food and health have overall responsibility. Also carry out research and risk assessment on behalf of the Department.
	Finnish Maritime Administration		E		E		E	N	Y	Overall responsibility for investigation of incidents at sea; including chemical and environmental incidents. Has a role to protect the marine environment and ensure safe transport of hazardous goods at sea.

Military	Finnish Defence Forces							Y	N	Will assist the rescue service under the Ministry of the Interior in the event of a large incident, such as a large fire.
Emergency Services	Ministry of the Interior (supported by the Ministry of Social Affairs and Health)	Fire Rescue Services	O	E, F?	O		O, E	Y	Y	Responsibilities include civil defence. They also have the capability to provide other types of rescue operations such as supply ambulance and emergency medical assistance for the municipalities. There are also voluntary and industrial fire brigades. The industrial fire brigades generally operate on hazardous sites. Includes some specially trained Chemical Officers, which may undertake some risk characterisation.
		Police					O	Y	N	Cordon, civil order, delivering shelter and evacuation messages.
		Finn Rescue Force			O		O	Y	N	A force set up specifically to deal with disasters in Finland and is already practicing cross-border with its neighbours, including Russia, Sweden and Norway.
					O		O	Y	N	A force set up specifically to deal with disasters in Finland and is already practicing cross-border with its neighbours, including Russia, Sweden and Norway.
		Emergency Response Centres						Y	N	Emergency services are harmonised in Finland and use one emergency number and a number of ERCs where all operations are managed from. They also use a single radio network, which allows for communication between emergency services and the frontier guards.
		Ambulance and Hospitals			O		O	Y	N	Emergency health care services. Patient observations may assist risk assessment.
Health	Ministry of Social Affairs and Health	Environmental Health			GIS?			Y	N?	Responsible for health protection, chemical, environmental and radiological risk prevention.
		Finnish Centre of Expertise on Chemical Threats	E	E					N	A collaboration network of different expert organisations, health sector, Finnish military, emergency rescue services and Police working with chemical threat preparedness in Finland. (Additional information is provided at FIOH webpages.
		National Institute of Health and Welfare (Environmental Health)		L					Y	Focus on environmental health risk assessment, including research on environmental epidemiology, toxicology, chemical hazards. Maintain their own laboratories.
		Finnish Institute of Occupational Health		L,F					Y	FIOH is committed by the Finnish Ministry of Social Affairs and Health to develop national provisions for situations where the citizen's health could be under threat from chemicals. FIOH maintains C-laboratory preparedness for the state of emergencies and maintains local field groups for chemical emergencies in its areal offices located in six different major cities in Finland.

	Drinking Water Companies			L, F	O		O	Y	Y	Have a responsibility to ensure wholesomeness within their networks. Private water supplies are the responsibility of individual land / supply owners.
Environmental Protection	Ministry of the Environment	Finnish Environment Institute			GIS	M	GIS	N	N	Research and environmental services, including risk assessment, monitoring and modelling. May be called upon in the event of a major or cross-boundary incident.
				L, F?	GIS	M	GIS	Y	Y	Contaminated land and soil quality guidance, support to local authorities. Would assist with a large scale land contamination incident or cross-boundary contamination.
				L, F		M		Y	Y	Responsible for measures against pollution incidents of open waters and ground waters. SYKE is also the nationally appointed competent authority that is empowered to request and give international assistance in response to marine pollution caused by oil or other harmful substances.

7.1.9 France Exposure Assessment and Risk Characterisation Matrix

Category	Agencies		Source		Pathway		Receptor		RC	Comments
Sector	Organisation	Group / Arrangement	Qual.	Quan.	Qual.	Quan.	ID	Comm. Y/N	Y / N	Specifics of role in exposure assessment and or risk characterisation.
Government	Central Government, national level	Directorate of Civil Defence and Security (DSC).							Y	At national level, the general task of the Directorate of Civil Defence and Security (DSC) is to protect the State, persons and property in response to threats of aggression by emerging dangers and against risks, disasters of all kinds and catastrophes. Finally, it also takes part in environmental protection. Its national operational centre (CODIG). Risk characterisation and civil response decisions for high impact and cross-border incidents.
	Central Government, zonal								Y	Zonal operational centres on public safety (COZ) are established in Marseilles, Lyon, Rennes, Bordeaux, Metz and Paris. Inside each defence area, the COZ ensures the coordination of the aid and rescue operations under the authority of the area prefect. Risk characterisation and civil response decisions for high impact and cross-border incidents.
	Local areas - responsibility of each towns mayor.		O	E	O		O	Y	Y	Risk characterisation and civil response decisions. Locality observations. Possible hand held and fixed monitoring equipment. Emergency plans.
	INERIS	COMAH competent authority	O	F, E	O			Y	Y	French National Institute for the Industrial Environment and Hazards. Monitoring of air quality may be by deployable monitoring equipment or by fixed monitoring equipment which is conveniently nearby: http://prevair.ineris.fr/en/introduction.php
	Météo France	Forecasts for input into dispersion modelling: PREV'AIR				M		N	N	Meteorological data and predictions. Météo France provides the weather forecasts required for the system to run correctly, develops the MOCAGE chemistry-transport model and provides its operational implementation for the needs of PREV'AIR

	ADEME	Official Air Quality Monitoring Associations (AASQA)		F		F				The Agency for the Environment and Energy Management (ADEME) is in charge of gathering the measurements published by the Official Air Quality Monitoring Associations (AASQA - Associations agréées de surveillance de la qualité de l'air) into the BASTER real-time database, transferring the measurements to maps and making all these data available to the PREV'AIR system.
	ANSES	National agency for health, food, environmental and work safety								ANSES, the National agency for health, food, environmental and work safety (Agence nationale de sécurité sanitaire de l'alimentation, de l'environnement et du travail http://www.afsset.fr/index.php?pageid=769) was created in July 2010 from the merger of the Afsset (French Agency for Environment and occupational health safety) and Afssa (French Food Safety Agency). It's an agency under the ministry of health.
	CEDRE	Non-profit making association which has a civil protection accreditation	O	L, M, GIS		L			Y	CEDRE is charged with providing advice and expertise to French authorities in cases of accidental water pollution
Emergency Services	Fire and Rescue Service	HAZMAT (Hazardous Materials) team. All the industrial departments have a fire department with a HMRT (hazardous materials response team).	O	F, E	O		O	Y	N	Scene observations. COMAH plans. Use of DIM equipment at the scene. The French Academy for Fire, Rescue and Civil Protection Officers (L'Ecole Nationale Supérieure des Officiers de Sapeurs-Pompiers or ENSOSP) http://www.ensosp.fr/index.php?pages=article&id=619
	Ambulance Services	SAMU	O		O		O	Y	N	Scene observations. On-scene health effects observations. http://www.samu-de-france.fr/en
	Ambulance		O		O		O	Y	N	Scene observations. On-scene health effects observations.
	Police							Y	N	Establishing cordon. Issuing shelter and evacuation advice on-scene.
Health		GPs (General Practitioners = Family / Community Doctors), hospitals						Y	Y	Public health risk characterisation based upon collated observations and information. Health effects observations. Alert and advise for treatment and to minimise cross-contamination.
	Health and Safety Authority	Seveso COMAH competent authority		E				Y	Y	Public health risk characterisation based upon collated observations.

Environmental Protection	Environmental Protection Agency		O	F, E	O		O	N	Y	Can provide mobile monitoring equipment for PM and SOx, NOx. Not a formal arrangement / dedicated cell.

7.1.10 Germany Exposure Assessment and Risk Characterisation Matrix

Category	Agencies		Source		Pathway		Receptor		RC	Comments
Sector	Organisation	Group / Arrangement	Qual.	Quan.	Qual.	Quan.	ID	Comm. Y/N	Y / N	Specifics of role in exposure assessment and or risk characterisation.
Government	Central (Bund)	BBK (bundesamt bevolkerungsschutz und katastrophen hilfe)						Y	Y	Give advice and support with regard to CBRN at county level and regional level.
		BMI (bundesministeriums des innern)								They set the framework for Civil protection (Zivilschutz- und Katastrophenhilfegesetzets). The contents are filled in and maintained by BBK.
	State (16 states)	LandesUmweltamt	O,F	O,F	O,F	O,F				All environmental compartments
		Landesgesundheitsministerie					O	Y		Take care of hospital emergency plans also
	Upperregional (bezirk	Chemical Laboratory	F, L	F, L	F, L	F, L				
		Analytical Taskforce	O, F	F, L,	O, F	F, L,				
	Counties (Kreis)	Umweltamt	O, F	O, F	O, F	O, F				All environmental compartments
		THW (Technische Hilfswerke)	O	F			O	Y		Tasks: (drinking)Water, Logistics, Infrastructure, Search and detection among others
		ABC ErkKW	O	F, L,	O	F, L,				Water, soil, air
	Local (Stadt)	environmental dep	O		O		O	Y	Y	
		Gesundheitsamt					O	Y		Identical to municipal health service Netherlands
Military	AKNZ	Academy Emergency planning civil defense								
	HAZMAT teams	HazMat teams	O, F	O, F	O, F	O, F				At County level
Emergency Services	Fire and rescue	HAZMAT team local	O,F	O,F	O,F	O,F	O,E	Y	Y	
		ABC ErkKW (regional)	O,F	O,F	O,F	O,F	O,	Y	Y	

							E			
	Ambulance		O		O		O	Y		
	Emergency MD	Public Health Advisor HAZMAT	O		O		O	Y		
	Police									
Health	Tox lab	Gift Notruf Zentrale					M	Y	Y	Identical to poison centre - RIVM /NL
	NGO	Arbeiter-Samariter Bund (ASB)					O	Y		Same activities as Ambulance. Also Health care.
		Johanniter Unfall Hilfe (JUH)					O	Y		
		Malteser Hilfsdienst (MHD)					O	Y		
		Deutsche Lebens RettungsGesellschaft (DLRG					O	Y		
		Deutsches Rotes Kreuz (DRK)					O	Y		
Environmental Protection	Landesumweltamt									See Umweltamt (state and county level)
	Umweltamt stadt									

7.1.11 Greece Exposure Assessment and Risk Characterisation Matrix

Category	Agencies		Source		Pathway		Receptor		RC	Comments
Sector	Organisation	Group / Arrangement	Qual.	Quan.	Qual.	Quan.	ID	Comm. Y/N	Y / N	Specifics of role in exposure assessment and or risk characterisation.
Government	Greek / Turkish Governments	Joint standby disaster response unit					O, E	Y	N	Set up following earthquakes in 1999 with the assistance of the UN to enable Greece and Turkey to work together to response to cross-boundary disasters.
	General Secretariat for Civil Protection	General Directorate of Coordination	E		E		E	N	N	Under the general directorate, there are a number of sub-directorates comprising: the civil protection operation centre; the directorate for planning and emergency response; the directorate for international relations, volunteerism, training and publications. These authorities undertake various tasks to assist the local and national Government with responding to a major incident.
	Hellenic Food Safety Authority			L?				Y	Y	Overall responsibility for food safety and would be involved where a cross-boundary issue was identified. Collaborates with national laboratories of other organisations such as the National Chemical Agency, Ministry of Agriculture and Development, Veterinary bodies and rural bodies (territories)
	Local Authorities	Greek municipalities		L?	O		O	Y	Y	Responsibility for local food safety inspections and communicating with the public with regard to risk. Laboratories in house?
			O		O		O	Y	N	The Greek municipalities have responsibility for local functions and resources, including fire fighting, civil protection, hospitals, shelters, environmental protection, farming and fishing and roads.
	Ministry for Environment and Public Works	National Centre for Environment and Sustainable Development						N	N	Reports on air quality, land use and waste environmental indicators on behalf of the Government.
	Ministry of Maritime Affairs, Islands and Fisheries	Directorate for Protection of Marine Environment (D.P.TH.P)	E		E		E	N	Y	Maintains a National and Local Contingency Plans to prevent prepare and respond to incidents which may impact upon the maritime environment or territory. The management and implementation of the local contingency plans are the responsibility of municipal port authorities and rural bodies.

		Unified Coordination Centre for Research and Rescue (E.K.S.E.D)		F, L	O	M	O	N	Y	Coordinates with the Directorate's response to a pollution incident which may impact upon the marine environment. These authorities maintain equipment to investigation, assess, monitor, model and respond to incidents of marine pollution. On scene observations.
		Port Authority	O, E		O		O	Y	N	The management and implementation of the local contingency plans are the responsibility of municipal port authorities and rural bodies.
Military	Hellenic National Meteorological Service					M		N	N	Weather prediction models and forecasts for the public, Government and maritime.
Emergency Services	Hellenic National Centre for Emergency Care (EKAB)	Ambulance	O		O		O	Y	N	Responsible for health emergency transport and coordination, including ambulance, helicopters and marine rescue. Scene and casualty observations.
	Ministry of the Interior - Citizen Protection	Police	O		O		O	Y	N, Y	Establish Cordon; scene observations; assist with sheltering and evacuation. The Ministry of the Interior may have further involvement (including with risk characterisation) where terrorism or a national security incident occurs or is suspected.
		Fire Brigade		E, F			E	Y	N, Y	The Greek Fire Service Rescue Team is a member of SAR and have an International Cooperation Section. They include officers trained to respond to incidents involving chemicals and have a field monitoring capability. No national HazMat teams, the local Fire Service may undertake sampling and give the sample to the General State Chemical Laboratory or to the environmental and health protection state services. In the biggest cities of Greece are established Special Search & Rescue Modules called EMAK, which include basic equipment and personnel also trained to be involved in chemical incidents response if needed.
	Ministry of the Interior - Citizen Protection	Hellenic Coastguard	O		O		O	Y	N	Search and rescue, pollution prevention, response to pollution incidents, maintains emergency vehicles. On scene observations and would coordinate removal of receptors from the scene etc. The coastguard would have an interest in an incident effecting land, where there was the potential for pollution of the maritime environment.
Health	National Health System	Hellenic National Centre for Emergency Care	O		O		O	N	N	Coordinates emergency care - ambulances and emergency hospitals (A&Es). May contribute to casualty and scene observations.

		(EKAB)								
		Greek National Poison Information Centre	O		O		O	Y	N	Funded by the Government; provides advice on acute poisoning and chemical advice to members of the public and health professionals (including hospitals and emergency services). Observations will based upon information communicated to them by other authorities, rather than on the scene etc.
Environmental Protection	Ministry of Environment, Energy and Climate Change		E	E, F/L?	E, GIS		E, GIS	N	Y	Relevant responsibilities: waste management, protection of aquatic environment and management of water resources, protection of the public from air pollution, environmental permitting and protection of the public from industrial pollution, risk management and management of spatial data. They maintain a publicly available GIS (www.geodata.gov.gr) as well as aerial photography. They are also responsible for Seveso II and maintain emergency plans, which are also shared with the Police and Fire Brigade. Field and Lab capabilities?
	National Observatory of Athens	Institute of Environmental Research and Sustainable Development		L, F	O	M	M	N	N	Undertakes a number of relevant activities, which the Government may call upon in the event of a major incident, including: atmospheric modelling, remote sensing and emission modelling, indoor and outdoor air quality monitoring, maintenance of chemical laboratories and environmental and health impact assessments and risk assessment.

7.1.12 Hungary Exposure Assessment and Risk Characterisation Matrix

Category	Agencies		Source		Pathway		Receptor		RC	Comments
Sector	Organisation	Group / Arrangement	Qual.	Quan.	Qual.	Quan.	ID	Comm. Y/N	Y / N	Specifics of role in exposure assessment and or risk characterisation.
Government	National Directorate General for Disaster Management (NDGDM)	Fővárosi Központi Rendeltetésű Mentőszervezet (FKRMSZ) (Central Metropolitan Rescue Service): VFSZ (Emergency Services Intelligence) and VFCS (Emergency Reconnaissance) Teams.	F,O	F,O	F,O	F,O	Y		Y	VFSZ and VFCS Teams deployed to monitor chemical or radio nuclear accidents. Are equipped with DIM equipment.
	Hungarian Met Office and NDGDM	Monitoring, early warning and information system (MoLaRi).	F,O	F,O	F,O	F,O				The MoLaRi system comprises of a series of station positions around Hungary near sites identified as high risk. The sites are capable of monitoring recognised pollutants and local meteorological data, this is then sent to a central MoLaRi data system.
	Hungarian Met Office	Research and Development Department; Pollution and accident modelling and background measurements. Air Quality	F,O, M	F,O, M	F,O, M	F,O, M	Y			Background measurement department capable of monitoring a variety of air pollutants.

		Reference Centre (LRK).								
Military										
Emergency Services	Fire	Combined with Civil Protection to form NDGDM, utilise VFSZ and VFCS teams.	O	O	O	O				
Health										
Environmental Protection	Ministry of Rural Development	National Air Quality Network (OLM).	E,F, O	E,F,O	E,F,O	E,F,O	Y		Y	The Ministry of Rural Development has an overall role in environmental protection with the Secretary of State for Environmental Matters overseeing environmental protection. The National Air Quality Network carries out air quality measurements through automatic stations and manual readings.

7.1.13 Ireland Exposure Assessment and Risk Characterisation Matrix

Category	Agencies		Source		Pathway		Receptor		RC	Comments
Sector	Organisation	Group / Arrangement	Qual.	Quan.	Qual.	Quan.	ID	Comm. Y/N	Y / N	Specifics of role in exposure assessment and or risk characterisation.
Government	Central Government	Major Emergency Management (MEM)							Y	Risk characterisation and civil response decisions for high impact and cross-border incidents.
	Met Eireann					M		N	N	Meteorological data and predictions. Not a comprehensive, formal 24/7 service to Emergency Services.
	Local Authority	Environmental Health / Civil Contingencies. Fixed and mobile air quality monitoring. See also http://www.iaemo.ie/home/	O	E	O		O	Y	N	Risk characterisation and civil response decisions. Locality observations. Possible hand held and fixed monitoring equipment. Emergency plans.
Military	Irish Defence Forces			F						Have CBRN detection identification monitoring teams, but typically for CBRN not large chemical incidents.
Emergency Services	Fire and Rescue Service	HAZMAT (Hazardous Materials) team	O	E	O		O	Y	N	Scene observations. COMAH plans. Use of DIM equipment at the scene.
	Ambulance		O		O		O	Y	N	Scene observations. On-scene health effects observations.
	An Garda Síochána (Police)							Y	N	Establishing cordon. Issuing shelter and evacuation advice on-scene.

Health	Health Services Executive	Public Health Specialist provide health advice to stakeholders / multi-agency meetings GPs (General Practitioners = Family / Community Doctors)						Y	Y	Public health risk characterisation based upon collated observations and information. Health effects observations. Alert and advise for treatment and to minimise cross-contamination.
	Health and Safety Authority	Seveso COMAH competent authority		E				Y	Y	Public health risk characterisation based upon collated observations, information.
Environmental Protection	Environmental Protection Agency		O	F, E	O		O	N	Y	Can provide mobile monitoring equipment for PM and SOx, NOx. Not a formal arrangement / dedicated cell.

7.1.14 Italy Exposure Assessment and Risk Characterisation Matrix

Category	Agencies		Source		Pathway		Receptor		RC	Comments
Sector	Organisation	Group / Arrangement	Qual.	Quan.	Qual.	Quan.	ID	Comm. Y/N	Y / N	Specifics of role in exposure assessment and or risk characterisation.
Government	Department for Civil Protection (DPC).	National Research Council (CNR).	F,O	F,O	F,O	F,O	Y		Y	CNR is responsible for assimilating the knowledge/ data required for the DPC. It is composed of the various research centres and organisations involved in environmental research.
	National Research Council (CRN).	IMAA (Institute for environmental analysis), IRC (Institute for combustion research), ISAC (Institute of atmospheric sciences and climate), UORECI (Operational research unit for emergencies in industrial chemistry), CONPRICI (National consortium for the protection of industrial chemical risks), ISPRA (Environmental protection and research).	F,O	F,O	F,O	F,O				UORECI and CONPRICI can carry out field monitoring of chemicals in the environment/ atmosphere. CONPRICI keeps a record industrial sites and the processes taking place at the for the purpose of civil protection.
Military										

Emergency Services	Fire (Vigili del Fuoco).	CRRC/ NBC (CBRN department/ equipment) of the National Fire Service (Corpo Nazionale dei Vigili del fuoco).	F,O	F,O	F,O	F,O	Y		Y	Capable of identifying CBRN material, with HAZMAT suits.
	Ambulance.	Provision throughout the country varies greatly by region.	O	O	O	O				Some regions have an ambulance service provided by the local hospital whilst in others regions volunteer organisations such as the Italian Red Cross provide the ambulance service.
Health										
Environmental Protection	ISPRA (Environmental protection and research).	Air quality assessment department.								ISPRA is the network that coordinates the regional environmental protection and research centres.

7.1.15 Latvia Exposure Assessment and Risk Characterisation Matrix

Category	Agencies		Source		Pathway		Receptor		RC	Comments
Sector	Organisation	Group / Arrangement	Qual.	Quan.	Qual.	Quan.	ID	Comm. Y/N	Y / N	Specifics of role in exposure assessment and or risk characterisation.
Government	Ministry of the Interior	Prime Minister	E		E					The Prime Minister is responsible for the continuous function of the operation of the system and the implementation of the tasks and fulfilment of its obligations. Civil protection operations are planned, coordinated, led and controlled by the SFRS under the Ministry of the Interior
		State Fire and Rescue Service(SFRS)	E		E					The main responsibility on the State level for CEP rests with the State Fire and Rescue Service (SFRS) under the Ministry of the Interior
		The Crisis Management Council								
Military	National Armed Forces	Defence Forces, the Home Guard and the Reserve Forces	O	O	O	O	Y		Y	The National Armed Forces consist of the Defence Forces, the Home Guard and the Reserve Forces. The duty of the Armed Forces is to participate during peacetime emergency operations as stated in the Armed Forces Law. Their main tasks are as follows: o to support civilian services with manpower, vehicles, communication and life-support equipment o to participate in the maintenance of public order o to participate in rescue work o to fulfil specific tasks, such as blowing o up ice on rivers, clearing mines, decontamination, etc.
Emergency Services		State Fire and Rescue Service								
	Red Cross	Ambulance Service	O	O	O	O				Latvian Red Cross is the auxiliary to public authorities in the disaster preparedness and humanitarian field

Health	Ministry of Health									
Environmental Protection	Ministry of the Environment of Latvia.	Latvian Environment, Geology and Meteorology Centre	L,E,O	L,O	L,O	L,E,O	Y	Y	Y	The State Ltd “Latvian Environment, Geology and Meteorology Centre” (LEGMC) is a governmental institution under the supervision of the Ministry of the Environment of Latvia. It ensures the implementation of national policy in the areas of environment protection, meteorology, climatology, hydrology, geology and hazardous waste. environment laboratory testing; o management of environmental data, maintenance of databases on water resources and inland water quality, air emissions, air quality, chemicals, waste management, protected nature areas, protected biotopes and species, and polluted areas; o supervision of subsoil resources and insurance of rational subsoil use.

7.1.16 Lithuania Exposure Assessment and Risk Characterisation Matrix

Category	Agencies		Source		Pathway		Receptor		RC	Comments
Sector	Organisation	Group / Arrangement	Qual.	Quan.	Qual.	Quan.	ID	Comm. Y/N	Y / N	Specifics of role in exposure assessment and or risk characterisation.
Government	Ministry of the Interior	Government Department	E	E	E	E		Y		Co ordinates part of the Civil Protection and Rescue System to prepare for an emergency
	State Food and Veterinary Service	Reports to national government	E,F,L,O	E,F,L,O	E,F,L,O	E,F,L,O	Y	Y	Y	The State Food and Veterinary Service (SFVS) is the Central Competent Authority with overall responsibilities in relation to food and feed safety, animal health and animal welfare. The National Food and Veterinary Risk Assessment Institute (NFVRAI), under the SFVS, is the main public laboratory performing official analyses in the foodstuffs, drinking water and veterinary area. The NFVRAI provides diagnostic and scientific support to the SVFS. The Food Risk Assessment Unit, Veterinary Risk Assessment Unit and Veterinary Medicines and Biocides Risk Assessment Unit of NFVRAI are responsible for risk assessment and risk communication in relation to food and feed safety, provide support and recommendations on minimising the effect of risk factors on the safety of food, animal health and welfare and the environment. The Emergency Response Department of the SFVS is the National Contact Point for The Rapid Alert System for Food and Feed (RASFF). Where unsafe foodstuffs are found on the market, notifications are submitted to the national contact point, which is responsible for assessing the information and issuing alerts through the RASFF. According to Governmental Resolution of 20 October 2010 No. 1503 for the State Emergency Management Plan, SFVS is responsible for organising water, animal and non-animal food, animal feed laboratory tests and risk assessment. SFVS has the general plan for crisis management referred to in Article 55 of Regulation (EC) No 178/2002. Prepared Food and Feed crisis contingency plan activated without

										delay when feed or food is found to pose a serious risk to humans or animals either directly or through the environment.
Military										
Emergency Services	Fire & Rescue Department	Reports to Ministry of the Interior	O, E		O, E		Y	Y	Y	The Fire and Rescue Department (FRD) is responsible for protection of people, property and environment in case of emergencies. In addition it is in charge of fire and emergency prevention. FRD is assigned to determine the national policy of the fire and civil protection in the country, lay down strategies for its subordinate services, draw up fire and civil protection legislation an see to its enforcement, control the state fire supervision, provide counselling to the public institutions and businesses in the field of civil protection, coordinate fire and civil protection training, give advice to the public in fire and civil protection matters, record fire and rescue statistics, encourage NGO's and volunteer organisations in the field of fire protection. Therewith, FRD warns and informs state institutions, economic entities and population about a nationwide disaster that threatens human lives, health, property and environment in the event of an emergency.
Health	Ministry of Health	Health Emergency situations centre (HESC)	E		E				Y	The main aim of the Health Emergency Situations Centre (HESC) - to participate in implementation of the strategy (policy) of the Government of Lithuania in the field of health emergency management; to create and implement national health emergencies' management system; to coordinate preparedness and activities of the institutions of the National Health System in case of emergency. The main objectives: • to coordinate the preparedness and activities of the National Health System institutions in case of emergency; • to implement the roles and responsibilities of the National WHO International Health Regulations Focal Point and to participate in the implementation of WHO International Health Regulations (2005) in Lithuania; • to coordinate the dispatch functions of the emergency medical services; • to monitor and advise on poisonings (Poison control bureau is department of HESC) • to administer State Medical Reserve, ensure its target use in case of crisis and emergencies. Health Emergency Situations Centre of the Ministry of Health is - Emergency 24/7 Contact Point for receiving and exchange of information on all kind of emergencies for

										institutions of National Health Care System, European Union institutions (EWRS, RAS-BICHAT), WHO, other international organisations. HESC was designated as National WHO IHR Focal Point in 2006. HESC organise daily activities of Emergency Operations Centre of the Ministry of Health. Organise workshops, conferences, exercises in the field of heath emergencies management. <u>Functions:</u> - Accessibility at all times (24/7) - Communication with WHO IHR Contact Point - Dissemination of information to national authority - Consolidating input from relevant sectors, including those responsible for surveillance and reporting, points of entry, public health services, clinics and hospitals and other government departments. HESC of the MoH Poison control bureau specialists participate in the ASHT project (Alerting System for Chemical Health Threats Phase II) According this project RAS-CHEM will be extended and developed into a health monitoring system for chemical health threats. To further develop RAS-CHEM and incorporate the EUPC Forum as an integral Component of RAS-CHEM that will be part of the assembly of EU rapid alert systems. <u>In case of chemical emergency:</u> - Exchange of information with Public Health Centres (10 regional institutions – it depends on localisation of event), Lithuanian Fire and Rescue Department (for specification of information), the Environmental Protection Agency (EPA) of the Ministry of Environment (for air tests outside, if necessary), National Public Health Surveillance Laboratory (NPHSL) under the Ministry of Health (for air tests inside of building, if necessary). If necessary to the Lithuanian Hydrometeorological service under the Ministry of Environment about weather forecast and dominant wind direction. - Public information, advising with regard to measures (website http//:www.essc.sam.lt, The Media) - Information flow about event to the Ministry of Health (Public Health department.) - In case of major chemical accidents – set up of Emergency operation centre of the Ministry of Health, make certain its

									activities.
	Centre for Health Education and Disease Prevention						Y	N	The centre focuses on the prevention of environmental risk factors in the following areas: air pollution, water pollution, disease and injury prevention, child safety, living environment and housing, global environmental issues, such as climate change. The centre provides technical support for the Ministry of Health in co-ordination the implementation of a number of international commitments. It also deals with health promotion issues. The Centre is receiving annual reports from the State and Food Veterinary Service on drinking water quality and develops reports to the Ministry of Health. The centre gathers information on the national list of environment and health indicators. It issues public communications in case of increase air pollution and other events threatening public health.
	Public Health Department of the Ministry of Health							Y	Summarising of information and decision making
	County Public Health centres (10) – (PHC)		F, L		F, L		Y	Y	It depends on localisation of event which PHC will take measures in their own region: - Organises air tests inside of building (if necessary) - sampling and transportation to the National Public Health Surveillance Laboratory (NPHSL) under the Ministry of Health. - Exchange of information with other institutions (Environmental Protection, State Food and Veterinary service etc) - for specification of information about event, for receiving data of air, water, soil, food etc tests results and their assessment (according aspect of public health impact) - Restriction of Institution’s activities in the contaminated area - Public information, advising with regard to measures. - Recommend to implement public health measures (safety of living place, personal protective measures, necessity of evacuation etc.) - Information flow to the Health Emergency Situations Centre of the Ministry of Health, to the Emergency Operation Centre of Municipality, to the Public and The Media (about tests results etc).

		Radiation Protection Centre Reporting to Ministry of Health	F	F						Coordinates the activity of the executive branch of government and other bodies of public administration and local government in the field of radiation protection. It does this by exercising state supervision and control of radiation protection, monitoring and expert examination of public exposure. The main objectives of the Radiation Protection Centre are to: protect members of the public and radiation workers from the hazardous effects ionising radiation; coordinate the radiation protection activities of different agencies; and organise and conduct supervision and control of radiation protection, evaluation and expertise as it pertains to the exposure of members of the public and radiation workers.
Environmental Protection	Environmental Protection Agency of the Ministry of Environment	Environment Research Department Marine Research Department Environmental Impact Assessment Department	O	F, L	O	F, L			Y	The Environment research department performs different types of environment quality examination: air, water, water objects (rivers, lakes) ground, natural ecosystems studies; also performs national level research on pollutant emissions and environment pollution in extreme situations. Performs investigations in case of extremely large incidents, including emergency, contamination. Investigates potential environmental pollution from existing or newly established technologies. Organises and performs according to the competence chemical, biological and radiological investigations of environment and pollution sources', coordinates applied and other scientific environmental research, programs and projects.

7.1.17 Luxembourg Exposure Assessment and Risk Characterisation Matrix

Category	Agencies		Source		Pathway		Receptor		RC	Comments
Sector	Organisation	Group / Arrangement	Qual.	Quan.	Qual.	Quan.	ID	Comm. Y/N	Y / N	Specifics of role in exposure assessment and or risk characterisation.
Government	Ministry of Home Affairs and Greater Regions	Interagency Co-ordination (CSPN) Crisis Cell (**CC**)							Y	Civil protection being a governmental organisation does not coincide with the administrative structure which initiates, CC Coordinates and monitors the execution of all measures destined to counter the consequences of a crisis and to favour recovery.
		Command post of ASS Luxembourg Rescue Services Agency (Administration des services de secours - ASS)	E		E		Y	Y	Y	The Luxembourg Rescue Services Agency (Administration des services de secours - ASS) is subordinate to the Minister of Home Affairs and the Greater Region which assures the political and administrative authority of the ASS. The administration was established by the Act of 12 June 2004, merging the Civil Protection and the General Inspectorate of the Fire Brigades within the same integrated body. The ASS in Luxembourg consists of 55 civil servants and employees. 15 operators serve the Emergency Assistance Centre (CSU-112). Leads rescue operations and reports to the Minister of Home Affairs and the Greater Region. The ASS is responsible for implementing all the necessary measures and means, which must be taken in order to protect and supply aid to the population and to safeguard the national inheritance and other assets. The ASS is responsible for the organisation of the first aid, rescue and transport of victims needing medical care.
		Ministerial Council for National Protection	E	E	E	E				The Ministerial Council for National Protection (**CMPN**) which determines mainstream policy, defines objectives and ensures strategic control during implementation. For very large incidents with national impact, the inter-agency coordination is assured by the CSNP.
Military		Civil-military								Civil-military cooperation is an intrinsic part of the national security framework. It operates without special regulations in Luxembourg. This mechanism is tested in national and international exercises

Emergency Services	Town Councils	Fire Service	O	O	O	O	Y	Y	Y	fire brigades are local bodies placed under the authority of the town councils At local level, the mayor, head of a municipality, has obligations to his community and is responsible for the safety of the population. He has the obligation to operate and supervise the municipal fire brigade. For small local incidents, the mayor will take the lead of the operations (or the chief of the local fire brigade representing the mayor). In case of large incidents lying beyond the local means, the coordination of operations is assured by the ASS, in most cases by an inspector of the Fire and Rescue Division of the ASS. In case of even larger incidents, the Director of the ASS nominates a person responsible for the Operational Command Post (OPC), depending on the nature or extent of the incident or on the number of forces involved.
	Luxembourg Red Cross	Ambulance	O	O	O	O				The Luxembourg Red Cross acts as auxiliary to the public authorities
Health	Ministry of Health	LNS, National Health Laboratory	L		L		?	?	?	The LNS, National Health Laboratory, (Laboratoire National de Santé, http://www.lns.public.lu/index.html) is an institution with functions of national laboratory of reference in some domains and with expert functions in public health matters. The activities performed are organised in several domains: cancer, infectious diseases, toxicology, medicines control, hereditary diseases, biological and environmental surveillance and food safety. The LNS collaborates with other public institutions to perform research in the area of medicines, microbiology, haematology and toxicology.
		CRP-Santé, Public research centre for health								Public Health; Clinical and epidemiological investigations.
Environmental Protection										

7.1.18

7.1.19 Malta Exposure Assessment and Risk Characterisation Matrix

Category	Agencies		Source		Pathway		Receptor		RC	Comments
Sector	Organisation	Group / Arrangement	Qual.	Quan.	Qual.	Quan.	ID	Comm. Y/N	Y / N	Specifics of role in exposure assessment and or risk characterisation.
Government	Ministry for Justice and Home Affairs	Malta Civil Protection Department	E		E			Y		The main scope of the Civil Protection Department is to safeguard human lives, property and the environment. The Department is established under the relevant legislative act (Civil Protection Act XV, 1999) to maintain a national system of prevention, preparedness and response to any Disaster which might affect the Maltese community. Responsible for fire and rescue services both land and sea
	Office of the Prime Minister	Local Government	O		O					
		Marine Section								
Military	Office of the Prime Minister	Defence Armed Forces								If asked by The Department of Civil Protection – can provide assistance and will report back to the department
		Environmental Upgrade Committee								
Emergency Services	Civil Protection Department - Stations	Fire Rescue Service	O		O					Scene observations.
		Malta Police Corporation	O		O					Establishing cordons
		Ambulance service	O		O					Scene observations. On-scene health effects observations.
		Malta Maritime Authority								
Health	Ministry for Social Policy	Public Health Laboratory	L	L	L	L		N		Generally supports and provides essential technical backup services for other units and sections within the Department for Environmental Health. The laboratory is equipped to test water and food for chemical

	Department for Environmental Health									and bacteriological analysis.
		Malta National Laboratory	L	L			N	N	N	The MNL provides a diverse range of testing services to various clients from the public and private sectors. The impartiality and competences of the MNL are particularly attractive to clients who require testing for reasons of trade, quality and conformity, procurement, regulatory purposes, consumer protection and environment.
		Environmental Health	E				N	N	N	Department for Environmental Health and MEPA actively collaborate in areas such as policy formulation, research, legislation and implementation.
Environmental Protection	Malta Environment and Planning Authority		F, O	F, O	F,O	F,O	Y			MEPA is responsible for the monitoring of air pollution in ambient outdoor air and for coordinating policy measures. As part of the requirements of the Preliminary Assessment of Air Quality in Malta (Stacey and Bush, 2002), a need to install four fixed air monitoring stations was identified. Presently, MEPA runs four automated real time measuring stations in Malta which are situated at fixed sites: a traffic site in Msida, at Kordin (at point of maximum ground level concentration for the plume from the Marsa Power Station), an urban background site in Zejtun and in a rural background site in Gharb, Gozo. Three of the above mentioned five stations have been part financed by two European Funding Programmes, namely Transitional Facility 2004 and the European Regional Development Fund 2004-2006. These stations cover all pollutants requiring monitoring and reporting under the Air Quality Framework Directive and the four Daughter Directives.
	The Malta Resources Authority		L	**L**	L	L				The Malta Resources Authority is a public corporate body with regulatory responsibilities relating to water, energy and mineral resources in the Maltese Islands. It was set up by the Maltese Parliament through the Malta Resources Authority Act of 2000. The MRA has wide ranging responsibilities essentially involving regulation of water and energy utilities, industrial enterprises exploiting resources such as oil exploration, quarry operators and private abstractors of groundwater, retailers, operators and tradesmen in the regulated sectors. With the coming into force of the Malta Resources Authority Act, which provided for a separation of the regulatory functions from the operational ones, the Directorate for Water Resources Regulation was established and vested with the exercise of regulatory functions for water resources. Some of these functions were previously performed by the Water Services Corporation and the latter now remains solely an operator.

7.1.20 Netherlands Exposure Assessment and Risk Characterisation Matrix

Category	Agencies		Source		Pathway		Receptor		RC	Comments
Sector	Organisation	Group / Arrangement	Qual.	Quan.	Qual.	Quan.	ID	Comm. Y/N	Y / N	Specifics of role in exposure assessment and or risk characterisation.
Government	Central Government	National Crisis Center (NCC)						Y	N	The Minister of the Safety and Justice is responsible for the centralised coordination of order and safety measures. The National Coordination Centre plays a key part in the fulfilment of this responsibility. It arranges the information supply between the various administrative layers and, if other countries are also involved, it makes contact with the countries surrounding the Netherlands. The NCC also provides facilities that enable policy teams and government officials to operate effectively during an escalated situation. In the Netherlands an incident escalates through the Coordinated Regional Incident Control Procedure. It runs up to 4 levels. At level 4 the NCC will be operational
	Local authority (veiligheidsregio)	Command Mayor						Y	N	Mayors have overall administrative and operational command in their municipality. The mayor issues orders to the operational supervisor to direct the operations of the operational organisations performing the work also in case of chemical incidents
Military	Joint CBRN Center	CBRN unit	O	F,L	O	F,L	O	N	N	
	EODD	Bomb Squad	O	F				N	N	
Emergency Services	Fire and rescue Services	Hazmat advisor (AGS)	O	F,E	O	F,E	O	Y	y	Gives advice to Duty officer Fire Services about the affected area, decontamination and chemical incident management
		LIOGS	O		O		O	N	y	National Information Centre for Hazmat incidents, manned round the clock and gives second opinion advice to fire services.
		Hazmat teams (MPL, WVD)			O	F	O	N	N	

	Police	Explosive Investigation team	O	F,E				?	N	Assessment of risks and dangers at (possible) CBRN incidents, only operates when a threat is perceived. Is part of the Ministry of Defence and has 24 disposal teams, which work in the Netherlands as well as in territories where they have been posted.
	GHOR	Public Health Hazmat advisor (GAGS)	O		O		O	Y	Y	Public health assessment and first responder health assessment during hazmat incidents
Health	GHOR	Hospitals, Ambulances					O	N	N	GHOR coordinates the deployment of medical services ('white column') during disasters and serious accidents. GHOR is responsible for the following disaster control processes: "Medical Assistance – Somatic", "Psychosocial assistance in accidents and disasters" and "Preventive Public Health Care".
	Regional Public Health Services (GGD)	GP, Public Health Environmental Advice (MMK)	O		O		O	Y	Y	Municipal or Inter-municipal Health Service that performs public health tasks assigned to the local authority.
	RIVM	Centre for Public Health and the Environment (cGM)	O		O		O	N	Y	Supports and gives advice on Health Impact Assessment of disasters including chemical disasters
	University Medical Centre Utrecht	National Poisons Information Centre (NVIC)	O		O		O	N	Y	This centre specialises in conducting extremely rapid risk analyses following human exposure to potentially hazardous substances. The resulting information and advice is used to benefit individual patients or groups of people affected by a major incident. Given the urgent nature of its activities, the centre is manned around the clock to provide immediate assistance. A secure website is available (www.vergiftigingen.info – in Dutch only) to assist medical professionals in making their own risk analyses following exposure to a toxic substance.
Environmental Protection	Emergency Planning and Advisory Unit (BOTmi) - backoffice (hosted by Ministry of Environment and Infrastructure)	KNMI (metoffice), RIVM (external safety) , nVWA (foodsafety), Waterservice, NVIC (tox), Regional Environmental Agency (DCMR), Rikilt (Foodsafety), Defence (tox), NVBR (fireservice	O	F,L	O	F,L,M	O	N	Y	After a disaster, the effects on the environment and public health can be assessed quickly and comprehensively. Backed by the expertise working together in BOTmi, the team can identify a large number of chemical substances in polluted material, and advise on the nature of the pollution, and the threat it poses to man, animal, food and the environment. Working method is a virtual crisis management tool for national emergencies. It coordinates 6 ministries and 10 scientific institutes in order to provide advice through a secured website to local and national teams responding to disasters and accidents.

		association)								
	RIVM	air quality cell			O	F		N	N	fixed location monitoring, particulate matter, SOx, NOx
	RIVM	Environmental Incident Service (MOD)	O	F,L	O	F,L	O	N	Y	The MOD provides a nationwide service and is available 24 hours a day. The MOD assists the emergency services and disaster control organisations in determining the possible health impact and environmental damage of environmental disasters and incidents. Its task is an extension of that of the fire department in the impact area. To carry out its task, the MOD has at its disposal a number of advanced mobile sampling, detection and analysis units which are operated by specially trained experts. Besides its calculation models (dispersal and exposure levels) and extensive information files on hazardous substances the MOD can also draw on RIVM's comprehensive environmental and health expertise.

	National Laboratory Network					L	N	N	The LLN-TA's mission is to provide the authorities with timely and accurate analysis results, so that suitable measures can be taken. The LLN-TA is a virtual institute to which many Dutch research institutes are affiliated, namely: RIVM, NFI, TNO, Government Institute for Quality Control of Agricultural Products (RIKILT), Central Institute for Animal Disease Control (CIDC), Kiwa certification and research, Food and Consumer Product Safety Authority (VWA) and the Customs laboratory. These research institutes jointly provide the total analytical capacity for possible issues that occur in an emergency or terrorist attack in which CBRN agents are involved. It should be stressed that the LLN-TA is only activated in the case of good and well-founded reasons for suspecting the presence of chemical, biological or radiological substances either separately or in combination. Good and well-founded reasons for suspicion are only deemed to exist if the results of the initial observations, threat and risk analysis and investigation have established that there is a basis for believing that the risk of a serious threat actually exists. The LLN-TA has a physical collection office at the RIVM location.

7.1.21 Poland Exposure Assessment and Risk Characterisation Matrix

Category	Agencies		Source		Pathway		Receptor		RC	Comments
Sector	Organisation	Group / Arrangement	Qual.	Quan.	Qual.	Quan.	ID	Comm. Y/N	Y / N	Specifics of role in exposure assessment and or risk characterisation.
Government	Central Government	Government Centre for Security (RCB)							Y	Risk and threats analysis on the basis of information prepared by all 'crisis units' under public administration and data from international partners; Civil response decisions for high impact and cross-border incidents.
		*Inter ministerial Team for Terrorist Threats *The Counter – Terrorist Centre of the Internal Security Agency							Y	Coordination and analysis units in charge of preventing and combating terrorism. (under the command of ABW - Internal Security Agency
	Ministry of the Environment	Chief Inspectorate for Environmental Protection (GIOS) *State Environmental Monitoring System *Department of Major Accidents Counteracting		M		M		Y	Y(env)	Observational air quality data from network of fixed air quality monitoring equipment. Emergency plans.
		Voivodship Inspectorates for Environmental Protection (WIOS)	O	F, L, E	O	F, L, E	O	Y	Y	Hand held and vehicle based monitoring equipment. Emergency plans.

	Ministry of the Interior and Administration	Institute of Meteorology and Water Management (IMGW)						N	N	Meteorological data and predictions.
		National Headquarters of the State Fire Service (KGPSP) *National Centre for Co-ordination of Rescue Operations and Civil Protection (with local departments) (KCKRiOL)		E		E	GIS (O)	Y	Y	Analysis; Rescue Procedures Approval; Emergency Plans etc.
		National Headquarters of the Police (KGP) *Anti-terrorist Operations Bureau **PWGT – Police Working Group on Terrorism				E			Y(terr)	*ATLAS (cooperation within EU connected with police intervention abroad in case of crisis situation) **cooperation within EU
Military	Ministry of National Defence	Central Unit of Pollution Analysis	O	F, L, E	O	F,L,E	O	Y	N (Y ad hoc)	National System of Pollution Detection and Alarming
		chemical corps	O	F, E	O		O	Y	N (Y ad hoc)	In case of serious incidents - chemical corps are called upon for assistance and help for fire brigades
Emergency Services	Fire and Rescue Service	Specialised Chemical and Ecological Rescue Groups	O	F, E	O		O	Y	N (Y ad hoc)	Scene observations. Establishing cordon. Issuing shelter and evacuation advice on-scene. Analysis at the scene.

	SPOT	System of Dangerous Materials Transport Assistance	O	F, E	O		O	Y	N (Y ad hoc)	Fire and Rescue Service agreements with chemical plants. Advice and help (on the phone or directly) in case of accident.
	Ambulance		O		O		O	Y	N	Scene observations. On-scene health effects observations.
	Police							Y	N	Establishing cordon. Issuing shelter and evacuation advice on-scene.
	Chemical Rescue Units in chemical plants		O	F, E	O		O	Y	N (Y ad hoc)	Scene observations. Establishing cordon. Issuing shelter and evacuation advice on-scene. Analysis at the scene.
Health	Health Care System	Toxicological Information in Acute Intoxication Units (i.e. in NIOM)					O	Y	N	Provide medical advice by phone in case of intoxication.
		Hospitals					O	Y	N	Health effects observations.
		GPs (General Practitioners = Family Doctors)					O	Y	N	Health effects observations.
	NIOM	*Chemical Safety Department (Risk Assessment Unit) *Department of Environmental Health Hazards *Department of Environmental Epidemiology					GIS	Y	Y	Public health risk characterisation based upon collated observations, information and GIS.
Environment	Institute of Environmental Protection			M,F	O	M,F	O	N	Y	*State Environmental Monitoring System *expertises and advice on environmental pollution matters

7.1.22 Portugal Exposure Assessment and Risk Characterisation Matrix

Category	Agencies		Source		Pathway		Receptor		RC	Comments
Sector	Organisation	Group / Arrangement	Qual.	Quan.	Qual.	Quan.	ID	Comm. Y/N	Y / N	Specifics of role in exposure assessment and or risk characterisation.
Government	Met office	Instituto de metereologia				M?		N	N	Weather modelling and predictions. Would support regional and national authorities in the event of a major incident.
	Ministry of the Interior	National Authority for Civil Protection					E	N	N	The civil protection system integrates the National Authority for Civil Protection (ANPC), the Regional Services for Civil Protection in the Azores and Madeira (SRPC), the District Commands for Relief Operations (CDOS, one in each district) and the Municipal Services for Civil Protection (SMPC, one in each municipality). A National Coordination Operation Centre is run in the event of a major incident. Portugal has a number of bilateral agreements with other countries.
	Ministry of Environment	Institute for the Environment and General Environment Inspectorate	O, E	E, F?	O	M?	E	N	Y	Responsible for environmental quality. May provide support to local and regional authorities in the event of a major incident. Seveso II competent authority.
	Ministry of Science, Technology and Higher Education	The FCT, Science and Technology Foundation		L?				N	Y?	Promoting the advancement of scientific and technological knowledge in Portugal, exploring opportunities that become available in any scientific or technological domain to attain the highest international standards in the creation of knowledge, and to stimulate their diffusion and contribution to improve education, health, environment, and the quality of life and well being of the general public. Includes the Scientific Council for Natural and Environmental Sciences. May provide support in the event of a major incident.
	Local Authorities	The National Association of Portuguese	O, E		O		O	Y	N	Includes regional and local level Emergency Operation Centres to be activated in the event of a major incident. Responsible for general public health on a local and regional level.

		Municipalities								
		Environment Regional Authorities	O		O	M?	O, GIS?	Y	Y	The Environment Regional Authorities are responsible for the evaluation and monitoring of air quality in their regions as well as for collaborating air quality plans or programmes. There are commissions for coordination and regional cooperation.
Military	Armed Forces							Y	N	Part of Civil Protection Arrangements, to support the civil agencies as required.
Emergency Services	Fire National Service		O	F?	O		O	Y	N	National Directorate for Fire Brigades and The Portuguese Fire League. The Portuguese Red Cross also provides voluntary aid for civil protection, including a fire brigade.
	Police and National Guard		O		O		O	Y	N	Civil order and protection, including shelter and evacuation advice. Coordinating with other authorities.
	Ambulance Service	SAMU	O		O		O	Y	N	Ambulance service coordinated through SAMU.
Health	Ministry of Health	National Health Service and National Institute for Medical Emergency						N	Y	The High Commissariat for Health (Alto Comissariado da Saúd) has the responsibility of coordinating the Ministry of Health activities in the fields of strategic planning and international relations. The National Institute for Medical Emergency coordinates the emergency services. Would have a part to play in the event of a major for cross boundary incident.
	INSA, National Institute of Health						L, F?	N	Y	State Laboratory of the health sector, national reference laboratory and national health.
Environmental Protection	Portuguese Environment Agency	Including the National Environmental Reference Laboratories (LRA)		L, F?			GIS?	N	Y	Environmental reference laboratories with the capability of analysing air, water and land. Would also be involved in incident response where required by the local and regional authorities.

7.1.23 Romania Exposure Assessment and Risk Characterisation Matrix

Category	Agencies		Source		Pathway		Receptor		RC	Comments
Sector	Organisation	Group / Arrangement	Qual.	Quan.	Qual.	Quan.	ID	Comm. Y/N	Y / N	Specifics of role in exposure assessment and or risk characterisation.
Government	Government (Ministry of Interior and Administrative Reform)	National Committee for Emergency Situations (strategic)	O	E	O		O		Y	In case of an emergency situation, a National Committee for Emergency Situations comes into action, overseeing directly General Inspectorate for Emergency Situations and working closely with the other ministries involved in a given crisis situation, to ensure the horizontal coordination
		General Inspectorate for Emergency Situations (GIES) (Operational)	O	E	O		O	Y	Y	GIES ensures unitary countrywide application of the legislation in force as regards human, assets and environment defence against fire and disasters, the civil protections measures and the emergency situations management. It runs as a national point of contact for the governmental and nongovernmental organisations and institutions with responsibilities in the emergency situations field and ensures coordination and specialised control of the professional and voluntary community public services for emergency situations.
	County Prefect	County Committees for emergency situations	O		O		O	Y		Work with local committees for emergency situations and communicate upwards to GIES
	Mayor- Local Level	Local committee for emergency situations	O		O		O	Y		Work with the operative centre and the emergency cell to coordinate information and communicate upwards to the County committees for Emergency Situations
	Government- Ministry of Environment and Forests	The National Metrological Administration				M				Meteorological data and predictions. SIMIN - Integrated Meteorological Information System, provides information on weather conditions in the event of an emergency

		National Veterinary and Food Safety Authority (ANSVSA)		L						Responsible for managing food safety, have laboratory capabilities and ability to communicate messages to partners in emergency
Military	Ministry of National Defence	Centre for Emergency Situations	O		O		O			The centre for emergency situations liaises directly with the General Inspectorate for Emergency Situations. The ministry of National Defence has a major role in the consequence management process, depending on the emergency situation
Emergency Services	Police	General Inspectorate for Criminal Investigations/ Romanian Intelligence Services (SRI)	O		O		O		N	Part of the Ministry of Interior and Administrative Reform. Deal with serious crime such as terrorism
	Ambulance	Bucharest Ambulance Service (S.A.M.B.)	O		O		O		N	Specialist unit who can deal with emergency scenarios within the Bucharest prefect
	Ambulance/Rescue	SMURD/SIAMUD	O		O		O		N	Specialist units with rescue capability and can deal with hazardous substances
Health	Ministry of Health	National Institute of Public Health								The Institute of Public Health Bucharest is a specialised agency of the Ministry of Health, providing scientific, technical and methodological support to health policy-making. It develops and conducts public health studies, elaborates norms and methodologies, produces reports and coordinates various public health programmes. Role in chemical incidents unclear.
Environmental Protection	Ministry of Environment and Sustainable Development	The National Environmental Protection Agency								The National Environmental Protection Agency is a specialised authority of the public central administration, subordinated to the Ministry of Environment and Sustainable Development. Implements Environmental Protection Legislation. Role in chemical incidents unclear.
	APELL National Centre for Disaster Management Foundation	-		E					N	Private non government organisation who collaborate with government organisation to produce emergency management plans

7.1.24 Slovakia Exposure Assessment and Risk Characterisation Matrix

Category	Agencies		Source		Pathway		Receptor		RC	Comments
Sector	Organisation	Group / Arrangement	Qual.	Quan.	Qual.	Quan.	ID	Comm. Y/N	Y / N	Specifics of role in exposure assessment and or risk characterisation.
Government	Ministry of the Environment	Slovak Environmental Inspection *Environmental Information System (EIS): Monitoring IS (MIS) Territory IS (TIS) - Central geographical information system		M		M GIS		Y	Y(env)	Observational air quality data from network of fixed air quality monitoring equipment. Emergency plans.
		District and Regional Offices of Slovak Environmental Inspection	O	F, L, E	O	F, L, E	O	Y	Y (env)	Hand held and vehicle based monitoring equipment. Emergency plans.
		Slovak Environmental Agency		M		M		Y	Y(env)	Monitoring, documentation and scientific-technical information, environmental impact assessment, environmental risk assessment and management and chemical safety
		Slovak Hydrometeorological Institute						N	N	Meteorological data and predictions.
	Ministry of Interior	Section of Crisis Management and Civil Protection		E		E	GIS	Y	Y	Civil response decisions for high impact and cross-border incidents.
	Ministry of Health	Inter-Ministerial Commission		E		E	GIS	Y	Y	Integrated Rescue System. Analysis; Rescue Procedures Approval; Emergency Plans etc.

		Chemical Safety									
Military	Ministry of Defence	Nuclear, chemical and biological protection corps	O	F, E	O		O	Y	N (Y ad hoc)	In case of serious incidents - chemical corps are called upon for assistance and help for fire brigades
Emergency Services	Fire and Rescue Service	Anti-gaz Service	O	F, E	O		O	Y	N (Y ad hoc)	Specialised chemical group of Fire Service. Scene observations. Analysis at the scene.
		Rescue Brigade of Fire and Rescue Service							N (Y ad hoc)	Force to undertake the tasks of the Ministry of Interior in the implementation of rescue, localisation and liquidation of work in emergencies and natural disasters. Scene observations. Establishing cordon. Issuing shelter and evacuation advice on-scene.
	Ambulance		O		O		O	Y	N	Scene observations. On-scene health effects observations.
	Police							Y	N	Establishing cordon. Issuing shelter and evacuation advice on-scene.
Health	Health Care System	Toxicological Information in Occupational Medicine and Toxicology Clinic					O	Y	N	Provide medical advice by phone in case of intoxication.
		Hospitals					O	Y	N	Health effects observations.
		GPs (General Practitioners = Family Doctors)					O	Y	N	Health effects observations.

7.1.25 Slovenia Exposure Assessment and Risk Characterisation Matrix

Category	Agencies		Source		Pathway		Receptor		RC	Comments
Sector	Organisation	Group / Arrangement	Qual.	Quan.	Qual.	Quan.	ID	Comm. Y/N	Y / N	Specifics of role in exposure assessment and or risk characterisation.
	National Assembly							Y	N	Lays down the basic guidelines for organising and implementing protection measures against natural and other disasters at national level; adopts the National Programme of Protection Against Natural and Other Disasters; supervises its implementation, and provides funds to redress the effects of major disasters. Would be involved in the event of cross boundary incidents.
	Central Government Ministries							Y	Y	Ministries have individual responsibilities in relation to response to disasters. However, the Government directs and coordinates the activities of ministries in the area of protection against natural and other disasters. Therefore, several governmental inter-ministerial working groups have been established to deal with cross-cutting issues. Slovenia has a number of bilateral cooperation agreements with neighbouring countries
Government	Ministry of Higher Education, Science and Technology	The Metrology Institute				M	GIS	N	N	Determines and runs the national meteorology system in Slovenia. It represents these systems in the corresponding international organisations, and develops them in an internationally comparable and recognisable way. Would assist the Meteorological Office in the event of major or cross boundary incidents.
	Local Authorities	Municipalities	O, E	E, L, F?	O, E		E, GIS?	Y	Y	Municipal bodies make local decisions within the 210 municipalities. At local level, the municipalities operate and manage the system of protection and rescue independently in their areas. Professional protection, rescue and relief tasks are carried out by the municipal administration and local protection and rescue units and services. The responsible authority is the mayor. Responsibilities include: adopting emergency response plans and providing for the notification of inhabitants of danger, state of protection and protective measures taken.

Military	Ministry of Defence	The Administration for Civil Protection and Disaster Relief – ACPDR		E	E		E, GIS?	N	N	ACPDR is a constituent body of the MoD and performs administrative and technical duties in relation to civil protection. Responsibilities include: organising the monitoring, notification and warning system and preparing national emergency response plan. The ACPDR also manages international cooperation and is - through its Emergency Notification Centre of the Republic of Slovenia - also the point of contact for requests for assistance and other enquiries from abroad.
		Armed Forces					O	Y	N	The armed forces undertake a number of protection, rescue and relief tasks in cases where available civilian forces and resources are insufficient (i.e. participation of the airborne unit with helicopters in mountain rescue operations and fighting forest fires). Their participation has to be approved by the Minister of Defence on a proposal from the Civil Protection Commander of the Republic of Slovenia
Emergency Services	Ministry of the Interior and Ministry of Internal Affairs	Police	O		O		O	Y	N	The Slovenian police also participate in protection, rescue and relief tasks. The primary task of the police in the event of a disaster is to ensure public order and provide security in affected areas. Assists with civil protection activities including shelter and evacuation and maintaining cordons.
	Fire	The Slovenian Professional Fire Fighters Association	O	F?	O		O	Y	Y	Professional protection, rescue and relief tasks are administered by the municipal administration and local protection and rescue units and services. Fire-fighters are employed in municipal fire brigades and maintained on private industrial premises. There are also voluntary forces.
	Health Insurance Institute of Slovenia	Ambulance	O		O		O	Y	N	The Counties finance the ambulance service. Physicians are often involved in pre-hospital care.
Health	Ministry of Health	National Institute of Public Health						N	Y	In addition to the National Institute there are 9 Regional Institutes of Public Health, covering all regions of Slovenia covering areas of public health research such as social medicine, hygiene, health promotion, epidemiology, microbiology, and environment health. Responsible for risk assessment of intake of chemicals within the population and may assist in the event of a major incident.

		National Chemicals Bureau - Chemical Office of the Republic of Slovenia		L, F?			GIS?	N	Y	National Chemical Safety Programme (NCSP) was adopted by Parliament in September 2006. Responsible for chemical risk assessment, REACH, environmental hazards, human health risk assessment, international cooperation on chemical issues, laboratory access and QA. Would provide advice and support to municipalities and Government as required in the event of a major or cross-boundary incident.
Environmental Protection	Ministry of the Environment and Spatial Planning	Meteorological Office			F	M	GIS	N	N	The Met of Office of Slovenia is situated in the Environment Agency. Their capabilities includes: provision of a mobile meteorological unit; publicly available information from fixed met stations in Slovenia and across Europe. They also provide services to support incident response, though what this includes is not clear.
		Environment Agency of the Republic of Slovenia including the National Reference Laboratories (AQUILA)		F	O	M	GIS	Y	Y	Duties include monitoring outdoor air quality and performing administration procedures for air quality protection. Includes the National Reference Laboratories. Maintain an alert system in case of accidents. The Ministry of Environmental and Spatial Planning is the competent authority under Seveso II.

7.1.26 Spain Exposure Assessment and Risk Characterisation Matrix

Category	**Agencies**		**Source**		**Pathway**		**Receptor**		**RC**	**Comments**
Sector	Organisation	Group / Arrangement	Qual.	Quan.	Qual.	Quan.	ID	Comm. Y/N	Y / N	Specifics of role in exposure assessment and or risk characterisation.
Government	Local Authority	Ayuntamientos (Municipal Government)	O	F?	GIS?		O, GIS?	Y	Y	Responsibilities under Article 42 of the General Health Law include: health control of the environment (including air pollution). Health control of industries, activities and services, transport, noise and vibrations. Health control of cemeteries and mortuaries.
			O	L, F?	O, GIS?	M?	O	Y	Y	Responsibilities under Article 42 of the General Health Law include: health control of the environment including urban and industrial residue. Health control of industries, activities and services. Health control of cemeteries and mortuaries. The local authorities have a role in contaminated land investigation though it is not clear how this is structured. There are no laws requiring remediation in Spain.
			O		GIS?		O, GIS?	Y	Y	Responsibilities under Article 42 of the General Health Law include: health control of the environment including water supply and water quality, wastewater treatment, urban and industrial residue. Health control of industries, activities and services and transport.
	Ministry of the Environment, Rural and Marine Affairs	Environmental Protection						Y	Y	Responsibility for air pollution and impact assessment, risk evaluation for chemicals. Spain is not currently compliant with Seveso II and was issued a warning in October 2010. Would support the municipal government and autonomous communities in the event of a major incident.
			O	L, F?	O	M?	O	Y	Y	The agency with overall responsibility for contaminated land, though actions and role are not clear. Supports autonomous and municipal government where required. Would lead on a major incident.
					O			N	Y	Responsibility for water resource management and the marine environment; including management of the Coast Guard
		State Meteorological			O			N	N	Provision of meteorological information need for national defence, including predictions and modelling for inland and marine purposes.

		Agency		F, L?		M		N	N	700 automatic observation stations, 2 mobile meteorological offices of defence. Provision of meteorological information need for national defence
	Ministry of Health and Social Welfare	MARM					O	Y	N	Overall control for imports and exports of food for human consumption.
Military	Police	National Police	O		O		O	Y	N	Responsible to royal family and Government. May be involved where criminal activity such as terrorism is a cause. Establish cordon, assist with shelter and evacuation in the event of major incident or where requested by the civil guard or municipal police.
	Ministry of the Navy	Sea SAMU	O		O		O	Y	N	Emergency medical care for offshore incidents.
	Civil Guard	Coast Guard	O	L, F	O		O	Y	N	Search and rescue, prevention and mitigation of pollution, transport of hazardous substances. Maintains vessels, land vehicles and pollution response kits for a coordinated response. The front line for response at sea.
Emergency Services	Fire		O	F?	O		O	Y	N	Separate brigades in each autonomous community with the exception of Barcelona and Madrid which have their own. Valencia created bomberos sin fronteras, which helps in natural disaster worldwide.
	Police	Civil Guards and Municipal Police	O		O		O	Y	N	Responsible for national security, traffic control and customs. May issue shelter advice and cordons.
	Voluntary Sector	Spanish Red Cross	O		O		O	Y	N	Assist with incident response, including search and rescue, shelter, evacuation and casualty support. Assist with public communication.
	Ambulance	SAMU (servicio de atencion medica urgente) / SEM (Servicio de Emergencias Medicas)	O		O		O	Y	N	Decentralised to autonomous communities. Two emergency numbers 061 and 112. Can cause problems of coordination between the services. There is a 'Medical Coordinator' which is generic term across the communities. The SAMU and SEM are part of the public health services in each region. There is a private assistance company which assists the health authorities and military for training and disasters called 'SAMU Sociedad Anonima'. Samu is also described as the dean of emergency health care in Spain. Casualty observations.
Health	Inter-territorial Council of the Spanish National Health Service	Primary Care Services, general and specialised hospitals			O		O	Y	N	17 health departments from the 17 autonomous communities. Management of the Spanish National Health Service has been transferred to some for the autonomous services, while some continue to be the National Institute of Health Management (INGESA). The activity of the services is managed by the Inter-territorial Council for the Spanish National Health Service (CISNS).

	Ministry of Health	Spanish Food Safety and Nutrition Agency			O		O	Y	Y	Has overall responsibility for food safety in Spain. Will assist local authorities as required.
	Drinking Water Companies		O	L, F	O	M?	O	Y	Y	Privately owned and responsible for the quality of water within their supply. Private water supplies are the responsibility of individual owners.
Environmental Protection	Instituto de Salud Carlos III	National Centre for Environmental Health		L	GIS		GIS	N	Y	Research in the areas of air quality, analysis and modelling methods, identification of chemical and environmental toxins, health risk assessment. Responsible for guaranteeing the quality of output from the national air quality monitoring networks. Would assist the autonomous communities and the municipal government in the event of major or cross-boundary incident.
					GIS		GIS	N	Y	Research in the areas of chemical and environmental toxins, health risk assessment. May assist the autonomous communities and the municipal government in the event of major or cross-boundary incident.
									Y?	Study the impact of environmental contamination due to physical agents on human health. Would support the Ministry of Environment and local authorities as required.
	EU	Fisheries Control Agency			O	M	E	N	Y	Would assist with communication and risk assessment in the case of a major incident with cross-boundary implications for fisheries contamination.

7.1.27 Sweden Exposure Assessment and Risk Characterisation Matrix

Category	Agencies		Source		Pathway		Receptor		RC	Comments
Sector	Organisation	Group / Arrangement	Qual.	Quan.	Qual.	Quan.	ID	Comm. Y/N	Y / N	Specifics of role in exposure assessment and or risk characterisation.
Government	Ministry of Environment	Municipal Environment and Health Protection Committees	O		O		N	N	N	Local government
		The Swedish Radiation Safety Authority	O,F, L, M	O,F, L, M	O,F, L, M	O,F, L, M	Y	Y	Y	Works with the protection of people and the Environment from the harmful effects of radiation, present and future. *www.stralsakerhetsmyndigheten.se*
		IVL Swedish Environmental Research Institute	O,F,L,M	F,L,M	O,F,L	F,L,M	N	Y	Y	IVL, conducts both research and contract work. Its research is financed by the state, research foundations, the EU and business. Its contract work covers consultancy assignments and national and international research and development contracts. www.ivl.se
		The National Chemicals Agency					Y	Y	Y	KemI, works to prevent harm to people and the environment from chemical and biotechnical products.
		The Swedish Environmental Protection Agency					Y	Y	Y	Coordinates and promotes environmental work at national level, in the EU and at international level. The agency produces and communicates knowledge and guidance in the field of the environment, drafts proposals for objectives, action strategies and policy instruments in environmental policy and implements environmental policy decisions. *www.naturvardsverket.se*
		The Swedish Meteorological and Hydrological Institute,	M	M	M	M	N	Y	Y	SMHI, processes general forecasts and severe warnings to provide forecasts tailored to meet the specific needs of different sectors of society. www.smhi.se (www.cost728.org Meteorology Models METM HIRLAM, ECMWF, MM5, MESAN) (Atmospheric Chemical Transport Models; MATCH)

		Swedesurvey AB						N	N	exports Swedish expertise in the land survey area focusing on real property systems, geographical information, real property information and geographical information technology.www.swedesurvey.se
		The Swedish National Water Supply and Sewage Tribunal					Y	Y	Y	Deals with cases under the Act concerning public water supply and sewer systems. *www.va-namnden.se*
	Ministry of Rural Affairs, Food and Fisheries	National Food Administration								An autonomous government agency reporting to the Ministry of Rural Affairs, Food and Fisheries, is the central administrative authority for matters concerning food. NFA is the central regulator of food and drinking water and has overall responsibility for the crises in these areas. Administration also provides support to local environmental health authorities, responsible for local supervision.
		Municipal Environment and Health Protection Committees								Local Level food control for 290 municipalities County Administrations are responsible for food control at farms and for co-ordinating food control within each county.
		The Swedish National Water Supply and Sewage Tribunal	O		O			Y	Y	Deals with cases under the Act concerning public water supply and sewer systems. *www.va-namnden.se*
Military	Ministry of Defence	Swedish Civil Contingencies Agency	O, E	O	O,E	E	Y	Y	Y	The task of the MSB is to enhance and support societal capacities for preparedness for and prevention of emergencies and crises. When one does occur, we support the stakeholders involved by taking the right measures to control the situation. http://www.msb.se
		Swedish Defence Research Agency	F, L, M	F,L,M	F,L,M	F,L.M	Y	Y	Y	FOI holds Sweden's advanced expertise in CBRNE issues. FOI represents excellence in applied issues like threat and risk assessment, scenario building and modelling. FOI also contributes with specialised laboratories and scientists for hands on CBRNE activity. Built on the experience of the Chernobyl fallout, FOI remains the body commissioned by the Swedish Radiation Protection Authority to maintain preparedness for radiological disasters in the north of Sweden. The FOI also holds the Swedish Centre for Disaster Toxicology funded by the Swedish Board of Health and Welfare.

		SkyddC - National CBRN Defence Centre	F, L, M	F,L,M	F,L,M	F,L,M		Y	Y	SkyddC is the centre of knowledge and excellence for Sweden's Total Defence. The Centre is the lead authority for protection against CBRN incidents. SkyddC provides support for national and international preparedness and rapid response capabilities, and is also responsible for the production of specific CBRN units. In addition, SkyddC is a lead developer of CBRN equipment and methods. At the CBRN school, training and exercising is provided for career officers, service units and other personnel from emergency services.
		FOI	L	L	L	L		?	Y	FOI is an assignment-based authority under the Ministry of Defence. The core activities are research, method and technology development, as well as studies for the use of defence and security. The organisation employs around 950 people of whom around 700 are researchers (2009). Measurement of and protection against the emission of CBRN substances. FOI also has one of the few security classified CBRN laboratories in Europe that is licensed to receive and examine all types of hazardous substances. This makes FOI the largest research institute in Sweden. http://www.foi.se
		Swedish Coastguard HQ	F,O,M	F,O,M	F,O,M	F,O,M	Y	Y	Y	The Swedish Coast Guard is a civilian authority under the jurisdiction of the Ministry of Defence. The overall aims of the Coast Guard are decided by the Swedish Parliament while the government takes decisions on more detailed aspects. If an accident were to occur, the Swedish Coast Guard's responsibility is to take care of the discharges at sea. We work to ensure any damage caused by the discharge of oil and other hazardous substances is minimised, so that the environment is protected as far as possible. We have the highest readiness for emergency responses, and are always prepared with specially equipped environmental protection vessels designed for environmental responsewww.kbv.se
Emergency Services	Swedish Civil Contingencies Agency (Ministry of Defence)	Ambulance	O	O	O	O	Y	N	?	
		Fire Rescue Service	O, F	O, F	O, F	O, F		Y	N	
		Swedish National Police Board	O		O			Y	N	The Swedish Police Service consists of the National Police Board, the National Laboratory of Forensic Science and 21 police authorities, each of which is responsible for policing in the county in which it is based.
Health	National Board of Health and Welfare	Swedish Centre for Disaster Toxicology funded by the Swedish Board of					N	Y	Y	Based in the FOI

		Health and Welfare								
	Swedish Environmental Protection Agency (Ministry of Environment)	Health -Related environmental Programme	O,F.L	O,F,L	O,F,L	F,L		Y	Y	Air pollutant - exposure studies, symptoms, health effects. Estimating human exposure to hazardous substances in the ambient environment
	Swedish Environmental Protection Agency	Health -Related environmental Programme	F,L,	F,L,	F,L	F,L	Y	Y	Y	Sub - programmes to monitor well water
	National Food Administration									
Environmental Protection	Swedish Environmental Protection Agency	Toxic substance Coordination Programme								
		Ambient Air Quality Programme	F, L, M	F, L,M					Y	Regulation of Swedish Air Quality Environmental Quality Standards
		IVL Swedish Environmental Research Institute	O,F,L,M	F,L,M	O,F,L	F,L,M	Y	Y	Y	IVL is commissioned by the Swedish EPA to undertake and manage the majority of the air quality monitoring activities within the national air quality monitoring programme EMEP. They also provide analysis for water and contaminated land. www.ivl.se
		Health-related environmental Monitoring Programme	F, L, M	F,L,M	F,L,M	F,L,M				Monitoring flow of pollutants from urban environment

7.1.28 United Kingdom Exposure Assessment and Risk Characterisation Matrix

Category	Agencies		Source		Pathway		Receptor		RC	Comments
Sector	Organisation	Group / Arrangement	Qual.	Quan.	Qual.	Quan.	ID	Comm. Y/N	Y / N	Specifics of role in exposure assessment and or risk characterisation.
Government	Central Government	SAGE / STAC / AWE / HSL							Y	Risk characterisation and civil response decisions for high impact and cross-border incidents. DSTL and AWE may be called upon in the event of terrorism. HSL may undertake laboratory analysis for speciation and identification of chemicals.
		Security & Emergency Measures Directions (SEMD)			E		E	N	N	Requirements for Water Company contingency plans. SEMD is particularly concerned with the provision of alternative water to large numbers of people, should piped supply fail.
		Defra / WAG					O	N	N	Liaise with other Government Departments; particularly in the event of a major incident or with cross-boundary implications. Observation made through information from other agencies.
		Regional Civil Contingencies Committees (RCCCs)			O		O	Y	N	Co-ordination of response at regional level. More strategic than exposure assessment or RC.
	Health and Safety Executive (HSE)		E		E, O		E, O	N	N	May investigate where there is an off-site impact from an HSE regulated site. Pesticide controls?
	Department of Transport	Maritime and Coastguard Agency	O	L,F	O	M	O	Y	Y	Equipment - counter pollution at sea equipment - including salvage and chemical response equipment; shoreline clean up equipment; boom and dispersant. Airborne surveillance flights. Modelling for fate and transport of spills. Search and rescue, pollution response, maritime incident response group, resilience, specialist equipment to assess and respond to incidents. Maritime and Coastguard Agency - Counter Pollution and Response Branch (CPR) - comprising the Chemical Hazards Advisory Group and the Hazardous & Noxious Substance

										Response Team. Equipment - counter pollution at sea equipment - including salvage and chemical response equipment; shoreline clean up equipment; boom and dispersant. Airborne surveillance flights. Modelling for fate and transport of spills.
	Highways Agency		O		O		O	Y	N	If spillage on a highway. Possible on scene observations. Communication with some highway users.
	Drinking Water Inspectorate			L, F		L, F	E	N	Y	Responsible for assessing drinking water quality in public supplies and appropriate action when water is unfit for consumption. Scientific advice to water companies.
	Local Authority	Environmental Health - Contaminated Land Officer	O	L, F?	O	M	O	Y	Y	GIS to identify geology and preferential pathways.
		Environmental Health Officers	O	L, F	O	L	O	Y	Y	Food safety inspections. Local and regional communication with the public and business. Food safety risk assessments.
		Environmental Health / Civil Contingencies	O	E	O		O	Y	N	Locality observations. Possible hand held and fixed monitoring equipment. Emergency plans.
		Local Resilience Forum					E, O	Y	N	Provision of information on vulnerable groups to water companies. If agreed at SCG request Military Aid to the Civil Community.
		Environmental Protection Officers	O	L	O, GIS		O	Y	Y	Drainage plans. GIS to identify geology. Responsibility for private water supplies.
Military	Met Office	EMARC				M		N	N	Meteorological data and predictions. CHEMET and FIREMET.
Emergency Services	Fire and Rescue Service	Hazardous Materials Officer (HAZMAT)	O	F, E	O		O	Y	N	Scene observations. Emergency plans. Use of DIM equipment at the scene. Use of spill kits etc. On-scene observations - such as observations of spillage quantity, drainage routes and seepage observations.
	Ambulance	Hazardous Area Response Teams (HART) and Hazardous Area Medical Officer (HAZMED)	O		O		O	Y	N	Scene observations. On-scene health effects observations.

	Police	National CBRN Centre (Terrorism)						Y	N	Establishing cordon. Issuing shelter and evacuation advice on-scene. Cordons; road closures; civil order. Will be notified by the DWI / water company if terrorism is suspected. Co-ordination of emergency services. Request Military Aid to the Civil Power as considered necessary.
	NCEC - National Chemical Emergency Centre	CHEMSAFE Response Network (REACH - EU wide)	O		O			N	N	Multi-agency scheme - mainly for chemicals in transit on highways. May provide equipment for containment and neutralisation to the scene.
Health	National Health Service	NHS Direct, PCTs, Hospitals, GPs					O	Y	N	Health effects observations. Alert and advise for treatment and to minimise cross-contamination - upon advice from HPA.
	Health Protection Agency			E	GIS		GIS	Y	Y	Public health risk characterisation based upon collated observations, information and GIS. AQC Client.
	Water Companies			L, F		L, F	E, O	Y	Y	Use restriction advice - boil, do not drink, do not use, all clear. Risk communication. Sampling and analysis. Legal obligation to notify DWI, LA, EHOs, HPA. Provide alternative drinking water supply. Analytical and scientific services.
Environmental Protection	Environment Agency	NAQTA / AQC Chair	O	F, E	O		O	N	Y	AQC Chair. Hand held and vehicle based monitoring equipment (Gasmet and Osiris).
		Environmental Protection Officers / ABCs	O		O	M	GIS	Y	Y	Responsibility for fisheries.
		Enforcement Officers / ABCs	O		O	L, F, M	GIS	Y	Y	Mitigation actions in the event of spillage to reduce risk to public health and the environment, such as spillage containment in coordination with the FRS and Highways Agency. Maintain records of oil separators, penstocks, catchpits and lagoons and containment capacity on highways. On-scene observations. Contaminated land obligations where controlled waters may be at risk. Responsibility for controlled waters (surface waters and groundwater). Responsibility for fisheries.
	Natural England						O	Y	N	Where a SSSI may be threatened. Loss of amenity and biodiversity impact upon public health. May assist communication with relevant receptors.

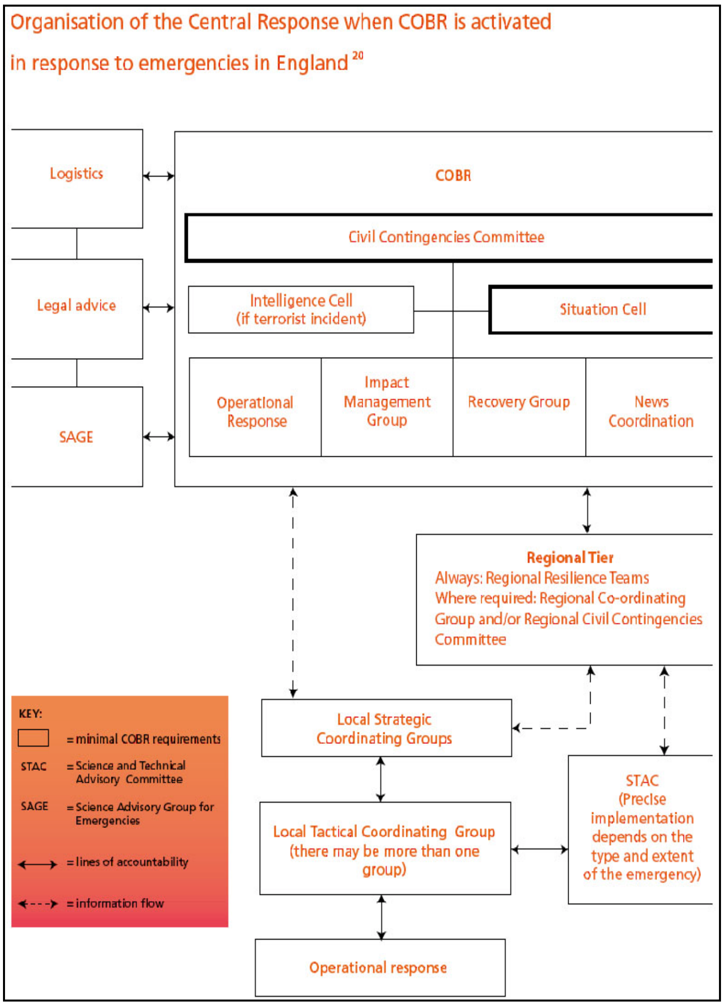
8 Appendix 4

8.1 Detailed examples of Member State organisational and technical setup of exposure assessment in chemical incidents

8.2 United Kingdom Central Government Response

A more comprehensive review of UK Central Government response can be obtained from the British Red Cross report on Analysis of Law in the United Kingdom pertaining to Cross-Border Disaster Relief which formed part of a wider study on cross-border disaster assistance within the EU, carried out in conjunction with five other European National Societies, under the overall coordination of the International Federation of Red Cross and Red Crescent Societies[77]

Figure 8.0 UK Organisation of Central Response when Cabinet Office Briefing Room (COBR) is activated



[77] The British Red Cross, (J Stefanelli and SWilliams), 2010, *Analysis of Law in the United Kingdom pertaining to Cross-Border Disaster Relief*, British Institute of International and Comparative Law.

8.2.1.1 Cabinet Office Briefing Rooms (COBR)[78]

Collective decision-making within central government is delivered through the Cabinet committee system, and decision-making during emergencies follows the same pattern. Due to the unpredictable nature of emergencies, the government maintains dedicated crisis management facilities - Cabinet Office Briefing Rooms (COBR) - and supporting arrangements which are only activated in the event of a major national emergency. Officials in the COBR will identify options and propose advice on the issues on which Ministers will need to focus. Within the COBR, a senior decision-making body and the Civil Contingencies Committee (CCC) oversees the government's response.

8.2.1.2 Civil Contingencies Secretariat (CCS) and Civil Contingencies Committee (CCC).

Major chemical incidents are coordinated and managed in the UK by the Civil Contingencies Secretariat (CCS), based in the Cabinet Office. This is a devolved responsibility in Scotland and Northern Ireland. If the scale of a disaster overwhelms available local resources, regional resilience teams will coordinate supplementary resources which may be called in from neighbouring authorities and organisations as well as from Central Government. Only major national disasters justify coordination at central government level by the CCS or the relevant lead department nominated by CCS or the Civil Contingencies Committee (CCC).

UK emergency levels:

1. Significant emergency (Level 1) has a wider focus and requires central government involvement or support, primarily from a lead government department (LGD)

2. Serious emergency (Level 2) is one which has, or threatens, a wide and/or prolonged impact requiring sustained central government coordination and support from a number of departments and agencies, usually including the regional tier in England

3. Catastrophic emergency (Level 3) is one which has an exceptionally high and potentially widespread impact and requires immediate central government direction and support, such as a major natural disaster, or a Chernobyl scale industrial accident.

With respect to major chemical incidents the UK central Government will:

- prioritise access to scarce national resources;
- use data and information management systems to gain a national picture and support decision making, without overburdening frontline responders;
- base policy decisions on the best available science and ensure that the processes for providing scientific advice are widely understood and trusted;

[78] UK Cabinet Office http://www.cabinetoffice.gov.uk/sites/default/files/resources/conops-2010.pdf

- apply risk assessment methodology and cost benefit analysis within an appropriate economic model to inform decision making;
- work with international partners to share information and request assistance if necessary;

8.2.1.3 Science Advisory Group for Emergencies (SAGE)

The effective management of most emergencies will require access to specialist scientific and technical advice, for example regarding the public health or environmental implications of a release of toxic material, or the spread of a disease. The role of SAGE is to bring together scientific and technical experts to ensure coordinated and consistent scientific advice to underpin the central government response to an emergency. In many cases this will be limited to advising the lead minister, however in the most complex cases the SAGE will work closely to ensure the advice submitted to ministers is based on the best possible evidence (see also fig 6.1).

8.2.1.4 Police

In most emergencies, the strategic local response will be coordinated by a senior police officer at the Strategic Coordinating Group. A senior Association of Chief Police Officers (ACPO) representative in COBR will normally advise central government on the wider implications of response options and will represent the police service's views on wider policing issues.

Fig 6.2 Stakeholders

AGENCY	England	Wales	Scotland	Northern Ireland
Site Specific Information (Including advice on how to deal with a substance released).	Site operator	Site operator	Site operator	Site operator
Specialist Public Health Advice	Dep't of Health/ Health Protection Agency	National Public Health Service for Wales / Health Protection Agency Dep't of Health /	Dep't of Health / Health Protection Scotland / Health Protection Agency	Dep't of Health, Social Services and Public Safety / Health Protection Agency
Direction of NHS Resources	Dep't of Health	Welsh Assembly Government (WAG)	Scottish Ministers	Northern Ireland Executive
Food Safety	Food Standards Agency	Food Standards Agency	Food Standards Agency	Food Standards Agency
Environmental Protection	Environment Agency	Environment Agency	Scottish Environmental Protection Agency	Heritage Service NI
Public Water Supply	Water Companies / Defra	Water Companies/ Welsh Assembly Government	Scottish Water / Scottish Ministers	Water Service NI / Environment and Heritage Service NI

Meteorological Information	Met Office	Met Office	Met Office	Met Office
Animal Welfare	Defra	Welsh Assembly Government	Scottish Ministers	Northern Ireland Executive
Radiological monitoring (RIMNET)	DECC	Welsh Assembly Government	Scottish Ministers	Northern Ireland Executive
Decontamination advice	Government Decontamination Service	Government Decontamination Service	Government Decontamination Service	Government Decontamination Service

8.2.2 National Emergency Response

8.2.2.1 United Kingdom Emergency Command Structures

For emergencies in the UK, local responders (including national agencies delivering local services such as the Maritime and Coastguard Agency or the Highways Agency) are the essential building block of the UK response to most emergencies. The emergency services including, police, fire and ambulance will usually be the first to arrive at the scene of an incident and provide operational, tactical and strategic control of the local response.

Operating below the local (multi-agency) Strategic Coordinating Group (SCG) are three levels of command at a single agency level – operational (Bronze), tactical (Silver) and strategic (Gold). Often these will be implemented without the need for multi-agency coordination through the SCG with any necessary coordination taking place at silver or bronze level. The need to implement one or more of these response levels will depend on the nature of the incident, but normally incidents will be handled at the operational level, moving to the tactical or strategic level if required depending on the scale or nature of the incident.

8.2.2.2 Science and Technical Advice Cell (STAC)[79]

To ensure timely coordinated scientific and technical advice during the response to an emergency, local responders consider collectively through the relevant arrangements for establishing a STAC to provide advice to the Strategic Coordination Group (SCG) when required.

[79] Science and Technical Advice Cell (STAC) http://interim.cabinetoffice.gov.uk/media/132949/stac_guidance.pdf

8.2.3 Environment

8.2.3.1 Department for Environment Food and Rural Affairs (Defra)

8.2.3.1.1 Environment Agency (EA)[80]

The Agency undertakes sampling and testing of material collected by ground level monitoring stations or deployed teams.

The Air Quality Cell (AQC)– a national, multi-agency group of technical experts chaired by the Environment Agency with the Health Protection Agency, Met Office, Health and Safety Laboratory and the Food Standards Agency – A quick response service set up to co-ordinate air quality monitoring in major pollution incidents. The Air Quality Cell advises the local health community, police and fire service during a chemical incident. National Air Quality Advisors / AQC Chair - Hand held and vehicle based monitoring equipment (Gasmet and Osiris) which can monitor at defined receptor locations (within occupational controls) EA have sampling and analytical laboratory capability.

8.2.3.1.2 Food Standards Agency (FSA)[81]

The Food Standards Agency has statutory responsibility for ensuring the safety of the food chain (excluding tap water) and for advising the public on food safety matters. The FSA may undertake testing, sampling and analysis of an area affected by potentially hazardous substances to determine the consequences for the food chain and take any necessary actions to protect public health.

8.2.4 Health

8.2.4.1 Department of Health

8.2.4.1.1 National Health Service

NHS Direct, PCTs, Hospitals, GPs Health effects observations. Alert and advice for treatment and to minimise cross-contamination - upon advice from HPA. The relevant Director of Public Health or Primary Care Trust Chief Executive is responsible for ensuring the most effective mobilisation and deployment of NHS (non-ambulance service) assets to meet the health needs of those affected.

8.2.4.1.2 Health Protection Agency (HPA)[82]

Local and Regional Services / Environmental Hazards and Emergencies Department - Public health risk characterisation based upon collated observations, information and GIS. The HPA will give advice on public health threats and may, where appropriate, make this advice public. While the Agency has some sampling and testing capability, this would not necessarily be deployed during an incident.

[80] Environment Agency *http://www.environment-agency.gov.uk/*
[81] Food Standards Agency *http://www.food.gov.uk/multimedia/pdfs/taskforcepaper0512.pdf*
[82] Health Protection Agency *http://www.hse.gov.uk/*

8.2.4.2 Health and Safety Executive (HSE)[83]

Has statutory (regulatory) responsibility for ensuring that people's health and safety in the workplace is protected, drawing on advice from, and giving advice to, other agencies (e.g. HPA) as necessary. This will include advice on how responders might fulfil their duty of care obligations to workers, responders and others involved in the response to an emergency.

8.2.5 Military / Defence

8.2.5.1 Home Office

8.2.5.1.1 Police Service

National CBRN Centre - Establishing cordons, issue shelter and evacuation advice.

8.2.5.2 MET Office[84]

The Met Office Environment Monitoring and Response Centre (EMARC) provides meteorological data and predictions via modelled outputs. The Met Office works closely with environmental agencies; emergency planners; crisis response experts and aid agencies, such as DECC, Defra and DFID. Hazard manager is a web portal providing a one-stop information source for the emergency response community, allowing access to Met information in one location, using a single username and password.

Chemet - In the event of an incident involving hazardous chemicals, local Fire and Police services will contact the Met Office Environment Monitoring and Response Centre (EMARC). Typical scenarios could be a chemical spillage, a fire at a chemical plant or oil refinery, or a road traffic accident in which a hazardous substance has either escaped or ignited. For small-scale events, EMARC produces meteorological guidance and a plume prediction as a chemical meteorology (CHEMET) report. For larger release events, such as the Buncefield Oil Depot fire, more-sophisticated plume modelling techniques are utilised.

Firemet - The aim is to provide immediate access to forecast conditions, while they are waiting for a more detailed Chemical Meteorology (CHEMET) report. It also provides three hours of hind cast data, as well as three hours of forecast data.

The Met Office may also be able to make available in conjunction with the Natural Environmental Research Council (NERC) an airborne sampling capability to support the multi-agency response.

8.2.5.3 Defence Science and Technology Laboratory (DSTL)[85]

DSTL supply sensitive and specialist science and technology services for the Ministry of Defence (MOD) and wider government. They provide expert advice, analysis and assurance to aid decision-making and to support the MOD and wider government.

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[83] Health and Safety Executive http://www.hse.gov.uk/

[84] MET Office http://www.metoffice.gov.uk/publicsector/emergencies

[85] Defence Science and Technology Laboratory http://www.dstl.gov.uk/pages/117

MOD technical experts from Dstl or Atomic Weapons Establishment (AWE) would deploy, on behalf of the Home Office and in support of the police, as part of the Government response to a terrorist incident involving (or suspected of involving) Chemical, Biological, Radiological, or Nuclear material. The teams would provide advice on handling any device as well as identifying and advising on the material involved and appropriate counter-measures that might be taken during the initial response phase. They would also undertake the plume modelling. Advice and support may also be provided during the recovery phase[86].

8.2.5.4 Home Office Scientific Development Branch (HOSDB)

The Home Office is the lead government department for immigration and passports, drugs policy, crime, counter-terrorism and police. They have undergone recent changes and have drawn expertise together into capability areas which includes: contraband detection and chemical, biological, radiological and nuclear material) chemicals capability.

8.2.6 National agreements and examples of interoperability

It appears that the UK is not a party to any bilateral or regional agreements specifically relating to the provision of disaster assistance. This may reflect the traditional focus of UK contingency planning on self-sufficiency[87].

8.2.7 Local capability and capacity

8.2.7.1 Fire and Rescue Services [88]

Provide on scene observations and cascade information relating to the incident to multi-agency partners as required. Undertake scene risk assessment and make initial shelter or evacuation risk assessments based on scene observations. Officers provide immediate response in the form of a Hazardous Materials Advisor, providing guidance and support to Incident Commanders at a full range of operational incidents either as part of a pre determined attendance or on request direct from the incident ground. The officers attending have at their disposal a nationally recognised chemical information and actions database (Chemdata), supported by the National Chemical Emergency Centre (NCEC). Support in Detection Identification and Monitoring is also available using specialist teams and equipment.

8.2.7.2 FRS Maritime Incident Response Group (MIRG)[89]

The MIRG consists of fifteen strategically located shore based Fire Rescue Services who provide a 24/7 response to incidents at sea where there is a risk to life or high environment risk for which fire fighting, chemical hazard and/or rescue teams may be required.

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[86] The Home Office http://interim.cabinetoffice.gov.uk/media/132949/stac_guidance.pdf

[87] The British Red Cross, (J Stefanelli and SWilliams), 2010, *Analysis of Law in the United Kingdom pertaining to Cross-Border Disaster Relief*, British Institute of International and Comparative Law.

[88] UK Fire and Rescue Services http://www.shropshirefire.gov.uk/the-emergency-service/hazmat-chemicals

[89] UK FRS Maritime Incident Response Group http://www.dft.gov.uk/mca/mcga07-home/emergencyresponse/mcga-hmcgsar-firefightingatsea.htm

8.2.7.3 Police Service

Establishing cordons, issue shelter and evacuation advice.

8.2.7.4 Ambulance Service (HART)[90]

Hazardous Area Response Teams (HART) are specially recruited and trained personnel who provide the ambulance response to major incidents involving hazardous materials, or which present hazardous environments, that have occurred as a result of an accident or have been caused deliberately. Also HAZMED trained paramedics.

8.2.7.5 Local Authority

Locality observations with some possible hand held and fixed monitoring equipment. Emergency plans. AURN ambient air quality monitoring.

8.2.7.6 Health Protection Agency[91]

Local and Regional Services / Environmental Hazards and Emergencies Department - Public health risk characterisation based upon collated observations, information and GIS. The HPA will give advice on public health threats and may, where appropriate, make this advice public. While the Agency has some sampling and testing capability, this would not necessarily be deployed during an incident.

8.2.7.7 The National Poisons Information Service[92]

The National Poisons Information Service (NPIS) is the Department of Health approved, and Health Protection Agency (HPA) commissioned, National service that provides expert advice on all aspects of acute and chronic poisoning.

8.2.7.8 Environment Agency

Provide an 'Area Base Controller' to scene and National Air Quality Advisor in collaboration with HPA can trigger Air Quality Cell.

8.2.7.9 Food Standards Agency

Will provide local support to multi-agency command structure meetings and is a member of Air Quality Cell.

8.2.7.10 Health and Safety Executive (HSE)[93]

The HSE will, unless agreed locally, undertake necessary sampling and testing for harmful substances arising from an affected workplace once the Fire and Rescue Service or other competent authority has advised that the site, or parts of it, is safe to enter.

8.2.7.11 Health and Safety Laboratory (HSL)[94]

Support Health & Safety Executive but also work with a wide range of other public and private-sector organisations. Undertake risk characterisation and civil response decisions for high impact and cross-border incidents. HSL have modelling capabilities and may undertake laboratory analysis for speciation and identification of chemicals. HSL provide

[90] Hazardous Area Response Teams http://www.ambulancehart.org.uk/
[91] Health Protection Agency http://www.hpa.org.uk/
[92] The National Poisons Information Service http://www.npis.org/
[93] Health & Safety Agency http://www.hse.gov.uk/
[94] Health and Safety Laboratory http://www.hsl.gov.uk/about-hsl.aspx

modelling outputs on the size and height of the chemical plume during a chemical incident.

8.2.7.12 Maritime Coastguard Agency [95]

The Maritime and Coastguard Agency (MCA) is the competent U.K. authority that responds to pollution from shipping and offshore installations. The MCA is regularly called upon to react to a wide range of maritime incidents and have developed a comprehensive response procedure to deal with any emergency at sea that causes pollution, or threatens to cause pollution.

8.2.7.13 UK Water Companies [96]

The industry is made up of twelve water and sewerage service providers and fourteen water suppliers. In England and Wales the companies are privately owned. Welsh Water, which supplies services in Wales, is a not-for-profit company. Scotland and Northern Ireland each have single water and sewage service provider (Scottish Water and Northern Ireland Water) that are in public ownership but rely upon private companies for delivery of many of their services. UK Water companies usually have their own analytical capabilities and would support exposure assessment during water related chemical incidents.

8.2.8 Other possible related organisations/ capability

8.2.8.1 Food and Environment Research Agency (FERA)[97]

Fera has long experience of developing methods to determine agricultural chemicals, pharmaceuticals and industrial chemicals in a wide variety of complex matrices including foodstuffs, soil, water, air and body tissues/fluids. They have over 100 analytical chemists with well equipped, modern and sophisticated analytical instrumentation. Assessing the fate and behaviour of chemicals in the environment through use of experimental methods and advanced computer modelling, can provide clients with robust data on the mechanisms, route and rates of degradation, and the risks degradants pose to human or environmental health.

8.2.9 Local Agreements and examples of Interoperability

8.2.9.1 CHEMSAFE[98]*.*

UK domestic transport legislation requires a 24-hour emergency response (specialist advice) telephone number to be displayed on vehicles carrying dangerous goods in bulk.

- Level 1 response (either through in-house resources or by using a third party agency) is a mandatory requirement for all members of the UK Chemical Industries Association (CIA). Companies are also required to provide SDS

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[95] The Maritime and Coastguard Agency *http://www.dft.gov.uk/mca/mcga07-home/emergencyresponse/mcga-pollutionresponse/mcga-dops_cp_environmental-counter-pollution.htm*
[96] UK Water Companies *http://www.water.org.uk/home/policy/publications/archive/industry-guidance/wastewater-from-hospitals/national-guidance-hospital-discharges-april-2011-v1.pdf*
[97] Food and Environment Research Agency http://www.fera.defra.gov.uk/environment/environmentalRiskAssessment/chemicalAnalysis.cfm
[98] CHEMSAFE *http://the-ncec.com/chemsafe/*

information on all their products to the National Chemical Emergency Centre (NCEC) at Culham, Oxfordshire, which assumes the role of National ICE (Intervention in Chemical Transport Emergencies) Centre.

- Level 2 response is provided either by the product owner or by around 30 industry operational sites/centres across the country. These constitute a round-the-clock mutual assistance network for other CIA members.

- Level 3 response are normally provided through the contract haulier or, should a spillage have occurred, by companies specialised in the disposal of chemical waste. NCEC (Culham) acts as National ICE Centre.

8.3 Bulgaria Central Response

8.3.1 Security Council at the Bulgarian Council of Ministers[99]

Major incidents are coordinated and managed by the Security Council at the Bulgarian Council of Ministers[100]; response to acute chemical incidents is similar to the UK and appears to be government centre led[101].

8.3.1.1 Ministry of Emergency Management (Situations) MES[102]

Ministry of Emergency Situations (MES) undertakes the activities of civil protection in the event of disasters, based on a policy for prevention, control and overcoming of the consequences of disasters and accidents; National Civil Protection Service General Directorate is a structure under MES[103].

The main tasks for the MES during chemical incidents are to:

- evaluate the situation and the outcomes of a chemical incident;
- determine the causes and sources of the chemical incident;
- forecast the rate of progress of the chemical incident;
- work with the National Centre of Public Health Protection and the Regional Inspectorate of Protection and Control of Public Health to identify the hazardous chemical
- outline the contaminated geographic area;
- provide immediate medical assistance to exposed individuals;
- perform decontamination activities on people and equipment that were present at the contamination site;
- monitor for chemical contamination; and

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[99] Ministry of Interior http://www.gdgz.mvr.bg/default.htm

[100] Crisis Management Act; State Gazette, Issue 19, March 1, 2005

[101] Amendment to the Crisis Management Act; State Gazette, Issue 102, November 28, 2008

[102] Third Revision of the Protocol for the Execution of Rescue and Urgent Recovery Disaster Relief Efforts, July 18, 2007

[103] Fifth Revision of the Protocol for Protection from Dangerous Substances and Materials Released during Radiological, Chemical and Biological Disasters, January 9, 2009

- determine the result from the executed complex restrictive, restoration, rescue and other efforts, undertaken by the Ministry of Emergency Management.

8.3.1.2 Ministry of Health.

The Ministry of Health also supervises '*crisis management*' teams under the:

- National Office of Civil Defence
- Ministry of Defence; and
- Military Medical Academy

8.3.1.3 National Centre of Public Health Protection and Situation Centres

A National Situation Centre is part of MES, where municipal or regional crisis staff coordinate and manage relief operations and provide information to other agencies. It collects, processes, and analyses data for spread of radiation, chemical and biological, hydro-meteorological, road and fire incidents.

8.3.1.4 Ministry of Interior

The Ministry of the Interior supervises the '*crisis response*' teams under the:

- National Public Safety Agency
- Directorate General Police
- Ministry of Health.

8.3.1.5 Ministry of Health[104]

The main tasks for the Ministry of Health during chemical incidents are to: join effort with the National Office of Civil Defence to identify the hazardous chemical and identify the amount and degree of immediate medical attention required by exposed individuals.

8.3.2 National Emergency Response

(No Information)

8.3.3 Environment

(No Information)

8.3.4 Health

8.3.4.1 State Health Departments

State health departments work closely with the health care authorities in the government. They coordinate a Health Alert Network, a nationwide integrated information and communication system, established as a platform for the distribution of health alerts and national disease surveillance.

8.3.4.2 Poison Information Centres (PIC)

The Poison Information Centre is a 24-hour emergency and information hotline service for public and health care professionals. Calls are directly answered by a poison information specialist who is qualified in clinical toxicology. Poison information centres

[104] Military Medical Academy, 2010, *Medical Management of Chemical and Biological Casualties,* JMedCBR, Volume 8, 2010 http://www.gdgz.mvr.bg/default.htm

play a key role in chemical disaster response planning and can be a great resource for response providers when establishing plans and responding to disasters. PICs may be one of the first agencies notified of a chemical emergency, probably by a call from a concerned citizen; it is responsible for notifying the proper response agencies. PICs play an important role in disseminating basic and clinical toxicology information during a chemical incident affecting the public and medical professionals

8.3.5 Military / Defence

8.3.5.1 National Office of Civil Defence

The National office of Civil Defence has specialised rescue vehicles for responding to incidents involving radiological, chemical and biological contamination and accidents involving dangerous substances and materials.

8.3.5.2 Ministry of Defence

The main tasks for the Ministry of Defence during chemical incidents are to:

- provide assistance in establishing the causes and sources of chemical damage
- provide assistance in identification of the hazardous chemical.

8.3.5.3 Centre for Military Epidemiology and Hygiene

Field identification teams and laboratories are mobile and could reach an incident, if required.

8.3.6 National agreements and examples of interoperability

8.3.6.1 Agreements

8.3.6.1.1 Bilateral cooperation[105]

- Bilateral agreements with the Russian Federation and Romania;
- Close cooperation with TEMA (Agency for Emergency Management of Tennessee), USA, on the basis of signed bilateral protocol with FEMA (Federal Agency for Emergency Management) from 2000;
- Active cooperation with the Peace Corps of the United States;
- Bilateral agreements on protection against disasters: Greece, Croatia, Macedonia, Ukraine, Azerbaijan, Afghanistan, Italy, Moldova, Bosnia and Herzegovina and others.

8.3.6.1.2 DG Civil Defence - Ministry of Interior is the national contact point for coordination in crises and emergencies, providing 24 / 7 information exchange:

- Manual coordination in crises and emergencies of EU;
- European Programme for Critical Infrastructure Protection;
- In accordance with binding guidelines NATO's request, provide and providing assistance with CBRN incidents or natural disasters since 2008.

[105] Bilateral agreements http://ec.europa.eu/echo/civil_protection/civil/vademecum/bu/2-bu-4.html#list

8.3.6.2 Conventions[106]

Convention on the Transboundary Effects of Industrial Accidents, adopted on March 17, 1992 by the Conference of the Parties to the UN Economic Commission for Europe. Point of contact with MEE and Ministry for European Economic Commission UN Convention.

8.3.7 Examples of interoperability

8.3.7.1 Meteorological data and predictions[107]

Aerospace Monitoring Centre - The centre has installed the country's first software system for locating fires based on satellite data in near real time. They automatically detect fires and the information is distributed via e-mail. Detected fires are accompanied by precise geographical coordinates, information about the affected area and the intensity of the fire. They also graphically present data on atmospheric pressure, direction and wind speed. The software is able to integrate data from numerical models for weather forecasting.

8.3.7.2 National Institute of meteorology and hydrology[108]

The Bulgarian Emergency Response System (BERS) has been developed in the Bulgarian National Institute of Meteorology and Hydrology since 1994. BERS is based on numerical weather forecast meteorological information and a numerical long-range dispersion model accounting for the transport, dispersion, chemical and radioactive transformations of pollutants

8.3.8 Local capability and capacity

8.3.8.1 Fire Rescue Services

Civil defence has specialist chemical vehicles.

8.3.8.2 National Medical Co-ordination Centre

Join effort with the National Office of Civil Defence to identify the hazardous chemicals.

8.3.8.3 Centre for Military Epidemiology and Hygiene

Field identification teams and laboratories are mobile and could reach an incident, if required.

8.3.8.4 Specific military units

Bulgaria has 5 battalions located on a territorial basis with special equipment for search and rescue operations and chemical accidents.

[106] Convention on the Transboundary Effects of Industrial Accidents http://www.unece.org/env/teia/

[107] Antoanetta Fratzova (AF) et al, *Aerospace Monitoring Center at the Civil Protection* Directorate General, Ministry of Interior, Sofia, BULGARIA

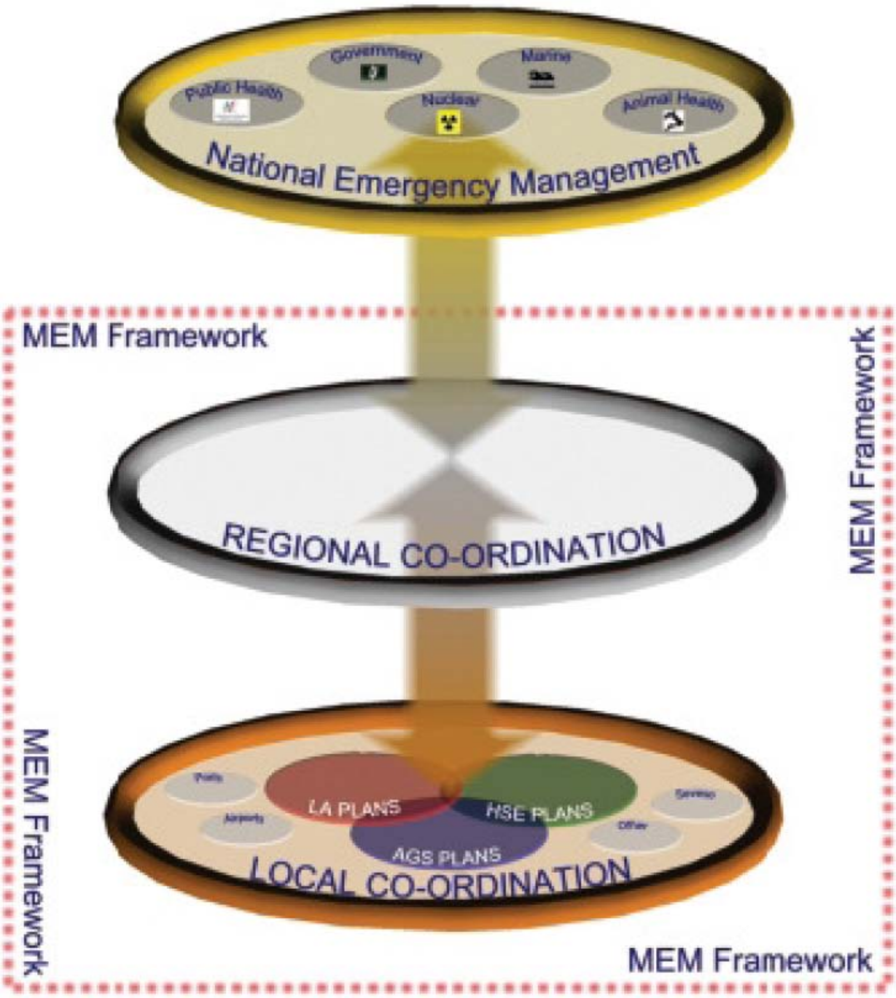
[108] National Institute of meteorology and hydrology http://www.meteo.bg/main.php?page=links&lang=en

8.4 Ireland

8.4.1 Central National/State Response[109]

The Minister for the Environment, Heritage and Local Government has established a Framework for Major Emergency Management (MEM)[110], which puts into place the arrangements that enable the Principal Response Agencies (An Garda Síochána (Police), Fire Service, the Health Service Executive and the Local Authorities) to co-ordinate their efforts whenever a major emergency occurs.

Figure 8.1 National Emergency Management Structure



[109] Ireland - Disaster management structure http://ec.europa.eu/echo/civil_protection/civil/vademecum/ie/2-ie-1.html#over

[110] A Framework for Major Emergency Management – 12 Sept 2006 http://www.environ.ie/en/LocalGovernment/FireandEmergencyServices/EmergencyPlanning/#Framework%20for%20Major%20Emergency%20Management

8.4.2 National/State Emergency Response

Ireland has 29 county councils: Carlow, Cavan, Clare, Cork, Donegal, Dun Laoghaire-Rathdown, Fingal, Galway, Kerry, Kildare, Kilkenny, Laois, Leitrim, Limerick, Longford, Louth, Mayo, Meath, Monaghan, Offaly, Roscommon, Sligo, South Dublin, Tipperary, Waterford, Westmeath, Wexford and Wicklow. Besides the county councils, Ireland has 5 city councils: Cork, Dublin, Galway, Limerick and Waterford. In addition, there are 5 borough councils and 75 town councils. The managers of the county and city councils are appointed following a competitive selection process by the Public Appointments Service. For the purposes of civil protection, each of the county and city councils function as Principal Response Agencies (PRAs) and as such has developed major emergency response plans.

There is no single agency responsible for major emergency management in Ireland. Rather, the relevant government ministries and public authorities are responsible for maintaining appropriate emergency management functionality according to their statutory ambits. Coordination between these stakeholders is promoted by a range of coordination arrangements as outlined above.

8.4.2.1 The Government Task Force on Emergency Planning

The Government Task Force on Emergency Planning oversees the emergency management activities of all Government ministries and public authorities.

8.4.2.2 The Office of Emergency Planning (OEP)

The Office of Emergency Planning (OEP) is responsible to the Minister of Defence for the coordination and oversight of emergency planning. The OEP chairs the Inter-Departmental Working Group on Emergency Planning (IDWG).

8.4.2.3 Inter-Departmental Working Group on Emergency Planning (IDWG)

The IDWG comprises officials representing government ministries and public authorities with lead or principal support roles in government emergency management. The Government Task Force charges the IDWG with carrying out specific studies and developing particular aspects of emergency management.

8.4.2.4 The National Steering Group

The National Steering Group undertakes the national level functions set out in A Framework for Major Emergency Management (the Framework/MEM) and continues to develop, maintain and update the Framework in light of the experience of its application, and reports on these issues to the Government Task Force on Emergency Planning. The group comprises representatives of the PRAs and their parent ministries, the Defence Forces and the Department of Defence.

8.4.2.5 Coordination centres

In the event of a major emergency, the coordination structures are enacted. Coordination centres can be established at the site, locally, regionally and nationally. The framework recognises that coordination is a specific function in emergency management, and the coordination task is assigned to the lead agency in the local and regional response and the lead government ministry at national level. For local and regional response, the determination of the lead agency is set out in the Framework based on the incident type. The lead ministry is pre-determined by incident type based on the Office of Emergency Planning's Strategic Emergency Planning Guidance.

The coordination structures are depicted in Figure 8.1. At national level, the objectives of civil protection or emergency planning are to implement, within a defined government framework, measures to identify and mitigate natural and technological hazards, and to plan for, to respond to, and to lead recovery from major emergencies, which threaten persons, infrastructure, the environment and property.

At ministerial level, the lead role for preparing and responding to an emergency of a particular kind rests with the functional government minister and government ministry, with support from other relevant government ministries and public authorities.

8.4.2.6 Government Task Force on Emergency Planning

The Government Task Force on Emergency Planning, chaired by the Minister of Defence, is the top-level structure, which provides policy and direction, and which coordinates and oversees the emergency management activities of all government ministries and public authorities.

8.4.2.7 The Principal Response Agencies (PRAs)

The agencies designated by the government to respond to major emergencies are:

- An Garda Síochána (National Police Service),
- The Health Services Executive (health)
- Local authorities (including the fire service),

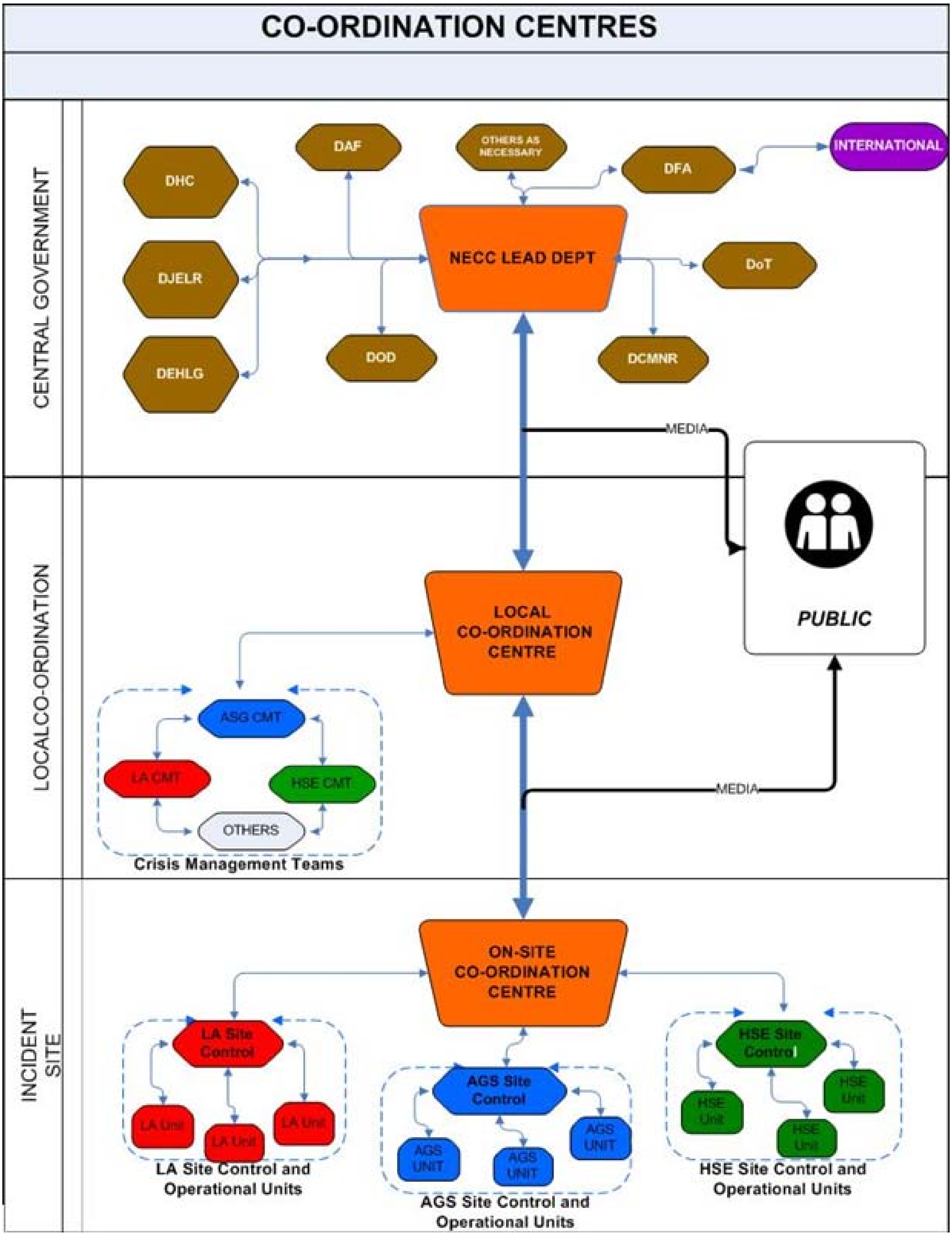
8.4.2.8 A Framework for Major Emergency Management

In 2006, the Government approved A Framework for Major Emergency Management (the Framework/MEM), which sets out specific requirements and uniform procedures in relation to those matters, which can be standardised nationally, including the declaration of a major emergency, the allocation of functions and responsibilities between the PRAs, and the command and control of operations and inter-agency coordination arrangements. The National Steering Group oversees the implementation of the Framework Programme.

There are eight regions for civil protection purposes. Arising from the provisions of the Framework, each of these regions has an inter-agency Regional Steering Group (RSG) on Major Emergency Management, comprising senior personnel from the PRAs within that region. Each region also has Regional Working Groups (RWGs) to support the RSGs and to undertake the functions assigned at regional level. At local/agency level, each PRA is responsible for undertaking the requirements and functions set out in the Framework. These requirements include risk assessment, developing plans, training and exercising, response and recovery.

Ireland operates an 'all hazards' approach to major emergencies, in which the common features of coordinated response and the management of common consequences are recognised, regardless of the origin of the emergency.

Figure 8.2 Organisational chart



8.4.3 At National level

There is no specific emergency planning legislation. Emergency planning is part of general planning carried out by each government department / agency under its appropriate legislation. In Ireland there is no specific statutory basis for emergency planning. Emergency planning arrangements are based on A Framework for Major Emergency Management adopted by the Government in 2006.

Each government department is responsible for ensuring that emergency plans exist in respect of its own area of responsibility. Operational responsibility for incidents, however, rests with the emergency services under the aegis of the departments concerned. Individual departments are also responsible for any necessary coordination between departments and/or services. Liaison officers in each department ensure that every request for support is dealt with rapidly and appropriately. Lists of contact officers and experts in the public services are kept up to date on a central level. Depending on the magnitude of the disaster, the Government can set up a national committee to monitor and advise on the crisis at central level.

There are aspects of emergency planning covered by dangerous substances regulations:

The Council Directive 96/82/EC on the control of major accident hazards involving dangerous substances commonly known as the Seveso II Directive was implemented into Irish legislation by the European Communities (Control of Major Accident Hazards Involving Dangerous Substances), Regulations, 2000, made by the Minister for Enterprise, Trade and Employment. The Health and Safety Authority is the Central Competent Authority for the Directive. In relation to the emergency planning provisions all Principal Response Agencies (PRAs) have been designated as local competent authorities for the purposes of the Regulations and the Directive.

8.4.4 Environmental

8.4.4.1 Environmental Protection Agency (EPA)[111]

Amongst the responsibilities of the EPA are:

- Licensing and control of large scale waste and industrial activities to ensure that they do not endanger human health or harm the environment.
- Monitoring, analysing and reporting on the environment
- Monitoring air quality and the quality of rivers, lakes, tidal waters and ground waters; measuring water levels and river flows.
- Independent reporting to inform decision making by national and local government

The EPA operates fixed air quality monitoring sites as part of the National Air Quality Monitoring Programme to monitor compliance with EU Directives[112]. However the EPA is not a principal response agency. The EPA is able to deploy mobile air quality monitoring equipment in the event of a significant prolonged incident.

[111] Environmental Protection Agency http://www.epa.ie/whatwedo/
[112] National Air Quality Monitoring Programme http://www.epa.ie/whatwedo/monitoring/air/data/

8.4.4.2 Health and Safety Authority (HSA)[113]

The Health and Safety Authority is the Irish Seveso competent authority.

8.4.4.3 Local Authorities[114]

The local authority may be able to deploy air quality monitoring equipment in the event of a chemical release.

8.4.4.4 Met Éireann, *the Irish National Meteorological Service*[115]

The Irish National Meteorological Service can provide custom dispersion forecasts for significant releases, although a dedicated 24/7 service is not provided.

8.4.4.5 Irish Coast Guard[116]

Depending on the size of an incident a Response centre is set up close to the scene. This response centre is manned by trained IRCG personnel and can be augmented by personnel from the Marine Pollution Response Team. Response to the incident is dictated by the size and complexity of the incident, which determines the measures to be taken and the type of incident response organisation to establish. With regard to the decision levels involved reference is made to the Coast Guard Operations Manual Part 3 Command and Control Organisation for combating marine incidents in the Irish Pollution Responsibility Zone.

A specialised 'Chemical Strike Team' would be sourced from European neighbours.

8.4.5 Health

8.4.5.1 Health Services Executive (HSE)[117]

The HSE manages the delivery of the entire Irish health service as a single national entity. The services it provides include:

- The HSE National Ambulance Service (NAS)[118]
- Environmental Health Officers[119]
- Public Health guidance and advice[120]

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[113] Health and Safety Authority
http://www.hsa.ie/eng/Your_Industry/Chemicals/Control_of_Major_Accident_Hazards/MAPP_and_Safety_Management/
http://www.hsa.ie/eng/Your_Industry/Chemicals/Control_of_Major_Accident_Hazards/Emergency_Planning/
http://ec.europa.eu/environment/seveso/natautho.htm

[114] Irish Local Authorities are indexed on:
http://www.environ.ie/en/LocalGovernment/LocalGovernmentAdministration/LocalAuthorities/
http://www.citizensinformation.ie/en/government_in_ireland/local_and_regional_government/local_authorities.html

[115] Irish National Meteorological Service http://www.met.ie/agri-environment/agri_env.asp

[116] Irish Coast Guard
http://www.transport.ie/marine/IRCG/Pollution/InvMeans.asp?lang=ENG&loc=2388

[117] Health Services Executive http://www.hse.ie/eng/

[118] The HSE National Ambulance Service http://www.hse.ie/eng/services/Find_a_Service/ambulanceservice/

[119] Environmental Health Officers
http://www.hse.ie/eng/services/Find_a_Service/Environmental_Health/Environmental_Health_Officers/

[120] Public Health http://www.hse.ie/eng/services/Find_a_Service/Public_Health/
www.hse.ie/eng/services/Publications/services/Environmentalhealth/HSE_Drinking_Water_and_Health_Review_and_Guide_2008.pdf

8.4.5.2 Food Safety Authority of Ireland (FSAI)[121]

The Authority is a statutory, independent and science-based body, dedicated to protecting public health and consumer interests in the area of food safety and hygiene. It comes under the aegis of the Minister for Health and Children and currently has a board of ten. It also has a 15 member Scientific Committee that assists and advises the Board. Therefore, decisions relating to food safety and hygiene take account of the latest and best scientific advice and information available.

The Authority is responsible for co-ordinating the enforcement of food safety legislation in Ireland. The FSAI is responsible for:

- Putting consumer interests first and foremost
- Providing advice to Ministers, regulators, the food industry and consumers on food safety issues
- Ensuring the co-ordinated and seamless delivery of food safety services to an agreed high standard by the various state agencies involved
- Ensuring that food complies with legal requirements, or where appropriate, with recognised codes of good practice
- Working with the food industry to gain their commitment in the production of safe food
- Setting food standards based on sound science and risk assessment
- Risk management in association with frontline agencies and the food sector, and communicating risks to consumers, public health professionals and the food industry.

8.4.5.3 The Department of Agriculture, Fisheries and Food (DAFF)[122]

The Laboratory Services of the Department of Agriculture, Fisheries and Food (DAFF) is an essential component of the role of DAFF in leading the sustainable development of a competitive farming and consumer focused agri-food business, which contributes to the rural economy and society. The Backweston Laboratory Complex has been developed to provide a laboratory infrastructure to support the diagnostic, regulatory and research and development functions necessary.

8.4.6 Military / Defence

8.4.6.1 Fire Service[123]

The Fire Services in Ireland are managed at local authority level, with the Department of the Environment, Heritage and Local Government playing an advisory, legislative and policy-making role. The Fire Services are operated by 37 Fire Authorities, which are managed by City Councils, County Councils, Borough Councils and Town Councils around the state.

[121] Food Safety Authority of Ireland http://www.fsai.ie/about_us.html
http://www.fsai.ie/resources_and_publications/chemical_contaminants.html
[122] The Department of Agriculture, Fisheries and Food
http://www.agriculture.gov.ie/animalhealthwelfare/laboratoryservices/
[123] Department of the Environment *and Irish fire services*
http://www.environ.ie/en/LocalGovernment/FireandEmergencyServices/FireAuthorities/
http://irishfireservices.ie/irish-fire-services-overview/fire-authorities

8.4.6.2 Police (Garda Síochána)[124]

Garda Síochána is a community based organisation with over 14,500 Garda and Civilian employees, who serve all sections of the community.

8.4.6.3 Ireland Defence Forces[125]

Provides Hazardous Material Identification, and bomb disposal teams are trained in dealing with chemical incidents.

8.4.7 National agreements and examples of interoperability

On 23 March 1998, the Council of Ministers for the Environment of the European Union decided the approval by the Community of the Convention (Council Decision of 23 March 1998 *on the conclusion of the* Convention on the Transboundary Effects of Industrial Accidents – *OJ No L 326 of 3 December 1998*). The instrument of approval was deposited with the Secretary-General of the United Nations on 24 April 1998. In addition to the Community all Member States except Ireland and Malta are Parties to the Convention[126].

8.4.8 Local capability and capacity

Inter-Agency Emergency Management Office[127]; duties of this office include:

- Providing support on a full time basis to the participating agencies in the consideration and implementation of their responsibilities in planning and preparing for their response to Major Emergencies in the Cork and Kerry Area.
- Chair the COMAH group, and report to the RWG Undertake work on behalf of the Regional Working Group (RWG) and other subgroups in relation to Major Emergency Management.
- Undertake work on behalf of the Regional Steering Group, (RSG).
- Co-ordinate the preparation of mandatory External Emergency Plans (EEPs) for COMAH sites.
- This preparation to include pre test planning, public consultation, testing and reviewing the 13 top tier COMAH/SEVESO sites.
- Review and issue the completed Major Emergency Plans to nominated individuals within the Principle Response Agencies, (PRAs).
- Co-ordinate and develop liaison between the participating agencies and the voluntary agencies.

[124] Police http://www.garda.ie/

[125] Ireland Defence Forces http://www.military.ie/ http://www.cbrneworld.com/pdf/cbrne-world-spring-2011-when-irish-eyes-are-smiling.pdf

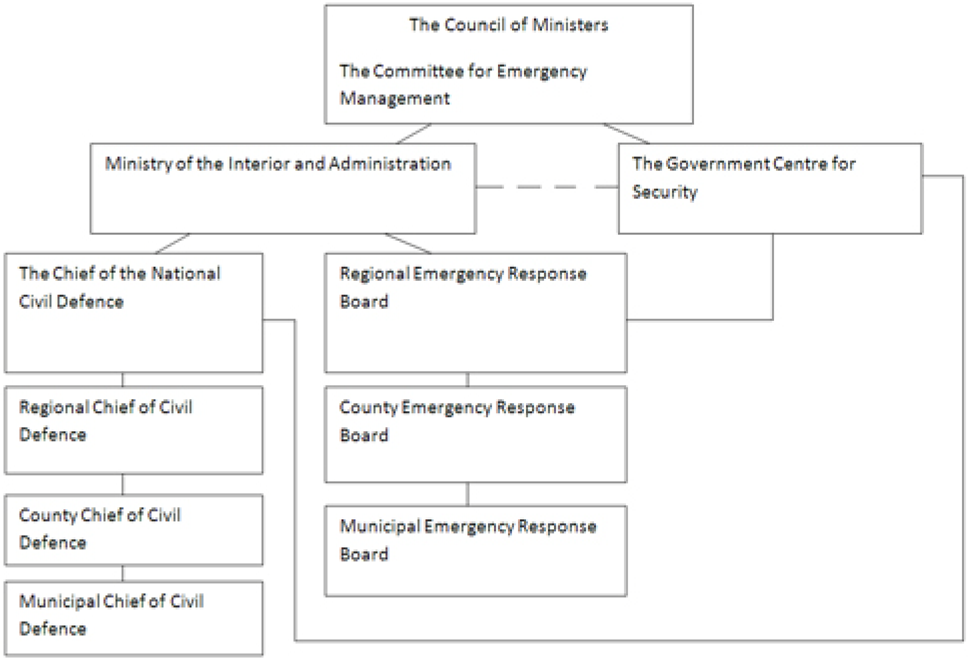
[126] Convention on the Transboundary Effects of Industrial Accidents – *OJ No L 326 of 3 December 1998* http://ec.europa.eu/environment/seveso/international.htm

[127] Inter-Agency Emergency Management Office http://www.iaemo.ie/home/

8.5 Poland

8.5.1 National Overview

Figure 6.5 Emergency management structure in Poland



8.5.2 Central Government Response

8.5.2.1 Council of Ministers

The Council of Ministers (subordinated to the Prime Minister) is responsible for the maintenance of public order and the internal security of the state, at national level. It is empowered to declare a state of emergency.

8.5.2.2 Government Crisis Management Team (GCMT)

The Government Crisis Management Team (GCMT) assists the Council of Ministers in the field of crisis management. It is chaired by the Prime Minister with the Minister of the Interior and Administration and the Minister of National Defense as deputy chairs. It works as an advisory body on issues related to initiating and coordinating activities in the field of crisis management, including civil emergency planning (CEP), at a national level. The main tasks of the GCMT are:

- o Develop proposals to use the capabilities and resources necessary to restore control of emergency situations;
- o Provide advice in the field of coordinating the activities of government administrations, state institutions and emergency services during emergencies;
- o Give opinions on the national emergency response plan and submit it to the Council of Ministers for approval;
- o Provide opinions on national and provincial critical infrastructure protection plans and submit them to the Council of Ministers for approval.

8.5.2.3 Government Centre for Security (GSC)

The Government Centre for Security (GSC) is a supra-ministerial structure which aims to optimise and standardise the perception of threats (including CBRN threats) by individual government departments; thereby increasing the degree of ability to cope with difficult situations by the competent services and public administration authorities. The main and basic task of the Government Centre for Security is dealing with the coordination of efforts in the field of crisis and emergency management. This includes for example, a detailed presentation of methods and means of reacting to threats and mitigating their results, gathering information on threats; analysing collected materials; as well as developing conclusions and recommendations for preventing and counteracting threats. The Centre serves as a national centre for crisis management. The Director of the Government Centre for Security is the secretary of the GCMT.

Government Centre for Security works with other nations within and outside of the EU and international organisations in the field of CBRN threats; critical infrastructure protection; trainings and exercises and civil protection. One of the working groups in which members of GSC participate is the Working Group on Transboundary Crisis Management, operating within the Euro region ‘Neisse’.

8.5.2.4 The Ministry of the Interior and Administration

The Ministry of the Interior and Administration is responsible for the maintenance of public order, the protection of the population in emergency situations and the prevention of disasters. It supervises most of the emergency services.

8.5.2.5 The National Headquarters of the State Fire Service (KGPSP)

The National Headquarters of the State Fire Service (KGPSP) with the Chief Commandant acting also as Chief of the National Civil Defence (subordinated to the Ministry of the Interior and Administration). The Chief Commandant of the State Fire Service is the central authority of the government administration responsible for the organisation of the National Firefighting and Rescue System (NFRS) and fire protection. One of the statutory duties is the direction of the NFRS, in particular:

- dispatching NFRS units in the country through the control room;
- setting up a joint plan for the network of NFRS units;
- setting up a plan for deployment of specialised equipment within NFRS in the country;
- dispatching operational resources supports and directing their forces;
- commanding rescue operations the extent or range which exceeds the provincial capacity;
- organising and directing the central operational resources support;
- analysing the rescue operations conducted by organisational units of NFRS.

8.5.2.6 The National Centre for Co-ordination of Rescue Operations and Civil Protection (KCKRiOL)

The National Centre for Co-ordination of Rescue Operations and Civil Protection (KCKRiOL) (within National HQ of the State Fire Service) is responsible for supervising the correct functioning of the National Firefighting and Rescue System. It functions as:

- the operations co-oordination centre of NFRS;
- the central point of the early warning and alarm system at national level;
- the national point for notifying threats and offering mutual assistance;
- the seat and centre for forwarding information and supporting decision-making; by
- the Crisis Response Team of the Minister of Internal Affairs and Administration or the Inter-ministerial Crisis Team.

It is also the focal point for co-ordinating international rescue and humanitarian operations and organising exercises of specialised groups envisaged for participation in rescue operations abroad.

According to regulations in force in Poland, each minister is responsible for actions in the field of CEP within their own area of competence.

8.5.2.7 Antiterrorism:

The Inter-ministerial Team for Terrorist Threats and the Counter Terrorist Centre of the Internal Security Agency are responsible for coordination and analysis units in charge of preventing and combating terrorism, under the command of the Internal Security Agency (AWB).

8.5.3 Stakeholders (examples of possible sources of advice)

8.5.3.1 Site operator

The site operator will maintain site specific information, including how to deal with the released substance. Information on dealing with the released substance is provided by NIOM (Chemical Safety Department; MSDS emergency phone service).

8.5.3.2 Institute of Meteorology and Water Management (IMGW)

The National Research Institute (IMGW PIB) is responsible for meteorological information. It is a research development unit supervised by the Minister for Environment. Amongst its general tasks are:

- Making regular measurements and observations with the use of basic systems and measurement networks;
- Acquisition, archiving, processing and making available measurement and observational materials, both national and international ones;
- Preparation and dissemination of forecasts and warnings for general public and national economy protection as well as for state defense;

- Forecasting of water resources quality and air pollution;
- Participation in the activities of the World Meteorological Organisation and other specialised UN agencies, co-operation with other organisations, national and international institutions.

The State Hydrological and Meteorological Service (PSHM) carried out by the IMGW PIB provides the state authorities, general public and national economy with continuous current information on the state of the atmosphere and hydrosphere, forecasts and warnings, both in normal as well as in emergency situations.

The system of the Polish Hydrological and Meteorological Service includes three sub-systems, as follows: observing-measurement, information for the media, data processing, forecasting and warning. IMGW is responsible for the maintenance and operability of meteorological data network consisting of 62 meteorological stations, reading main meteorological parameters (wind, pressure, humidity, temperature and rainfall in part of them). From these stations raw meteorological data is sent via telex to 9 local forecasting offices (LFO). The LFOs together with the Central Telecommunication Node (CTN) are located in IMWM constitute the basic meteo network, called METPAK.

8.5.4 Specialist public health advice:

8.5.4.1 Nofer Institute of Occupational Medicine (NIOM)

Comprising the following sections / departments:

- Chemical Safety Department (Risk Assessment Unit)
- Department of Environmental Health Hazards
- Department of Environmental Epidemiology

8.5.4.2 National Institute of Public Health and National Institute of Hygiene (PZH)

These agencies are responsible for monitoring of biological, chemical and physical risk factors in food, water and air and for diseases and infections. PZH provides expert advice for the government, NGOs and civil society in the field of risk assessment and also advice on how to avoid risks.

8.5.4.3 Division of Environmental Health

Includes Departments of Communal Hygiene, Food and Consumer Articles Research and Department of Environmental Toxicology) and offers advice and possibility of laboratory testing of air, water, soil, food samples.

8.5.4.4 The Chief Sanitary Inspectorate

A central administration body, subordinate to the Minister of Health, focusing particularly on communicable disease control, food and nutrition safety, environmental hygiene, health promotion and other issues, related to public health. It supervises Sanitary-Epidemiological Stations within the country.

8.5.5 Environmental protection:

8.5.5.1 Inspection for Environmental Protection (GIOS)

(see below – Section 6.5.7)

8.5.5.2 Institute of Environmental Protection

The Institute of Environmental Protection is a ministerial / governmental institute, supervised by the Ministry of the Environment. It is engaged in the development of state policies at national and international levels; and measurement and analytical methods in environmental pollution. It is also engaged in State Environmental Monitoring System and other research fields, connected with environmental protection.

8.5.5.3 Public water supplies

Water companies

8.5.5.4 Central Institute for Labour Protection – National Research Institute (CIOP)

The centre comprises Major Chemical Incidents (online service), and the Central Institute for Labour Protection – National Research Institute (CIOP), which is the main research institution comprehensively dealing with the problems of improving working conditions in accordance with human psychophysical abilities. The subject of the Institute's activity is conducting research and development works leading to new technical and organisational solutions in the field of labour protection, related to occupational safety, health and ergonomics, as well as carrying out other tasks especially important for reaching the goals of the state's social-economic policy in this field. The Department of Chemical and Aerosol Hazards provides implementation and promotion of tools supporting tasks and procedures of a system of preventing major accidents by enterprises and competent authorities (guidelines, databases, recommended procedures), and preparing methods of controlling dangerous chemical substances, not present in normal conditions i.e. present in emergencies. They also prepare and update on-line services on major chemical incidents[128].

8.5.6 National Emergency Response

8.5.6.1 The National Firefighting and Rescue System (NFRS)

The National Firefighting and Rescue System (NFRS) (coordinated by National HQ of the State Fire Service) was created to protect life, health and property, when: fighting fires; dealing with other local threats and natural disasters; as well as in the course of technical and chemical rescue operations. NFRS is based within the fire service, but is supported (pursuant to agreements on central, regional and local levels) by different services and institutions, having various capabilities valuable in the case of emergency. Depending on the nature of the emergency, such agencies may include:

- the Mountain, Water and Tatran Voluntary Rescue Services (GOPR, WOPR, TOPR);
- the Polish Aeroclub;

[128] Department of Chemical and Aerosol Hazards http://www.ciop.pl/7351.html / http://www.ciop.pl/18385.html

- the Polish Scouts Association;
- 11 hospitals, including 10 of the Ministry of Internal Affairs and Administration and the Centre for the Treatment of Burns in Siemianowice Śląskie;
- the Polish Medical Mission;
- the Police;
- the Border Guard;
- the State Inspectorate for Environmental Protection;
- the State Agency of Atomic Energy;
- the Central Mining Rescue Station.

Structure of NFRS is based on the administrative levels of the country – local (counties), regional (provinces/voivodship) and national; depending on the range of emergency situation or its nature, suitable resources are activated. NFRS continuously monitors and initiates immediate rescue action on the basis of resources available on the local level. Additionally Operational Resources Supports established in the framework of the National Firefighting and Rescue System conduct rescue operations, which exceed the rescue capacity of counties or provinces.

The Central Operational Resources Support consists of separated special resources of the State Fire Service, including equipment and extinguishing and neutralising agents from 16 national special equipment bases. It includes:

- 34 firefighting companies;
- 16 special companies;
- 13 flood protection companies;
- 5 school-based companies and a container base;
- specialised groups for operations in the scope of: high rescue (12), chemical rescue (23), environmental rescue (4), technical rescue (6), water & diving rescue (23), medical rescue (1), search and rescue (5), including 2 for international operations.

8.5.7 Environmental

8.5.7.1 Inspection for Environmental Protection

It includes Chief Inspectorate for Environmental Protection (a central organ of government administration - GIOS) and Voivodships Inspectorates for Environmental Protection (WIOS). The major tasks of the Inspection for Environmental Protection include: controlling compliance with environmental protection regulations, examining the state of the environment under the programme of the National Environmental Monitoring and preventing major accidents. These tasks are performed by, among others:

- controlling compliance with environmental protection regulations and sensible use of natural resources;
- controlling compliance with the decisions specifying the conditions of using the environment;

- participating in the proceedings related to the location of investments;
- participating in the commissioning of the structures or installations that may have a significant impact on the environment;
- controlling the use of installations and facilities protecting the environment against pollution;
- taking decisions suspending the activity violating environmental protection requirements or the principles specifying the use of the environment;
- cooperating with other inspecting authorities, prosecution authorities, justice and government administration, the organs of local government and civil first response administration as well as social organisations in the area of environmental protection;
- organising and coordinating State Environmental Monitoring System (the system of receiving, gathering, transforming and making available information on the environment), conducting environmental quality tests, observing and assessing the state of the environment and the changes taking place in the environment;
- observational air quality data from network of fixed air quality monitoring equipment. Hand held and vehicle based monitoring equipment.
- preparing and implementing analytical and examining methods as well as controlling and measuring methods;
- initiating activities with the purpose to establish the conditions preventing major accidents, helping to eliminate their consequences and restoring the environment to its proper condition.

The Chief Inspector for Environmental Protection is the competent authority, which implements the provisions of the Convention of the United Nations European Economic Commission (UNEEC) on the transboundary effects of industrial accidents, called the Industrial Accidents Convention (Helsinki; 17 March 1992).

The Chief Inspectorate for Environmental Protection, which implements the provisions of this Convention, is the focal point for exchange of information about the occurrence of transboundary industrial accidents.

8.5.8 Health

8.5.8.1 Health Care System

The system includes Toxicological Information in Acute Intoxication Units, which provide medical advice by phone in case of intoxication (i.e. in NIOM). The National Poisons Information Centre operating in NIOM, together with the physicians employed at the Acute Poisonings Department, run a 24-h telephone information service to medical practitioners, chemical safety services, work safety and hygiene units and also for the general public. The range of information provided includes: identification of chemical substances, their toxic effects, first aid, and treatment of acute poisoning cases. It compiles computerised databases of common chemical substances (such as medicines, pesticides, household products) containing information on chemical composition, toxicity, and treatment of acute poisoning cases. It collects and analysis information about all patients who are treated in poisoning units and toxicological departments in Poland.

8.5.8.2 Hospitals, GPs

Health effects observations.

8.5.9 Military / Defence

8.5.9.1 Police Service

Establishing cordons, issue shelter and evacuation advice on-scene.

8.5.9.2 Ministry of National Defense - Central Unit of Pollution Analysis (COAS)

Responsible for National System of Pollution Detection and Alarming (KSWSiA) created to ensure cooperation of existing systems (e.g. regional points of pollution detection and alarming), working in the fields of monitoring, detection and alarming on pollution of any kind on the territory of Poland. KSWSiA also includes intervention in case of pollution occurrence and serves as a source of information about incidents in the national crisis management system. KSWSiA assists by sampling and analysis of polluted areas.

8.5.9.3 Ministry of National Defense - Chemical Corps

In the case of major incidents, Chemical Corps is called upon for assistance by fire brigades in establishing the causes and sources of chemical damage and identification of the hazardous chemical.

8.5.10 National agreements and examples of interoperability

8.5.11 International cooperation -Cooperation within EU:

8.5.11.1 Civil Protection Mechanism[129]

From the beginning of 2003 the Mechanism was created to facilitate co-operation in civil protection assistance interventions in the event of major emergencies. It includes the accessible 24 hours a day Monitoring and Information Centre (MIC)[130] operated by DG ECHO of the EC. MIC platform enables appeals for assistance in case of major emergency. In Poland, KCKRIOL acts as contact point for MIC. For facilitating emergency communication among the participants the Common Emergency Communication and Information System (CECIS)[131] was created.

Participation of Poland in EU Working Groups and Committees:

- o EU Council Working Party on Civil Protection (PROCIV) - KGPSP is a body responsible for cooperation within PROCIV, whose work is aimed at developing the EU's capacity to prevent and manage disasters. It also deals with issues related to

[129] Civil Protection Mechanism http://ec.europa.eu/echo/civil_protection/civil/prote/mechanism.htm

[130] Monitoring and Information Centre http://ec.europa.eu/echo/civil_protection/civil/prote/mic.htm

[131] Common Emergency and Information System (CECIS) http://ec.europa.eu/echo/civil_protection/civil/cecis.htm

preparedness for critical infrastructure and chemical, biological, radiological and nuclear (CBRN) substances.

- the Committee for the Action Programme and for the Community Mechanism in the field of civil protection (competent institution – KGPSP);
- the Committee of Competent Authorities to Implement the SEVESO II Directive; (competent institution – KGPSP; GIOS)
- the Working Group on the Implementation of Article 18 of the SEVESO II Directive Concerning Plants Involving Major Accident Hazards; (competent institution – KGPSP; GIOS)
- the Working Group on Land Use Planning for Plants Likely to Involve Major Accident Hazards and their Vicinity; (competent institution – KGPSP; GIOS)
- the Steering Committee and implementing groups within the EUROBALTIC II Project, coordination of EUROBALTIC Programme (competent institution – KGPSP; GIOS).

8.5.11.2 Cooperation within NATO:

Mechanisms for cooperation with NATO:

- Senior Civil Emergency Planning Committee (SCEPC)
- Euro-Atlantic Disaster Response Coordination Centre (EADRCC),
- Civil Protection Committee (CPC)

8.5.11.3 Cooperation within United Nations

Convention on the Transboundary Effects of Industrial Accidents, adopted on March 17, 1992 by the Conference of the Parties to the UN Economic Commission for Europe. Ratified in Poland 22nd Dec. 2003; competent authority - GIOS;

8.5.11.4 Bilateral agreements:

Bilateral agreements on mutual assistance in case of disasters and serious accidents were signed (or are within negotiations) with the Federal Republic of Germany, Ministry of Interior of Brandenburg, Ministry of the Interior of Mecklenburg-Western Pomerania, Ministry of the Interior of Free State of Saxony, the Russian Federation, the Lithuanian Republic, the Slovak Republic, the Republic of Hungary, the Czech Republic, Ukraine, Republic of France, the Republic of Croatia, the Republic of Belarus, the Republic of Slovenia and the Republic of Estonia

- Agreement between the Republic of Poland and the Federal Republic of Germany on Mutual Assistance during Technological and Natural Disasters and Other Serious Accidents, signed in Warsaw on 10 April 1997
- Agreement between the Ministry of the Interior and Administration of the Republic of Poland and the Ministry of Interior of Brandenburg on Cooperation and Mutual Assistance During Technological and Natural Disasters and Other Serious Accidents, signed in Slubice on 18 July 2002
- Agreement between Ministry of the Interior and Administration of the Republic of Poland and the Ministry of the Interior of Mecklenburg-Western Pomerania on Cooperation and Mutual Assistance During Technological and Natural Disasters and Other Serious Accidents, signed in Slubice on 18 July 2002

- Agreement between the Ministry of the Interior and Administration of the Republic of Poland and the Ministry of the Interior of Free State of Saxony on Cooperation and Mutual Assistance During Technological and Natural Disasters and Other Serious Accidents, signed in Slubice on 18 July 2002
- Agreement between the Government of the Republic of Poland and the Government of the Russian Federation on Cooperation in Prevention of Technological and Natural Disasters, and in Relief of Their Consequences, signed in Warsaw on 25 August 1993
- Agreement between the Government of the Republic of Poland and the Government of the Lithuanian Republic on Cooperation and Mutual Assistance in Case of Technological and Natural Disasters and Other Serious Accidents, signed in Warsaw on 4 April 2000
- Agreement between the Government of the Republic of Poland and the Government of the Slovak Republic on Cooperation and Mutual Assistance during Technological and Natural Disasters and Other Serious Accidents, signed in Bratislava on 24 January 2000
- Agreement between the Republic of Poland and the Republic of Hungary on Cooperation and Mutual Assistance in Prevention of Technological and Natural Disasters and Other Serious Accidents, and in Relief of Their Consequences, signed in Warsaw on 6 April 2000
- Agreement between the Republic of Poland and the Czech Republic on Cooperation and Mutual Assistance in Case of Technological and Natural Disasters and Other Emergencies, signed in Warsaw on 8 June 2000
- Agreement between the Government of the Republic of Poland and the Cabinet of Ministers of Ukraine on Cooperation and Mutual Assistance in Prevention of Technological and Natural Disasters and Other Emergencies, and in Relief of Their Consequences, signed in Warsaw on 19 July 2002
- Agreement between the Government of the Republic of Poland and the Republic of France on Cooperation in the Field of Internal Affairs, signed in Warsaw on 12 September 1996
- Agreement between the Government of the Republic of Poland and the Republic of Croatia on Cooperation in Protection against Technological and Natural Disasters, and in Relief of Their Consequences, signed in Zagreb on 17 September 2003
- Agreement between the Government of the Republic of Poland and the Government of the Republic of Belarus on Cooperation in the Field of the Prevention of Technological and Natural Disasters and Other Emergencies, and in Relief of Their Consequences
- Agreement between the Government of the Republic of Poland and the Government of the Republic of Slovenia on Cooperation in the Prevention of Natural Disasters and Other Accidents, and in Relief of their Consequences
- Agreement between the Government of the Republic of Poland and the Government of the Republic of Estonia on Cooperation in the Field of Civil Protection (first round of negotiations).

8.5.12 Other examples:

8.5.12.1 The Visegrád Group,

Also called the Visegrád Four or V4, is an alliance of four Central European countries – the Czech Republic, Hungary, Poland and Slovakia – for the purposes of cooperation also in the field of civil protection:

- co-operation within Council of the Baltic Sea States (CBSS);
- co-operation within Organisation for Economic Co-operation and Development and Working Group for Chemical Accidents (OECD);
- the ADR Convention

8.5.13 National agreements/interoperability

Philosophy of NFRS (National Firefighting and Rescue System) includes tight cooperation between different units/services/institutions having equipment, staff and data basis useful in case of emergency. On the central level Chief Commandant of State Fire Service signs agreements on either inclusion into or cooperation with NFRS with different subjects that may help in emergency situation. These may be governmental / non-governmental organisations or professional rescue services. Agreements signed on central level describe general frames of the cooperation and serve as a basis for agreements on provincial and county levels.

8.5.14 National examples of interoperability

8.5.14.1 National System of Pollution Detection and Alarming (KSWSiA)

The System provides standardised procedures, methodologies and information flow for all subjects of the system.

8.5.14.2 IMGW

The State Hydrological and Meteorological Service (PSHM) carried out by the IMGW PIB provides the state authorities, general public and national economy with continuous current information on the state of the atmosphere and hydrosphere, forecasts and warnings, both in normal and emergency situations.

8.5.14.3 Head Office of Geodesy and Cartography (GUGiK)

Its role includes establishing and maintaining geodetic and gravimetric networks, preparing official topographic maps, national resources of geodetic and cartographic data, cadastral register of land and buildings. GUGiK is a member of Eurogeographics representing Poland.

8.5.14.4 State Environmental Monitoring System

The system includes a number of subsystems such as: air monitoring, noise and non-ionising radiation monitoring, ground and surface water monitoring, soil and wastes monitoring and animated nature monitoring. The information obtained in the systems is used to assess emissions, hydrometeorological and climatic conditions and to describe natural resources and natural structures.

8.5.14.5 National Poisons Information Centre

By making available its own information materials to regional toxicological centres, the National Poisons Information Centre enables the operation of a uniform nationwide toxicological information system in Poland.

8.5.15 Local capability and capacity

8.5.15.1 Fire and Rescue Service - Voivodeship commandants of Fire Service

The fire and rescue service helps to ensure that the on-site emergency preparedness plans are developed and maintained and that the public is aware of on-site emergency preparedness plans. Tasks:

- receiving and approving major accidents prevention plans and accepting Internal Emergency Plans providing by companies;
- developing and accomplishment of External Emergency Plans in case of major accidents;
- identification of companies that increase the possibility of domino effects;
- providing information to the public on actions to take if an accident involving hazardous substances occurs.

8.5.15.2 Fire and Rescue Service - Specialised Chemical and Ecological, Rescue Groups

There are fourteen specialist chemical and ecological rescue groups in the State Fire Service (SFS), included in the operational resources support of the Chief Commandant of the SFS. Within the area of almost every province, there are groups included in the regional operational resources support; two of them, from Warsaw and Katowice Piotrowice are entitled to act abroad. Tasks include:

- Provide on scene observations and cascade information relating to the incident to multi-agency partners as required;
- Undertake scene risk assessment and make initial shelter or evacuation risk assessments base on scene observations;
- Analysis at the scene.

8.5.15.3 Fire and Rescue Service SPOT - System of Dangerous Materials Transport

Assistance Fire and Rescue Service agreements with chemical plants. Advice and help (on the phone or directly) in case of a accident.

The Poland-wide Hazardous Materials Assistance in Transport System is an IT system providing technical assistance in emergencies and traffic accidents involving chemical products on roads, in warehouses and production facilities. Its aim is to limit the effects of an emergency or accident by providing speedy and professional assistance to the National Fire Department, as well as rescue crews. SPOT has been in operation since 2000 and associates companies from the refining and petrochemical industry. Some of the responsibilities of the signatories include:

- co-operating with inspection authorities in order to reach an optimum level for guaranteeing safety, phone consultations, dispatching specialists and specialised technical equipment;

- o conducting an open policy of information on present dangers and the safety and security measures applied.

8.5.15.4 Ambulance

Responsible for providing immediate medical assistance to exposed individuals; scene observations and on-scene health effects observations.

8.5.15.5 Police

Responsible for establishing a cordon and issuing shelter and evacuation advice, on-scene.

8.5.15.6 Chemical Rescue Units in chemical plants

Would undertake scene observations; establish a cordon and issue shelter and evacuation advice on-scene. They may also have the capability to undertake analysis at the scene.

8.5.15.7 Voivodship Inspectorates for Environmental Protection (WIOS)

A part of the State Environment Protection Inspectorate (PIOS) is constituted by the regional (voivod) Environment Protection Inspections (WIOS), often referred to as the environmental police. They are authorised to enter premises 24 hours a day; such inspections are not pre-announced. The inspectors are entitled to view documents, hear testimonies and publish the data collected during the inspection that relate to the subject of control. The inspector is entitled to take samples and perform the control. The inspection cooperates with other auditing bodies, law enforcement bodies and courts, as well as with state and government bodies, local governments and civil defense bodies, in the field of environmental protection. It initiates activities aimed at creating conditions for major accident prevention as well as accident recovery and environmental restoration.

8.5.15.8 Local authorities

At each administrative level, Crisis Management Teams (CMT) are established (not mandatory at the municipal level) as supporting bodies for the heads of authorities at the given level. The provinces are headed by representatives of the government (Voivodes). Their main tasks are to coordinate the prevention of all types of hazards, support efforts at self-governmental levels, and assist lower governmental levels if their resources are inadequate.

Responsibilities at municipal level are all local public issues, in particular fire protection and the maintenance of public order. Additional responsibilities are the monitoring of threats, early warning systems, alarms and the coordination of rescue operations and evacuations. The head of a municipality (Wójt) defines civil protection tasks for all institutions that are operational within the municipality.

8.5.16 Other possible related organisations/ capability

8.5.16.1 Legal owners

Legal owners and possessors of facilities, institutions and associations of critical infrastructure are responsible for developing and conducting activities and training connected with chemical safety.

8.5.16.2 Voivodship Sanitary-Epidemiological Stations

Present possibility of water/food analysis.

8.5.17 Local Agreements and examples of Interoperability

Examples of agreements signed by Podlaskie Voivodship Commandant of State Fire Service in connection with voivodship crisis management plans:

- o Agreement signed on 22 July 1997 with the Commander of Garrison in Bialystok.
- o Agreement signed on 10 March 1997 with the Main Inspector of Buildings Supervision.
- o Agreement signed on 3 September 1993 with Inspectorate of Environmental Protection.
- o Agreement signed on 12 January 2001 with the Regional Inspectorate of Labour.
- o Agreement signed on 14 May 2002 with the Fire School in Suprasl.
- o Agreement signed on 24 October 2000 with the Customs Office in Bialystok.
- o Agreement signed on 3 July 2003 with the Aeroclub in Bialystok.
- o Agreement signed on 15 April 1999 with the Company exploiting Oil Pipeline "Przyjazn"
- o Agreement signed on 31 May 2000 with the Regional Directorate of National Forestry in Bialystok.

Thanks to agreements signed all parties are aware of other parties competences and technological and equipment potential. Moreover, in the event of necessary use of assistance specified in agreements, there is no need to recognise and negotiate the terms and form of assistance.

References

- o The Crisis Management Act of 26 April 2007 (Official Journal 89/2007 p. 590) (with executive regulations)
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- o Report of the project: 'Crisis Management System in Podlaskie Voivodship' Podlaskie Voivodship Office in Bialystok, Podlaskie Voivodship Marshall Office, Białystok 2003

websites

- o http://www.unece.org/env/teia
- o http://ec.europa.eu/echo/civil_protection/civil/vademecum/pl/2-pl-1.html#over
- o http://rcb.gov.pl/eng/
- o http://www.straz.gov.pl/page/en.php?str=2139

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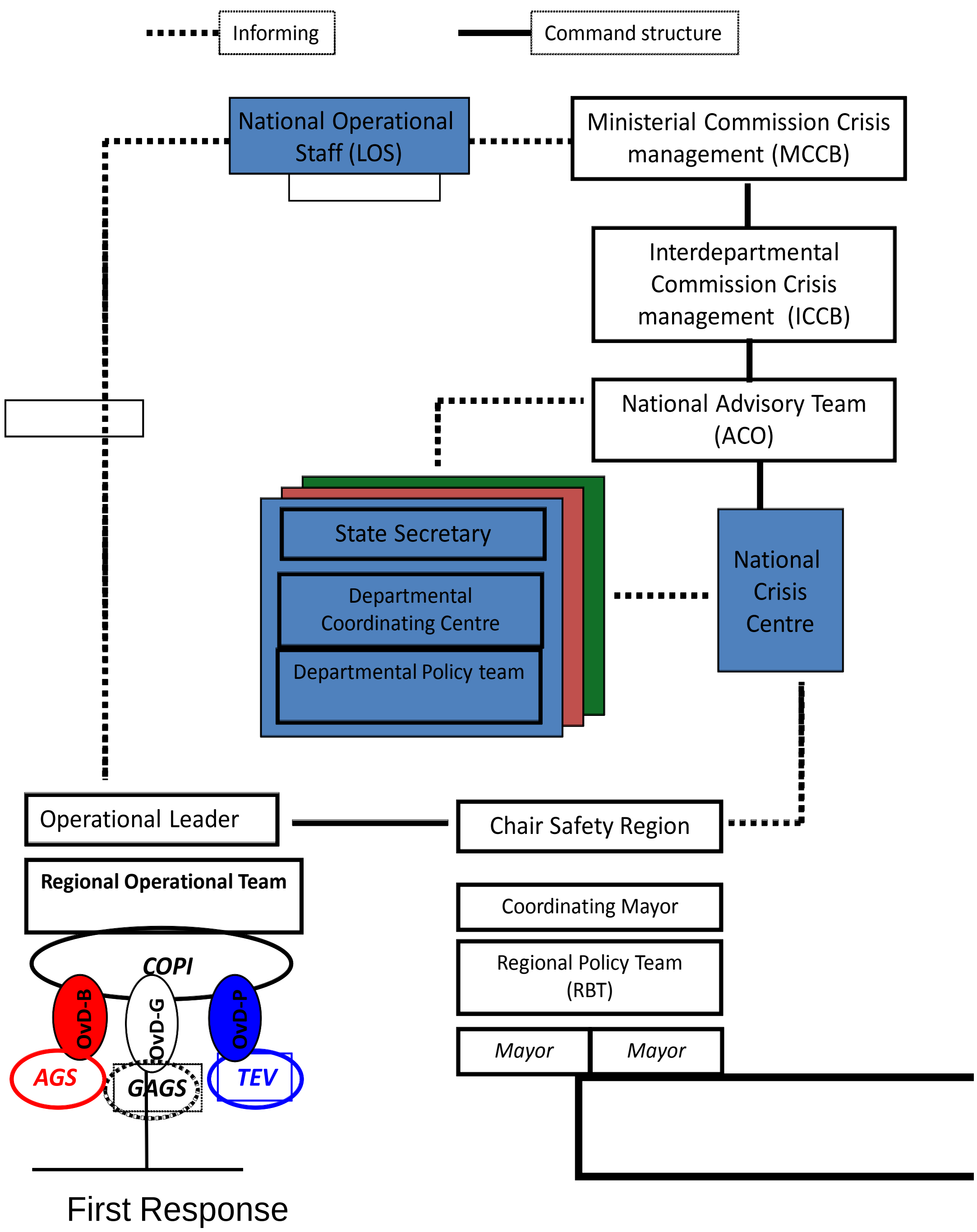
- http://www.nato-pa.int/default.asp?SHORTCUT=357)
- http://www.ock.gov.pl/portal/ock/16/362/Wspolnotowy_Mechanizm_Ochrony_Ludnosci.html
- http://www.gios.gov.pl/artykuly/323/Konwencja-w-sprawie-transgranicznych-skutkow-awarii-przemyslowych
- www.visegradgroup.eu/
- http://www.straz.gov.pl/page/en.php?str=2139
- http://www.straz.gov.pl/page/en.php?str=2147
- http://www.ios.edu.pl/eng/welcome.html
- http://www.antyterroryzm.gov.pl/portal/eng/
- http://www.abw.gov.pl/portal/en)
- http://www.wp.mil.pl/en/index/
- http://www.ciop.pl/7351.html
- http://www.ciop.pl/18385.html



Informing
Command structure
National Operational Staff (LOS)
Ministerial Commission Crisis management (MCCB)
Interdepartmental Commission Crisis management (ICCB)
National Advisory Team (ACO)
State Secretary
Departmental Coordinating Centre
Departmental Policy team
National Crisis Centre
Operational Leader
Chair Safety Region
Regional Operational Team
Coordinating Mayor
Regional Policy Team (RBT)
COPI
OvD-B
OvD-G
OvD-P
AGS
GAGS
TEV
Mayor
Mayor
First Response

8.6.1 Regional Response

In the event of a major accident or disaster, or a justifiable fear of such an incident occurring, the Mayor is in command of everyone involved in the response. In the event of a disaster or crisis affecting several municipalities, the Chair of the Regional Safety Board (comprising all the Mayors in the region) fulfils a special role. On the basis of statutory criteria, the Chair establishes whether this role applies and if so, he or she may convene a meeting of the Regional Policy Team (RBT) either independently, or at the request of a member of the Regional Safety Board or the Minister of Security and Justice. The RBT comprises of at least the Mayors whose municipalities are involved. The Chair consults the RBT as to the measures to be taken. The Mayors exercise their authority in accordance with the outcome of the consultations. The Chair remains answerable to the Minister of Security and Justice as to his or her actions within the RBT.

8.6.2 Central National/State Response

In the event of a disaster affecting several regions or a national crisis, the Secretary of State can assign tasks to the municipalities. If more Secretaries of State are involved, a National Advisory Team (ACO) comprised of crisis coordinators will convene under the coordination of the National Crisis Centre. Countermeasures will be prepared and handed over to the Interdepartmental Commission Crisis Management (ICCB) for decision-making.

8.6.2.1 National Operational Staff (LOS)

The National Operational Staff (LOS) is an operational unit which comes into force when the National Operational Coordination Centre (LOCC) is activated. The LOS is answerable to the Ministerial Commission Crisis Management (MCCB). It delivers a joint operational advice on behalf of the operational services involved. This advice can pertain to means and capacities to aid the management of the crisis, but it can also pertain to operational practicalities and consequences of administrative decisions.

8.6.3 National/State Emergency Response

8.6.3.1 Netherlands Emergency Command Structures

For emergencies in the Netherlands, local responders are the essential building block of the Netherlands response to most emergencies. The emergency services, including police, fire and ambulance, will usually be the first to arrive at the scene of an incident and provide operational, tactical and strategic control of the local response.

If there is a real risk for a large-scale incident, the incident coordination is handed over to the Duty Officer Fire Service (OVD-B). The OVD-B may decide to escalate the incident through the Coordinated Regional Incident Control Procedure (GRIP); this is determined by the nature and size of the incident. Depending on the GRIP procedure that is used, the incident coordination is subsequently handed over to other persons/structures, such as an Incident Location Command (CoPI). This may be and often is the Head Duty Officer Fire Service (HOVD-B), by agreement of the Duty Officer Fire Service (OVD-B), the Duty Officer Police (OVD-P) and the Medical Duty Officer (OVD-G).

The Hazmat advisor (AGS) advises the CoPI or OVB-B specifically with regard to dealing with hazmat incidents. This function must be present within 30-60 minutes (depending on the regional risks) and therefore, this specific position is regionally positioned. The Hazmat advisor can deploy hazmat teams who can work with simple detection equipment (e.g. Draeger tubes or PID) and can plot detection results and nuisance (odour, debris, smoke)[132].

8.6.3.2 Hazmat team

The Hazmat team is coordinated by a Hazmat team leader, who like the Hazmat advisor (AGS), is an expert on dangerous substances. Based on information provided by e.g. the AGS, the Hazmat estimates the size of the affected area and the risks for the population. He directs the team members who have Draeger tubes at their disposal and interprets the data. He advises the HOVD on measures to be taken.

8.6.4 Safety

8.6.4.1 LIOGS

National information centre for Hazmat incidents commissioned Ministry of Security and Justice. This centre provides advice by telephone to the Hazmat advisors of the Fire Service.

8.6.5 Environmental

8.6.5.1 KNMI (Met Office)

The aim is to provide immediate access to forecast conditions. This national institute is commissioned by the Ministry of Infrastructure and Environment

8.6.5.2 RIVM (National Institute for Public Health and the Environment)

A quick response service (the Environmental Incident Service/Environmental Assessment Module) was set up to co-ordinate environmental monitoring in major chemical incidents in order to conduct exposure assessment under the coordination of the Ministry of Infrastructure and Environment. This service undertakes sampling and testing of material collected by the teams deployed. It has hand-held equipment and analytical (field) laboratory capability. Furthermore, it can model the distribution of hazardous substances. During a chemical incident, this service advises the Fire Service on request on the nature of the pollution, the threat it poses to public health and the environment[133] and the consequences.

RIVM monitors the current state of the environment through several nationwide monitoring networks for air, soil and water to monitor compliance with EU Directives. Measurements are carried out regularly with the aid of remote sensing techniques.

8.6.5.3 Water service

When an accident occurs or great amounts of hazardous substances flow into the Rhine, the international Warning and Alarm Plan Rhine (WAP) is activated, which above all

132 www.brandweerkennisnet.nl/bovenbalk/zoeken/@746/leidraad_ogs/

133 rivm/organization/mev/imd/running_environmental_accident_service.jsp www.rivm.nl/en/about

warns all users downstream also the Water Service in the Netherlands. Apart from warnings, which are only issued during vast and serious water pollution events, the WAP is more and more also used as an instrument for exchanging reliable information on water pollution measured by monitoring stations along the rivers Rhine and Neckar. The WAP distinguishes between warnings, information and search reports.

8.6.5.4 KWR

KWR is the central research institute of the Dutch drinking water companies.

Research themes focus on behaviour and properties of water systems (i.e. river basins, groundwater systems), production and distribution of drinking water, treatment processes for drinking water and waste water and drinking water quality with regard to human health. One of the activities is a 24 hours a day and 7 days a week emergency response service in case of emergencies affecting the drinking water supply. This service provides information and advice regarding all aspects of the drinking water supply and laboratory analysis of chemical and biological parameters in (drinking) water.

8.6.6 Agriculture

8.6.6.1 Food and Consumer Product Safety Authority

The ministry of Economic Affairs, Agriculture and Innovation tasks this Authority to protect human and animal health. It may undertake testing, sampling and analysis of an area affected by potentially hazardous substances to determine the consequences for the food chain and the need to take action to protect public health[134].

8.6.7 Health

8.6.7.1 National Poisons Information Centre (NVIC)

The expertise of this centre can be called upon in the event of chemical disasters with threats to public health. There is a 24-hour telephone service for information on acute poisoning. Its task is to advise medical professionals on medical treatment of victims of exposure to chemical substances.

8.6.7.2 RIVM - Centre for Public Health and the Environment

The Ministry of Health tasks this centre to advise the local authorities on the usefulness and necessity of a health impact assessment and provides support in the design, start-up and execution of such an assessment.

Furthermore, this centre is the focal point for medical and environmental expertise for the Municipal Health Services. It advises the Public Health Hazmat advisor on the risks for public health and provides scientific expertise to underpin appropriate actions and measures to counter adverse environmental impacts.

[134] www.vwa.nl/onderwerpen/english/dossier/about-the-food-and-consumer-product-safety-authority

8.6.8 Military / Defence

8.6.8.1 Ministry of Defence

In the case of chemical disasters, the Ministry of Defence can provide relief to the first responders by offering a CBRN response capacity[135]. This quick response unit can detect and (preliminary) identify chemical substances. They can do this on foot or by car and can also take air samples that can then be analysed by the capabilities from RIVM.

Furthermore, the bomb squad (EODD) also has detection equipment to monitor chemical leakage at source materials.

8.6.9 National agreements and examples of interoperability

8.6.9.1 BOT-mi

To ensure timely coordinated scientific and technical advice during the response to an emergency, the Ministry of Environment and Infrastructure chairs the Policy Support Team for environmental incidents (BOT-mi)[136]. This team, comprising of 8 government institutes and services, advises the local health community, police and fire service during a chemical incident. The 8 members are:

- The Netherlands Association for Fire and Disaster Control Services (NVBR)
- RIVM
- Institute for Food safety (Rikilt)
- Food and Consumer Product Safety Authority (nVWA)
- DCMR Regional Environmental Protection Agency
- Expertise centre Military Health Care
- KNMI (Met Office)
- Rijkswaterstaat Water service

8.6.9.2 EPAd

To ensure timely coordinated scientific and technical advice during the response to an emergency within the infrastructure drinking water the Ministry of Environment and Infrastructure chairs the Emergency Planning and Advisory Unit Drinking water (EPAd)[137]. The following government institutes and services work together in this:

- KWR (Water research laboratory)
- Food and Consumer Product Safety Authority
- RIVM
- Institute for Food safety (Rikilt)
- Water laboratory

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135 www.defensie.nl/nationale_taken/samenwerking_bij_rampen_en_crisis/project

136 www.rijksoverheid.nl/onderwerpen/crises-en-nationale-veiligheid/documenten-en-publicaties/brochures/2010/07/22/folder-nationale-netwerken-voor-crisismanagement.html

137 www.rijksoverheid.nl/onderwerpen/crises-en-nationale-veiligheid/documenten-en-publicaties/brochures/2010/07/22/folder-nationale-netwerken-voor-crisismanagement.html

- Rijkswaterstaat Water service

8.6.9.3 National Laboratory Response Network

The Dutch National Laboratory Network has been set up to ensure an effective laboratory response to CBRN terrorist attacks. Members of this network also work together in chemical incidents. During an incident the network provides analysis results and information on chemical agents on request of the first responder, RIVM or BOT-mi/EPAd.

8.6.10 Local capability and capacity

8.6.10.1 NL Fire and Rescue Services

A Dutch fire brigade does not exist as such. The fire brigade in the Netherlands comprises over 450 municipal and 25 regional brigades. The municipal brigades are responsible for basic fire services. The municipal fire brigades are affiliated to one of the 25 regional fire brigade organisations. The Regional Fire Chief is in charge of operational control.

The fire brigade's duties are laid down in the Safety Region Act of 2011[138]. This act describes the manner in which the government fulfils its obligation to protect its citizens. The fire brigade's primary duty has grown from extinguishing fires (repression) to providing technical assistance in the event of accidents, incidents with hazardous materials, disasters and crises. The fire brigade's further duties are as follows: pro-action, prevention, preparation and aftercare. It is the fire brigade's job:

- to prevent, limit and fight the fire;
- to restrict or combat danger to humans and animals in accidents other than fire;
- to warn the population;
- to investigate hazardous substances and deploy decontamination;
- to advise other public bodies and organisations about fire prevention, fire fighting and to prevent, limit and fight incidents with hazardous substances.

8.6.10.2 Police Service

The Police Service establishes cordons and issues shelter and evacuation advice. In the case of suspect objects the Explosive Investigation Team Leader (TEV) from the police investigates the presence of hazardous materials (for instance CBRN) with handheld equipment.

8.6.10.3 Emergency Medical Services

Various medical institutions play a role in disaster relief and crisis management, such as hospitals, the Municipal Health Services (GGD), GHOR ambulance services, the Red Cross, GPs and mental health institutions responsible for psychosocial care and aftercare. The escalated medical assistance chain is regionally organised in the form of a mutual agreement within the municipality in the Emergency Medical Safety region. These regions are on the same scale as the police and fire brigade regions.

[138] http://wetten.overheid.nl/BWBR0027466/geldigheidsdatum_01-05-2011#4

8.6.10.4 Public Health Hazmat advisor (GAGS)

The GAGS has knowledge about the health risks of hazardous materials (CBRN) and the assessment of health risks in chemical and/or nuclear/radiological incidents. The GAGS are consulted by telephone in chemical incidents with (potential) exposure of the public and first responders. In the case of major events, the GAGS can be physically present in the Regional Operational Team (ROT). In specific situations, the GAGS are part of the CoPI or the Regional Policy Team (RBT).

The GAGS advises on operational measures and follow-up, after assessing the collective risk and symptoms and/or injuries. The advice is partly based upon the physical presentation of the casualties, albeit without diagnostic or therapeutic authority on the part of the GAGS.

Besides assessing exposure to and health risks from the chemicals released, and advising on the implications of these risks for the source area and the area affected, a GAGS advises on crisis and risk communication and environmental health care. In practice, this means that the tasks of GAGS are not restricted to purely advisory tasks, but also consist of crisis and risk communication to public health directors, the press and the general public.

8.6.10.5 Local Agreements and examples of Interoperability

The Netherlands has borders with Germany in the east and Belgium in the south. The North Sea lies to the west. Treaties exist with Belgium (1984) and Germany (1988, amended in 1997). These so-called assistance agreements contain procedures for requesting and providing assistance in the event of disasters.

- Neighbours Aid Agreement (Burenhulpovereenkomst) EU region Rijn-Maas-Noord
- Warning and Alarm Plan Rhine. The International Main Alert Centres (IHWZ) issue warnings in cases of water pollution incidents implying substances noxious to water, if the amounts or concentrations concerned may detrimentally impact the water quality of the Rhine or drinking water supply along the Rhine and/or are liable to raise great public interest. Information is issued in order to give the IHWZ objective, factual and reliable information independent of the media. Furthermore, the IHWZ inform all Rhine bordering countries in cases of excesses of guidance values. As a precautionary measure, information is also passed on to the drinking water works. Search reports are issued, in order find the polluter of the Rhine ***in cases*** not located within the area of responsibility of an IHWZ. The warnings, information and search reports issued every year are compiled in an annual report. The annual information messages and reports are listed in the table below and/or may be downloaded.

8.6.10.6 References

1. Mennen MG, van Belle NJ. Emissions of hazardous compounds from fires. RIVM report 609021051/2007
2. Mennen MG, Kooi ES, Heezen PAM, Munster G van, Barreveld HL. Dispersal of substances during fires: a foresight study. RIVM report 609022031/2009

3. van Belle NJ, van Putten EM, de Groot AC, Meeussen VJ, Banus S. Exposure assessment through realistic laboratory simulation of a soccer stadium fire Chemosphere. 2010 81:794-9. (2010)

4. Grievink L, Vries M de, Yzermans CJ, Velden PG van der, Berg B van den, Smilde-Van den Doel DA Health monitoring and research following a disaster. Questionnaires for use in general and psychosocial health assessments. RIVM report 630940006/2007

5. Grievink L, Velden PG van der, Christiaanse B, Berg B van den, Stellato RK, Roskam AJ, Drogendijk AN, Kamst RA, Dorresteijn AM. Health status of those affected by the firework disaster in Enschede, four years later. RIVM report 630930005/2004

9 Appendix 5

9.1 Initiatives and arrangements across Europe being administrated at national level within Member States

Initiative/arrangement	Participating Countries	Details	Role in chemical incidents
Community Mechanism for Civil Protection- Monitoring and Information Centre (MIC) http://ec.europa.eu/echo/civil_protection/civil/prote/mic.htm	Iceland, Norway, Sweden, Finland, Estonia, Latvia, Lithuania, Poland, Denmark, Germany, Czech Republic, UK, Ireland, the Netherlands, Belgium, Luxemburg, France, Spain, Portugal, Italy, Romania, Bulgaria, Greece, Cyprus. Malta, Austria, Slovenia, Slovakia, Hungary, Switzerland.	It gives countries access to the community civil protection platform. Any country affected by a major disaster – inside or outside the EU – can launch a request for assistance through the MIC. During emergencies the MIC plays three important roles: o Communications hub: Being at the centre of an emergency relief operation, the MIC acts as a focal point for the exchange of requests and offers of assistance. This helps in cutting down on the 30 participating states' administrative burden in liaising with the affected country. It provides a central forum for participating states to access and share information about the available resources and the assistance offered at any given point in time. o Information provision: The MIC disseminates information on civil protection preparedness and response to participating states as well as a wider audience of interested. As part of this role, the MIC disseminates early warning alerts (MIC Daily) on natural disasters and circulates the latest updates on ongoing emergencies and Mechanism interventions. o Supports co-ordination: The MIC facilitates the provision of European assistance through the Mechanism. This takes place at two levels: at headquarters level, by matching offers to needs, identifying gaps in aid and searching for solutions, and facilitating the pooling of common resources where possible; and on the site of the disaster through the appointment of EU field experts, when required.	Information dissemination and coordination of resource/assistance requests

Initiative/arrangement	**Participating Countries**	**Details**	**Role in chemical incidents**
Euromed civil protection cooperation http://www.euromedcp.eu/	EU Member states and Albania, Algeria, Bosnia & Herzegovina, Croatia, Egypt, Israel, Jordan, Lebanon, Montenegro, Morocco, Occupied Palestinian territory, Syria, Tunisia and Turkey.	The objectives of Euromed are to contribute to the development and reinforcement of the quality of Civil Protection services in the Euro-Mediterranean region and to the continuation of institutional cooperation in the field, both between the EU and the Mediterranean Partner Countries and among the Mediterranean Partner Countries themselves. As part of this the most recent programme is The Prevention, Preparedness and Response to Natural and Man-made Disasters Programme (PPRD) which contributes to the development of stronger prevention, preparedness and response capacities in civil protection at international, national and local level. PPRD objects are to develop risk assessment tools, organise training and workshops for disaster prevention and preparedness. Also to improve coordination of existing warning systems and operation centres.	No direct role but helping to improve emergency response between Mediterranean Countries.
Central European Initiative http://www.ceinet.org/	Austria, Croatia, Hungary, Italy, Poland and Slovenia	The Central European Initiative (CEI) cooperation is an agreement on the forecast, prevention and mitigation of natural and technological disasters. It includes exchange of scientific and technical information and relevant data on a regular basis, common research programmes and training of experts in order to set up common programmes on Civil Protection and disaster management. An operational manual comprising data for the five parties has been compiled for this purpose.	No direct role but helping to improve emergency response between participating countries
EUR-OPA Agreement (Council of Europe) http://www.coe.int/t/dg4/majorhazards/	Albania, Armenia, Azerbaijan, Belgium, Bulgaria, Croatia, Cyprus, France, Georgia, Greece, Luxembourg, Malta, Republic of Moldova, Monaco, Portugal, Romania, Russia, San Marino, Serbia, Spain, “the former Yugoslav Republic of Macedonia”, Turkey, Ukraine, and three Mediterranean countries which are not member States of the Council of Europe: Algeria, Lebanon, Morocco	The main objectives of the EUR-OPA Major Hazards Agreement are to reinforce and to promote co-operation between Member States in a multi-disciplinary context to ensure better prevention, protection against risks and better preparation in the event of major natural or technological disasters. Work is directed to policy making and scientific and technical co-ordination, including development of early warning systems and a significant number of research centres. It should be noted that not all EU Member States are parties to this agreement, while the Commission enjoys an observer status.	No direct role but helping to improve emergency response between participating countries

Initiative / arrangement	Participating Countries	Details	Role in chemical incidents
The Civil Military Emergency Preparedness Council, previously known as the Civil Military Emergency Planning Council for South Eastern Europe (CMEPC SEE)	Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Macedonia, Slovenia, Romania and Turkey.	The objective of the Council is to act as a consulting and coordinating body for regional cooperation in disaster management. The Council advocates for the development of common standards and procedures to be used by all the nations of the SEE region for planning and response to regional disasters and emergencies. Focusing on transboundary cooperation, the Council has drafted an agreement for facilitating border crossing procedures during emergency. The Council envisages developing and maintaining emergency, response and GIS databases for the region. The GIS database will include such elements as the roads, railways, gas pipelines and airports. The Council aims to open emergency operating centres in all the member countries, and to develop an emergency information network.	GIS/Information network
Organisation of the Black Sea Economic Cooperation (BSEC) http://www.bsec-organization.org/Pages/homepage.aspx	Albania, Armenia, Azerbaijan, Bulgaria, Georgia, Hellenic Republic, Moldova, Romania, Russian Federation, Serbia, Turkey, Ukraine.	BSEC is an agreement among the governments of the participating states to collaborate in emergency assistance and emergency response to natural and man-made disasters.	No direct role but helping to improve emergency response between participating countries
Convention on the Transboundary effects of industrial accidents http://www.unece.org/env/teia/	Norway, Republic of Moldova, Albania, Russian Federation, Hungary, Luxembourg, Bulgaria, Armenia, Spain, Greece, Germany, Switzerland, Austria, Finland, Sweden, Croatia, Estonia, Czech Republic, Lithuania, Kazakhstan, Denmark, Monaco, Slovenia, Italy, UK, Romania, Belarus, Poland, Slovakia, France, Azerbaijan, Latvia, Cyprus, Belgium, Portugal, Netherlands, Montenegro, Serbia, Former Yugoslav Republic of Macedonia.	The Convention aims at protecting human beings and the environment against industrial accidents by preventing such accidents as far as possible, by reducing their frequency and severity and by mitigating their effects. It promotes active international cooperation between the contracting Parties, before, during and after an industrial accident	No direct role but helping to improve emergency response between participating countries

Initiative / arrangement	Participating Countries	Details	Role in chemical incidents
Disaster Prevention and Preparedness Initiative for SEE (DPPI SEE) http://www.dppi.info/	Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Macedonia, Greece, Moldova, Romania, Serbia and Montenegro, Slovenia and Turkey	The DPPI has been conceived as an activity that seeks to provide a framework for South Eastern European nations to develop programs and projects leading to strengthened capabilities in preventing and responding to natural and man-made disasters. It also brings together donor countries and international governmental and non-governmental organisations to coordinate ongoing activities and identify unmet needs in order to improve the efficiency of national disaster management systems within the regional cooperation framework.	No direct role but helping to improve emergency response between participating countries
Convention on the Protection and Use of Transboundary Watercourses and International Lakes http://www.unece.org/env/water/	Norway, Republic of Moldova, Albania, Russian Federation, Hungary, Luxembourg, Bulgaria, Armenia, Spain, Greece, Germany, Switzerland, Austria, Finland, Sweden, Croatia, Estonia, Czech Republic, Lithuania, Kazakhstan, Denmark, Monaco, Slovenia, Italy, UK, Romania, Belarus, Poland, Slovakia, France, Azerbaijan, Latvia, Cyprus, Belgium, Portugal, Netherlands, Montenegro, Serbia, Former Yugoslav Republic of Macedonia.	The Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention) is intended to strengthen national measures for the protection and ecologically sound management of transboundary surface waters and ground waters.	No direct role but helping to improve emergency response between participating countries
The Major Accident Hazards Bureau (MAHB) http://mahb.jrc.it/index.php?id=1	All EU countries?	The Major Accident Hazards Bureau (MAHB) provides research-based scientific support to the European Community on the formulation, implementation and monitoring of EU policies for the control of major accident hazards, chiefly the Seveso II-Directive, 96/82/EC, concerning the processing and storage of hazardous substances. The Bureau has also an instrumental role in managing the European accidents database, analysing trends in accident occurrence and identifying and disseminating lessons learned in order to avoid recurrence of similar events	No direct role but helping to improve emergency response between participating countries

Initiative/arrangement	**Participating Countries**	**Details**	**Role in chemical incidents**
The Organisation for Economic Co-operation and Development (OECD) *http://www.oecd.org/dataoecd/10/37/2789820.pdf*	All EU Countries	The Organisation for Economic Co-operation and Development (OECD) is an intergovernmental organisation in which representatives of 30 industrialised countries (from Europe, North America, and the Pacific) and the European Commission meet to co-ordinate and harmonise policies, discuss issues of mutual interest, and work together to respond to international concerns. Most of the OECD's work is carried out by more than 200 specialised committees and subsidiary groups made up of member country delegates. Observers from several countries with special status at the OECD, and from interested international organisations, attend many of the OECD's meetings. Committees and subsidiary groups are served by the OECD Secretariat, located in Paris, France, which is organised into Directorates and Divisions.	Addresses a number of issues concerning the relationship between different countries including, for example, cross-border co-operation relating to hazardous installations near boundaries, as well as bilateral and multilateral assistance concerning chemical accident prevention, preparedness and response.
International Directory for Emergency Response Centres *http://www.cefic.org/activities/logistics/ice/ice.htm*	Poland, Slovak Republic, Austria, Denmark, Finland, Germany, Netherlands, Norway, Spain, Sweden, United Kingdom.	ICE (International Chemical Environment) is a network of national schemes, set up by the European Chemical Industry to provide information, advice and resources to the emergency authorities in case of land based chemical transport accidents. When called by the Authorities, the National ICE Centre will provide, in the local language, initial telephone advice for the immediate control of the incident. It will promptly alert the producing company, obtain further information (possibly via other national ICE centres) or mobilise mutual assistance. To do this, each Centre has at its disposal appropriate communication equipment, a library of reference books or databases and up to date lists of telephone and fax numbers of contacts within the Chemical Industry. European support in relation to on site assistance for monitoring and risk evaluation is provided in a series of matrices. http://www.oecd.org/dataoecd/0/39/1933386.pdf	Contains a number of matrix templates detailing country's capability to provide on-site international assistance in the areas of : o Expertise Response o Equipment Response o Operators for Equipment o Monitoring / Risk Evaluation

Initiative / arrangement	Participating Countries	Details	Role in chemical incidents
International Health Regulations (IHR)	194 WHO Member States	Global legal framework for the detection of and response to international public health risks and potential public health emergencies of international concern. States must prevent and control the spread of disease inside and outside their borders, and to report potential public health emergencies of international concern to WHO. IHR includes chemical incidents, as well as infectious diseases (its main focus). WHO coordinates change of information and a coordinated response.	Links to Member State focal points. Alerting of international incidents. Coordination route for international response – information exchange and risk assessment.

10 Appendix 6

10.1 Key success factors for exposure assessment

In considering key success factors for exposure assessment public health risk assessors would need the following information provided below available in a timely manner. The WHO Human Health Risk Assessment Toolkit: Chemical Hazards also considers the criteria required for undertaking appropriate exposure assessments and presents a generic road map for use in the exposure assessment process[139].

The following is a summary of the type of information which will inform a successful exposure assessment and ultimately risk characterisation, which was used to inform subsequent project tasks.

10.1.1 Reports from the scene:

- What is the situation and prognosis;
- Which populations have been evacuated/ have been asked to shelter;
- Where is the release going/which areas is it affecting;

COMAH and site specific plans are available which have been developed with consideration of public health needs and response.

10.1.2 Health effects reports:

- Ambulance, hospital reports;
- Health advice lines, doctors (GPs) sub emergency reports.

10.1.3 Release flux:

10.1.3.1 For chemical releases:

- What is being released;
- At what rate and time profile?

For fires:

- What is being consumed?
- At what rate is it being consumed?
- Under what conditions is it being consumed?

10.1.4 Dispersion modelling:

For air, it is understood:

- Where the plume is going, at various heights and times.
- How much dilution / reaction is taking place with time.

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[139] WHO Human Health Risk Assessment Toolkit: Chemical Hazards
http://www.who.int/ipcs/publications/methods/harmonization/toolkit.pdf

- The predicted air concentrations and deposition rates on sensitive receptors with time is known (e.g. time courses for the mass transport of the plume can be outputted).
- The model account for plume density with time and topographical features.
- The model can be output with contours corresponding to acute exposure reference values.
- The model can account for ingress of plumes and safety factors for those sheltering.
- The model can be scaled using monitoring data.
- The model can be scaled using health effect reports.

For water, it is understood:

- How will the release interact / degrade and disperse with time.
- What concentrations might sensitive receptors / facilities experience.
- The model can be output with contours for acute exposure reference values.
- The model can be scaled using monitoring data.
- The model can be scaled using health effect reports.

10.1.5 Geographical Information Systems

- Sensitive receptors (i.e. particularly vulnerable populations sites, such as hospitals, care homes and schools) and populations expected during the incident are mapped and can be selected and output in a list.
- Dispersion modelling can be readily overlaid.

10.1.6 Monitoring

Monitoring data is available quickly to public health risk assessors:

- Mobile resources are readily available – i.e. dedicated service, with sufficient resilience to deploy to the area of an incident.
- Data may be obtained at the scene for the purpose of characterising release / risks to responders – e.g. HazMat teams with breathing apparatus.
- Data may be obtained by fixed air or water quality sites, which are either coincidentally located at centres of population or provided by a COMAH site operator.
- Ideally data is available from sensitive receptor sites, using mobile units which can deploy to sheltering areas and assess air quality rapidly and continuously.
- Where sampling rather than analysis is conducted, results are obtained from a field laboratory.
- Where analysis is conducted involving a separation step, the time between each consecutive analysis is as short as possible to allow the time profile to be assessed.

10.1.7 Risk characterisation

- Public health risks are interpreted, agreed and communicated clearly to incident commanders and integrated public health actions and messages are outputted.

10.1.8 For cross border incidents in particular:

Risk assessors are readily able to communicate with colleagues across borders:

- Able to share plans, information with colleagues in neighbouring countries.
- Aware of response, particularly public health systems and resources in neighbouring countries.
- Able to understand the neighbouring countries risk assessment procedures and acute response trigger levels.
- Able to access translation services with some understanding of public health, science, emergency response.

Additionally:

- The dispersion modelling is equivalent and cross validated or the differences are understood and the public health messages on each side of the border are suitably balanced.
- GIS systems are integrated / maintain some cross border functionality.
- Mobile monitoring units are able / willing to cross borders according to wind direction to make best use of resource.
- Risk characterisation is integrated on both sides of the border, with an agreed assessment and if possible common messages.

10.2 Questions and considerations for task C

The following list of questions were used to aid completion of the exposure matrices, as it is not possible to obtain this detailed information through a review of readily available information alone. Therefore, these questions should be pursued further within the Task C survey.

Along with questions and notes raised throughout this report, they are presented as a basis for the Task C survey and are specifically derived to identify the information supporting the project objectives across all Member States. It is however noted that the use of terminology, definitions and phrases will need to be audited to ensure that double meanings or misunderstanding are reduced in the language of the questions. It is recommended that the CREATIF[140] glossary to define common language and delimitations for testing, evaluation and certification of CBRNE detection equipment be consulted to support this purpose.

[140] CREATIF Network of Testing Facilities for CBRNE detection equipment http://www.creatif-network.eu/docs/D.1.1_rev1_glossary_final.pdf

10.2.1 What agencies organisations undertake qualitative or quantitative monitoring? (e.g. civil, government, contractor).

i. *Is there a strategy for where monitoring is undertaken, for example, inside the incident cordon (hot zone – may need to define), or at sensitive receptors?*
   - *Possibly breakdown by environment: air, water, land and food.*

ii. *For what reasons is monitoring undertaken? i.e. occupational, identification, health assessment, risk assessment, environment, decontamination, remediation.*

iii. *What resource/equipment is available?*
   - *At or near scene of incident –i.e. typically obtained by hazardous area trained staff with suitable PPE available for sampling/ monitoring operations.*
   - *At nearby locations –for example sensitive receptors – areas where sheltering might be advised, but operators do not typically need hazardous area PPE.*

   (Detail – such as type, cost and limitations)
   - *Mobile laboratory (at scene and/or at affected area) – need to have both – i.e. Subset of above*
   - *Mobile sampling with return to Laboratory*
   - *For the scenario illustrated:*
     - *Which equipment would typically be deployed?*
     - *Which equipment types would likely be used to gather monitoring data for public health decision making?*
     - *Who interprets the data for public health decision making?*
     - *Which forum / agency provides the public health scientific recommendations to incident command.*
   - *Is continuous monitoring available?*
   - *Is it a local, regional or national resource*
   - *Is there location restrictions*

iv. *Are there dedicated monitoring and dispersion modelling resources available for acute incidents? For both monitoring and modelling, please state the nature of the resource availability (dedicated 24/7, ad hoc etc) and the capability. [Note there may be dedicated static air quality sites (ambient air monitors) which may not be useful for incident response]*
   - *We may need to determine if there are any ad hoc arrangements*

v. *What sort of chemicals can each of the listed resources monitor for? (This could be just general terms rather than a comprehensive list)*
   - *How frequently does the equipment provide monitoring data.*

vi. *Who is the recipient of the monitoring data?*
   - *Please estimate how long it might take on average to obtain the data? [Allowing for decision to deploy, through travel to site and actual acquisition of the first data set]. How is data transferred?*
   - *Time zones (i.e. does the instrument have different time zone outputs for data?)*

vii. *Is data provided to health officials?*

    - *If not who undertakes the risk assessment*

viii. *Which is the lead organisation for provision of advice? (and are they the one that gets the data)*
    - *Will likely differ by air, food, water, land?*

For a cross border incidents as outlined in the scenario:

- *Is a common GIS system capability available?*
    - *Does your GIS have the capability to show receptors in neighbouring countries?*
- *Are meteorological dispersion models available on both sides of the border?*
    - *Would the "source" countries dispersion modelling be used on both sides of the border?*
    - *Do the dispersion models on both sides of the border have equivalent capability and assumptions? Is this validated?*
- *Are water borne dispersion models available on both sides of the border?*
    - *Would the "source" countries dispersion modelling be used on both sides of the border?*
    - *Do the dispersion models on both sides of the border have equivalent capability and assumptions? Is this validated?*
- *How would data exchange and coordination happen in practice?*
    - *For monitoring data?*
    - *For modelling data?*
    - *For scientific public health interpretation to incident command*
    - *For public messages?*
- *Are there restrictions (e.g. military, legal or information governance) on data which can be shared across borders or outside forums.*
- *Do you expect that shared data could be misinterpreted due to:*
    - *Language*
    - *Different scientific rationales for monitoring and modelling*
    - *Unfamiliarity with neighbouring regions capabilities*
        - *E.g. sensitivity of equipment versus toxic effect levels.*
        - *Differing use of source terms / dispersion assumptions.*
        - *Unfamiliarity with data outputs.*
    - *Lack of understanding of neighbouring countries' response structures?*
    - *Lack of suitable contacts with peer organisations in neighbouring countries?*

10.2.2 What agencies or organisations within Member States undertake environmental modelling?

i. *Who undertakes modelling, what resource is available, how long will it take before data is provided, what are the location restrictions etc*
    - *What software is used (will need to consider water dispersion / interaction/ fractionation etc)?*

- *Where does source term information come from (i.e. is it direct from the incident scene and who provides this)?*
- *What are other restrictions e.g. modelling for dense gases, topography and deposition?*

ii. *Is modelling limited to prediction of meteorological conditions and behaviour of plumes?*

- *E.g. a limited dispersion model, or a complex dispersion model accounting for mixing layer, surface topography, plume buoyancy and deposition.*

iii. *Can modelling predict the environmental concentrations of a given chemical release?*

- *Including deposition*

iv. *Between Member States what is the compatibility between neighbour's models.*

- *Are risk assessors likely to correctly understand other countries data and suitably characterise the risk?*

10.2.3 How is information exchanged between Member State responsible organisations and agencies?

i. *Are there arrangements in place for cross-boundary interoperability / collaboration (e.g. across local/regional areas)?*

- *What are they?*
  - *At the first responder level*
  - *At a national level*
- *If not what restrictions and constraints prevent this*

ii. *Are there arrangements/ agreements in place for cross-border interoperability / collaboration during major chemical incidents (Are these unique to one country or agreed between both)?*

- *What are these arrangements / agreements?*
- *Are there plans, protocols, or procedures?*

iii. *If arrangements are not in place.*

- *What are the limitations or constraints?*

11 Appendix 7

11.1 Literature sources

1. ACUTEX Acute Exposure Project. http://www.acutex.eu/
2. ALOHA http://www.epa.gov/emergencies/content/cameo/index.htm
3. Analysis of Law in the European Union pertaining to Cross-Border Disaster Relief, Annex III Bilateral agreements http://www.ifrc.org/PageFiles/41191/193300-Analysis-of-law-in-EU-EN.pdf
4. Antoanetta Fratzova (AF) *et al*, *Aerospace Monitoring Center at the Civil Protection* Directorate General, Ministry of Interior, Sofia, BULGARIA
5. Association of National Air Quality Reference Laboratories (AQUILA) Network. http://ies.jrc.ec.europa.eu/aquila-homepage.html
6. ARAMIS Project: Accidental Risk Assessment Methodology for Industries in the Framework of the SEVESO II Directive http://www.sciencedirect.com/science/article/pii/S0304389405003900
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9. CAMEO. http://www.epa.gov/oem/content/cameo/what.htm
10. Central European Initiative http://www.ceinet.org/
11. Convention on the Transboundary effects of industrial accidents http://www.unece.org/env/teia/
12. Community Research and Development Information Service (CORDIS). http://cordis.europa.eu/newsearch/index.cfm?page=advSearch
13. Community Mechanism for Civil Protection- Monitoring and Information Centre (MIC) http://ec.europa.eu/echo/civil_protection/civil/prote/mic.htm
14. CREATIF http://www.creatif-network.eu/docs/D.1.1_rev1_glossary_final.pdf
15. CRAMD—a database for the validation of models used in chemical risk assessment. http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6TGH-3WFNNG6-5&_user=8810565&_coverDate=11%2F30%2F1996&_rdoc=1&_fmt=high&_orig=gateway&_origin=gateway&_sort=d&_docanchor=&view=c&_searchStrId=1749890460&_rerunOrigin=google&_acct=C000046143&_version=1&_urlVersion=0&_userid=8810565&md5=40ba429701e711dc32a76642215cec29&searchtype=a
16. Development of Generic Scenarios, Alerting System and Training Modules relating to Release of Chemicals by Terrorists. http://www.hpa.org.uk/web/HPAweb&HPAwebStandard/HPAweb_C/1217490107824
17. Development of an Alerting System for Chemical Health Threats (ASHT), Phase I. www.hpa.org.uk
18. Development of an Alerting System for Chemical Health Threats (ASHT), Phase II. http://www.hpa.org.uk/web/HPAweb&HPAwebStandard/Page/1267550490484
19. Disaster Prevention and Preparedness Initiative for SEE (DPPI SEE) http://www.dppi.info/
20. EFFMIS. http://i4c.eu/showProject.html?ID=40523
21. Enhancing Mesoscale Meteorological Modelling Capabilities for Air Pollution and Dispersion Applications. http://www.cost728.org
22. ENHIS. http://www.enhis.org/
23. ENHIS database. http://www.ktl.fi/attachments/database_eh_policy_information_ndt_ek.xls
24. EPA Network http://epanet.ew.eea.europa.eu/
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65. The Emergency Support System. http://www.ess-project.eu/
66. The European Union Network for the Implementation and Enforcement of Environmental Law http://impel.eu/
67. The Major Accident Hazards Bureau (MAHB)http://mahb.jrc.it/index.php?id=1
68. The Organisation for Economic Co-operation and Development (OECD) http://www.oecd.org/dataoecd/10/37/2789820.pdf
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APPENDIX 3

Cross-border Exposure Characterisation for Risk Assessment of Chemical Incidents CERACI

Member States Survey - TASK C Report

Main contributors:

NIOM: Task manager

NIOM: Design, implement, send, analyse and report on the survey.

RIVM (with sub-contractors) and HPA: Support NIOM in survey design and analysis. Provide practical experience of cross-border collaboration.

All partners and collaborators: review draft survey and contribute to initial network building.

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Sole responsibility for this report lies with the authors: the National Institute for Public Health and the Environment (RIVM), the Health Protection Agency (HPA) and the Nofer Institute of Occupational Medicine (NIOM). Neither the European Commission, nor the authors, nor any person acting on their behalf is responsible for the use which might be made of this information.

This report is a collation of the information made available via literature reviews, expert feedback and project surveys and workshops, within the resources available to the project. It does not represent the position of the European Commission, the National Institute for Public Health and the Environment, the Health Protection Agency or the Nofer Institute of Occupational Medicine.

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www.rivm.nl/ceraci

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Task C:
Member States Survey – Exposure assessment in chemical incident response

1 Executive Summary

This report provides the outcome of the Task C Member States Survey. The main objective of Task C was identifying Member States' environmental modelling and monitoring (sampling and analysis) capabilities, capacities, guidelines, tools and practices for chemical incident response. A web-based survey carried out among the representatives of governmental environment and health protection institutions, national fire and rescue services and research institutes from different European countries was undertaken to achieve the aforementioned objective. The Member States Survey was followed up by personal interviews with the respondents that declared their willingness to participate in an interview concerning more detailed information connected with exposure assessment after chemical incidents. The complete survey questionnaire, the questionnaire's overall results as well as detailed results for separate countries, the interview template and interview results are presented in this report. Furthermore, the report contains quantitative and qualitative analysis of responses which resulted in the identification of good practices and critical success and failure factors for environmental modelling and monitoring for risk assessment in chemical incidents.

2 Introduction

2.1 Task C objectives

Identifying Member States' environmental modelling and monitoring (sampling and analysis) capabilities, capacities, guidelines, tools and practices for chemical incident response was the main objective of the Task C Member States Survey. A preliminary understanding of exposure monitoring capability, capacity and organisation, during the acute phase of chemical incidents for health risk assessment purposes in Member States described in Task B served as a solid basis for designing the questionnaire.

Detailed aims of Task C are identified in the Project Strategy (v3.0) as:

- Survey Member States' environmental modelling and monitoring (sampling, analysis and interpretation) capabilities, capacities, guidelines, tools and practices for chemical incident response using web-based questionnaires (Survey Monkey).
- Analyse the results and identify organisations carrying out or coordinating the environmental monitoring capabilities linked with emergency response functions during chemical incidents.
- Analyse and report the questionnaire's outcome to identify good practices, critical success and failure factors and the extent to which arrangements for national and international collaboration on this subject are in place.

2.2 Task C realisation

The initial contact list of possible questionnaire recipients, made as one of the Task B deliverables, was extended and finalised before survey distribution, with the help and involvement of all project partners and collaborators.

To supplement the Task B literature review findings, a web-based survey was undertaken to gather additional information on the exposure assessment process in chemical incident response in EU Member States. The survey was sent to the representatives of governmental environment and health protection institutions, national fire and rescue services and research institutes from different European countries. The aim of the survey was specified as identification of:

- environmental modelling and monitoring (sampling and analysis) capabilities, guidelines, tools and practices for chemical incident response
- examples of organised cooperation between MS and interoperability on exposure assessment in the case of cross-border incidents.

The Member States Survey was followed up by personal interviews with the respondents that declared their willingness to participate in an interview concerning more detailed information connected with exposure assessment of chemical incidents.

The questionnaire's and interviews' outcome was analysed to identify good practices, critical success and failure factors for environmental modelling and monitoring for risk assessment in chemical incidents.

3 Methodology

3.1 Completion of questionnaire recipients list

The identification of organisations potentially involved in chemical incident response (in particular exposure assessment) as proposed recipients of the questionnaire was completed. The initial contact list of possible questionnaire recipients, made as one of the Task B deliverables, was extended, verified and finalised before survey distribution, with the help and involvement of all project partners. The contact list of the survey recipients included the representatives of governmental environment and health protection institutions, national fire and rescue services and research institutes from all 27 Member States (n=459).

3.2 Questionnaire design

After an analysis of information gaps identified in Task B, the draft questionnaire was prepared. To make sure that appropriate questions were chosen for the questionnaire and that the questionnaire survey was complete yet concise, all project partners and advisory board were asked to comment on draft versions of the questionnaire and also on the *introductory letter* and *invitation email*. Terminology used in the questionnaire was thoroughly discussed by project partners to reduce the possibility of misunderstanding or double meanings. Terms used for testing, evaluation and certification of CBRNE detection equipment stays in accordance with the CREATIF glossary[1] (as recommended in the Task B report) and for the rest of the terms the IMPACT glossary[2] was adapted to support this purpose.

The questionnaire consisted of 38 questions of different type and complexity. For improving its clarity it was divided into 6 parts:

I. **Introduction** (containing introductory letter explaining the purpose of the survey to the potential respondent and encouraging them to fill in the questionnaire)

II. **Examples of major chemical incident scenarios** (historical examples used to highlight the possible severity of major chemical incidents)

III. **Your professional background** (questions: 1-4 designed to identify the professional profile of the respondents)

[1] CREATIF http://www.creatif-network.eu/docs/D.1.1_rev1_glossary_final.pdf

[2] IMPACT (Innovative Measures for Protection against CBRN Terrorism), 2006; EU PASR 1 project

IV. **Environmental monitoring and modelling capabilities in your country** (questions: 5-26 designed to characterise the general and more detailed monitoring and modelling capabilities in Member States)

V. **Cross-border cooperation in case of chemical incident** (questions: 27-34 aimed at characterisation of possible forms of cross-border cooperation in case of a chemical incident)

VI. **Contact details** (questions: 35-38 asking about respondent's willingness to participate in a more detailed interview on exposure assessment in their country and in task D table-top exercises).

Types of the questions used included multiple choice questions with one or multiple possible answers, matrixes of choices with one or multiple possible answers per row and open descriptive questions allowing for individual comments or providing additional information by respondent. Where appropriate, 'I don't know', 'Not applicable' and 'Other' options were used.

The complete survey questionnaire is presented in Appendix I.

3.3 Dissemination

The survey was carried out as a web-based on-line survey, which allowed dissemination to a large final number of 514 recipients in all 27 Member States.

The link to the survey questionnaire was sent via direct e-mails together with an invitation letter explaining its purpose and encouraging participation. The survey was also advertised on the CERACI and Project partners' websites.

The survey was open between 4th of July 2011 and 30th of September 2011. To increase the response rate 2 reminders were sent within this period, 4 and 8 weeks after the opening date.

3.4 Verification and exploring the information gathered within the survey

One of the survey questions investigated the willingness of the respondents to participate in an interview concerning more detailed information connected with exposure assessment of chemical incidents in their country. Out of 36 respondents who declared their readiness to be interviewed and provided their contact details, project partners selected 21 interviewees from 18 EU countries. Selection was based on comprehensiveness of answers, information discrepancies for country and language preference of potential interviewee. To standardise the interview course the interview template with agreed questions and interviewing instructions (see appendix II) were prepared. Extracts of survey answers of the interviewee and primary results for their country were made to be compared with information included in Task B Exposure Assessment and Risk Characterisation Matrixes to raise the interview effectiveness and explain possible information discrepancies. Dates, hours and other arrangements of phone interviews were made individually for each interviewee. Interviewees were provided with the Exposure Assessment and Risk Characterisation Matrix for their home countries and with interview questions via email to mitigate the possible language barriers during further interview conversation. Finally 10 interviewees from 9 countries (Belgium, France, Germany, Ireland (2), Latvia, Lithuania, Spain, Poland, UK (NI)) were interviewed by project partners, as the rest of them resigned from participation in the interview.

Moreover the participants of CERACI workshops, conducted in Amsterdam (19-20th March) and Warsaw (2-3rd April) in the subsequent phase of the project, were asked to verify the data gathered for their countries within the survey. Information was updated by 8 delegates from:

- AUSTRIA
- FRANCE
- GERMANY
- GREECE
- LATVIA
- LITHUANIA
- POLAND
- PORTUGAL

and 1 additional respondent from Italy in the later phase of the project. The updates were included in the Appendix 3 of Task C report and highlighted by different colour of the font.

4 Survey results

Because of the high number of responses from the Netherlands and United Kingdom, the analysis were prepared both for total results and also for separate countries where appropriate – to avoid misinterpretations.

Because the majority of questions allowed choosing more than one answer the total percentage of answers may be over 100%.

The not always unequivocal character of the survey topic and different background of the respondents resulted in some discrepancies in the respondents' answers. An attempt was made to verify the answers through interviews in some of the countries. The rest of the results represent respondents' knowledge and opinions. Further verification may be possible during Task D.

4.1 Response rate and structure

A link to the CERACI questionnaire was sent to over 514 recipients. The exact number of recipients is impossible to assess as we got the information that some of our respondents propagated the survey among their colleagues and other personal contacts and we cannot exclude the possibility of people entering the survey from the CERACI website. The total number of started surveys was 131, of which 81 were sent with a status of completed questionnaires. One response contained only one answer and was considered void and excluded from analysis. The approximate response rate is 25% and 16% for started and completed questionnaires respectively which, in view of the limited number of experts in the field of CERACI research and the detailed character of some questions, may be considered satisfying. The analysis of 50 uncompleted questionnaires revealed that respondents answered only questions from the very beginning of the questionnaire demanding general knowledge, and the detailed questions concerning monitoring and modelling capabilities and cross-border cooperation remained unanswered. Probable factors contributing to not finalising the started questionnaires may have been the technical language barrier in non English speaking countries and insufficient knowledge in the field of CERACI research, which proves the need of projects focused, as CERACI, on the field of exposure assessment during chemical incidents.

Results presented in the report concern 80 completed surveys (equal to 80 respondents; n=80), 50 uncompleted questionnaires were analysed in the context of useful information contents and excluded as practically void.

The recipients of the survey were located in all 27 Member States, among which completed questionnaires were sent from all, apart from Malta. The highest number of responses was received from United Kingdom (17; 21.3%), the Netherlands (13; 16.3%) and Portugal (4; 5%). From most of the countries, 2 or 3 responses were received, and there was only one response from Austria, Bulgaria, Finland, Latvia, Luxembourg, Romania and Slovakia (Figure 4.1).

Probable reasons for differences in the response rates between the countries may have been:

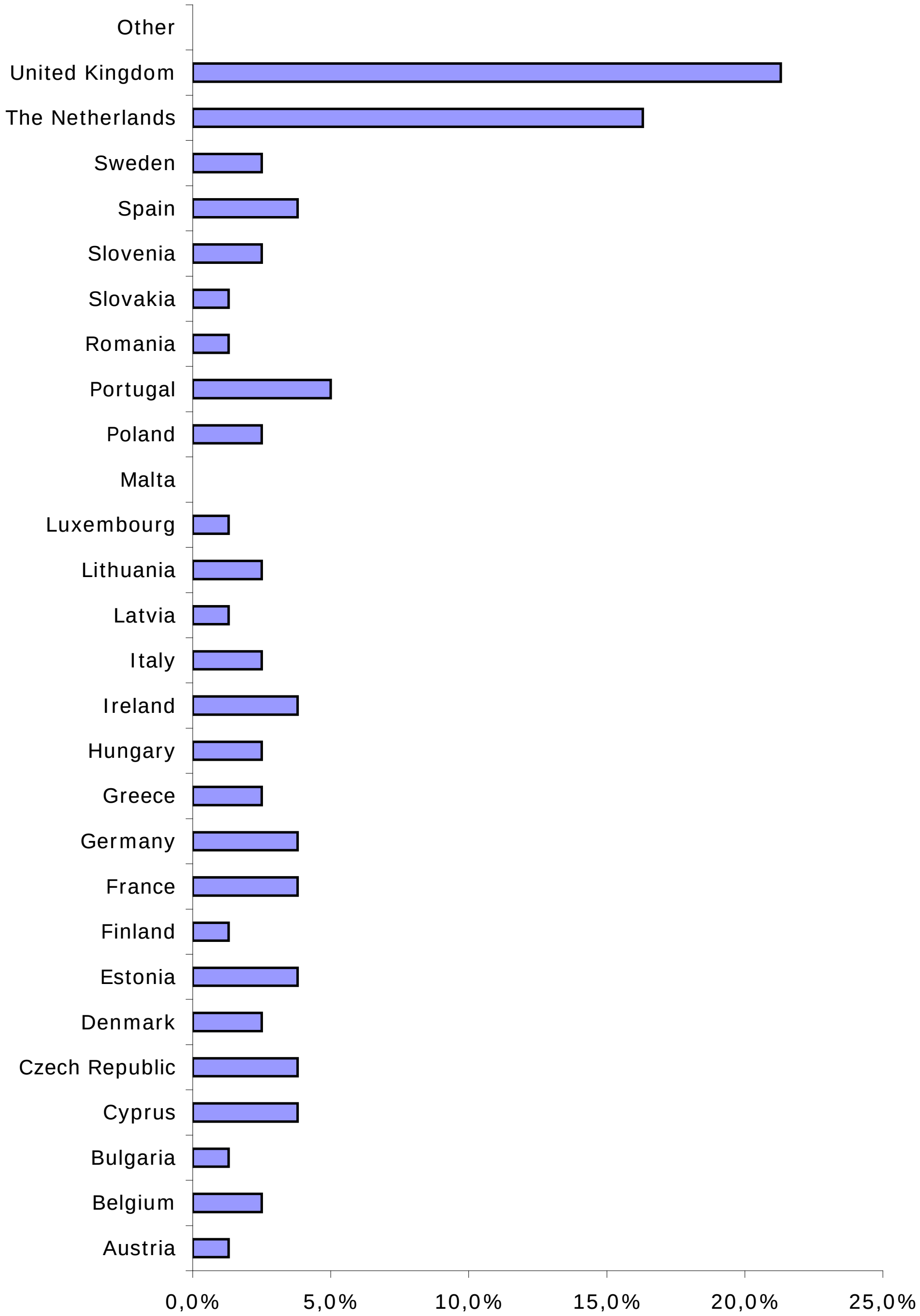
- The language barrier in non English speaking countries;

  In Cyprus, Greece, Poland and Slovakia, in spite of a relatively high number of questionnaire recipients (>20), there was a low response rate (1-3 responses)
- Lower number of questionnaire recipients due to limited number of contacts identified within the project;

  Only 4 people received the questionnaire in Luxembourg, 5 in Bulgaria, Czech Republic and Germany and 6 in Estonia, Latvia and Lithuania, while there were more than 25 recipients in the Netherlands and more than 100 in United Kingdom.
- Differences in the source of the contacts identified during the project

  The project partners had no personal contacts in Bulgaria, Cyprus, Malta and Romania. In such cases and where the number of personal contacts was limited, the contact details of potential survey respondents were acquired from the literature and internet searches during Task B and C. This sometimes resulted in not being able to reach the appropriate experts, which was confirmed by a few email messages from survey recipients informing us that they are not directly involved in exposure assessment during chemical incidents. The highest number of personal contacts came from the Netherlands and United Kingdom.
- The limited number of experts within a country in the field of CERACI research.

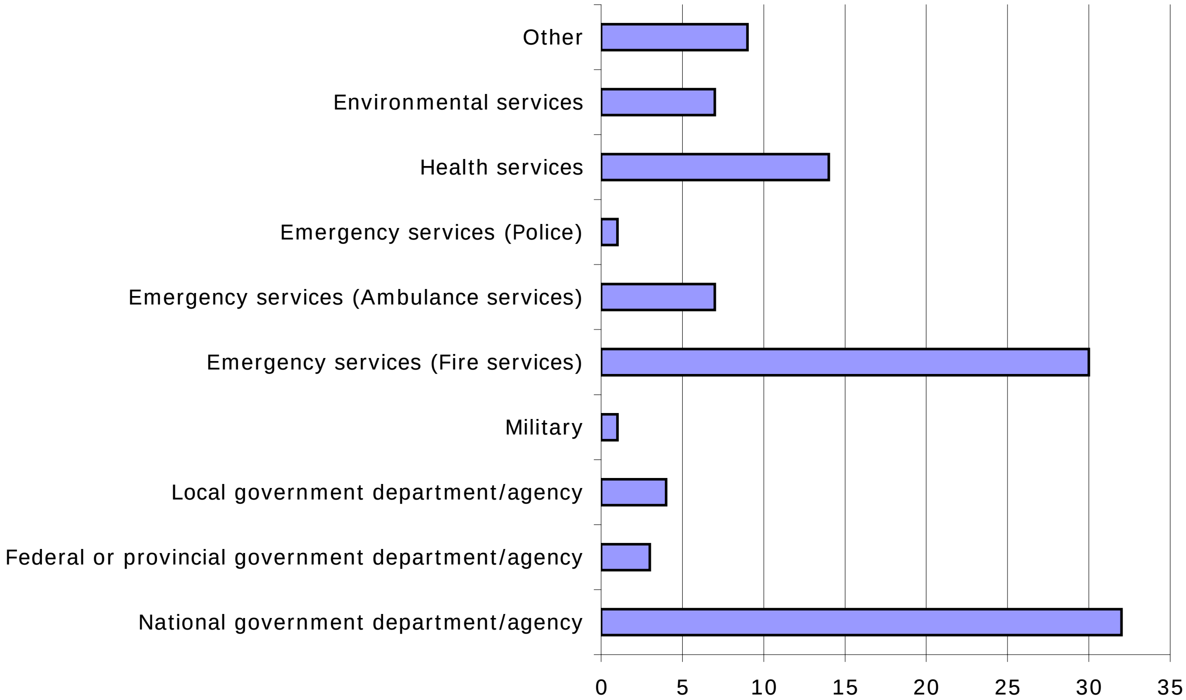
Figure 4.1 Country in which the survey respondent works (n = 80)



4.2 Professional background of respondents

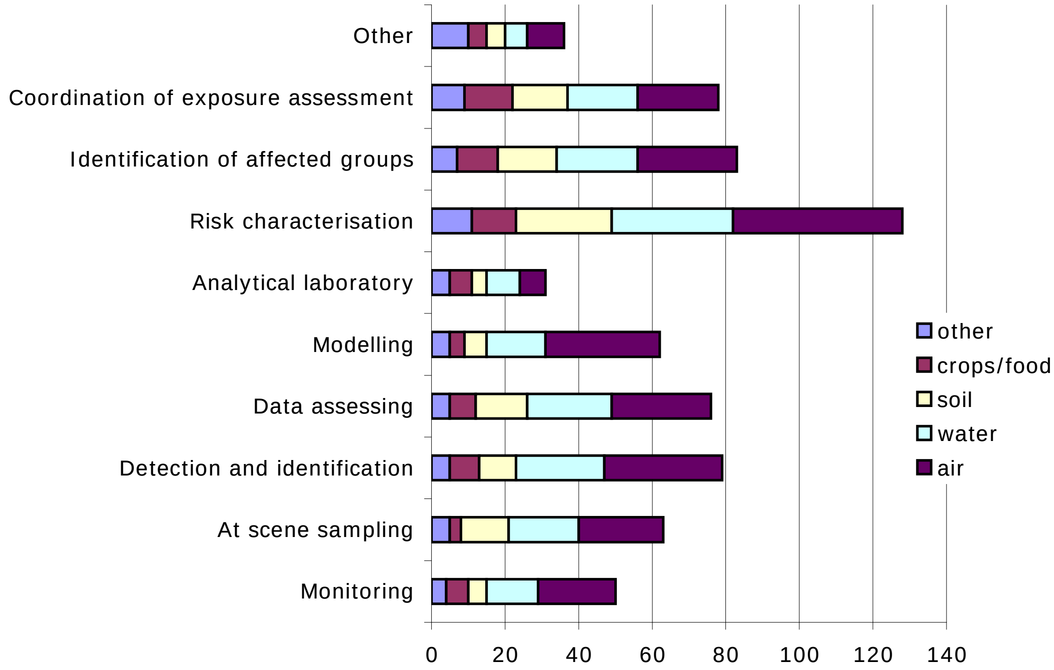
Various specialists responded to the CERACI survey. The majority of them are employed by governmental agencies or departments [39, 49.3% (10 from UK, 10 from NL and 19 from the rest of the countries)] 32 (40.5%) at national level, 3 at federal or provincial level and 4 at local level. The second most numerous groups of survey respondents were employees of fire and rescue services [30, 38.0% (4 from UK, 5 from NL, 21 from other MS)]. 14 (17.7%) respondents work in health services (among those 5 is from NL), 7 (8.9%) in environmental services, only 1 person (1.3%) works in military and 1 (1.3%) in police service (Figure 4.2).

Figure 4.2 Types of organisation the respondents work for (n=80)



As far as respondents' roles in exposure assessment are concerned, the majority of them declared their involvement in risk characterisation (51, 65.4%) for all the media, almost all (46) for air, 33 for water, 26 for soil and 12 for crops and food. Many of the respondents participate also in detection and identification procedures (39), modelling (36), data assessing (33) and identification of affected groups (32), monitoring (30), at scene sampling (29) and coordination of exposure assessment (28). The lowest percentage of respondents is involved in laboratory analysis (17) (Figure 4.3). Taking into account profession / roles of respondents, declared in their job descriptions (see section 6.1), more than 50% of public health advisors declared their involvement in risk characterisation (air) and modelling (air), fire fighters (including Hazmat specialists) are involved mostly in at scene sampling (air, water), detection and identification (air) and risk characterisation (air), health services and toxicologists in risk characterisation (air, water, soil, crops/food), identification of affected groups (air, water, soil, crops/food) and data assessing (air, water, soil) (Table 4.1).

Figure 4.3 Role of the respondents in exposure assessment



For an individual to be exposed to a substance, there must be a pathway linking the source to the person (receptor), (the source-pathway-receptor model). Based on this model, the respondents were asked to identify the subject they are focused on during exposure assessment. Out of 75 respondents that answered this question, 59 (78.7%) are focused on source, 47 (62.7%) on pathways and 40 (53.3%) on receptors (Figure 4.4). Considering profession / roles of respondents (see section 6.1), more than 60% of public health advisors declared that they are focused on source and pathways, 20 out of 23 fire fighters (including Hazmat specialists) are focused on source and 12 on receptors, almost all respondents from health services and toxicologists declare focusing on receptors, pathways and source (Table 4.2).

Figure 4.4 Respondents' focus on the elements of the source-pathway-receptor model during exposure assessment

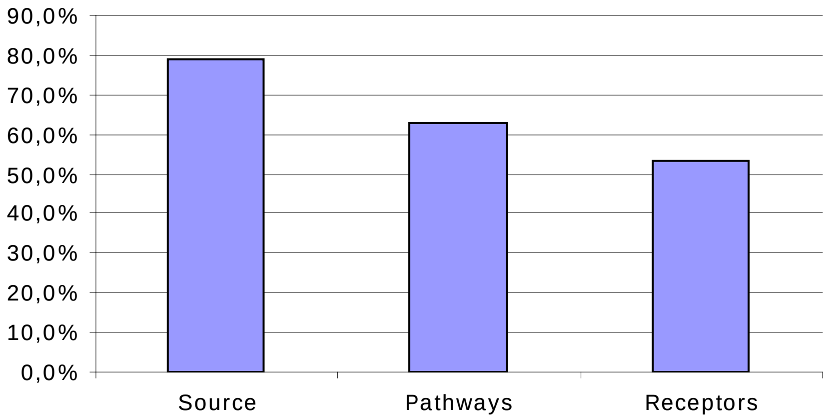


Table 4.1 Role of the respondents in exposure assessment by their profession

profession / job description	Matrices*	PH Advisors / coordination (n=31)	Fire fighters including Hazmat specialists (n=23)	Health services (MDs; Toxicologists) (n=11)	chemists (n=4)	MET services (+GIS) (n=4)	government – other (n=6)
Monitoring	**A**	10	8	1	0	1	1
	W	7	2	3	0	1	1
	S	2	1	1	1	0	0
	C/F	2	0	2	1	0	1
At scene sampling	**A**	9	11	1	0	1	1
	W	7	10	1	0	0	1
	S	4	8	1	0	0	0
	C/F	1	0	2	0	0	0
Detection and identification	**A**	13	18	0	0	1	0
	W	11	9	2	0	1	1
	S	4	6	0	0	0	0
	C/F	4	1	2	0	0	1
Data assessing	**A**	12	6	5	0	2	2
	W	9	5	5	0	1	3
	S	4	4	5	0	0	1
	C/F	3	0	3	0	0	1
Modelling	**A**	18	7	1	1	4	0
	W	9	5	1	0	1	0
	S	3	3	0	0	0	0
	C/F	2	1	1	0	0	0
Analytical laboratory	**A**	3	3	0	0	1	0
	W	4	1	2	1	0	1
	S	1	1	0	2	0	0
	C/F	1	0	2	2	0	1
Risk characterisation	**A**	21	14	7	1	2	1
	W	15	8	7	0	1	2
	S	11	8	7	0	0	1
	C/F	5	0	5	0	0	1
Identification of affected groups	**A**	12	8	7	0	0	0
	W	10	5	7	0	0	0
	S	6	3	7	0	0	0
	C/F	5	0	6	0	0	0
Coordination of exposure assessment	**A**	12	5	4	0	0	1
	W	10	4	4	0	0	1
	S	7	3	4	0	0	1
	C/F	7	1	4	0	0	1

*A – air; W – water; S – soil; C/F – crops/food

Table 4.2 Respondents' focus on the elements of the source-pathway-receptor model during exposure assessment by their profession

	PH Advisors / coordination (n=31)	Fire fighters including Hazmat specialists (n=23)	Health services (MDs; Toxicologists) (n=11)	chemists (n=4)	MET services (+GIS) (n=4)	government – other (n=6)
Source	23	20	9	3	1	3
Pathways	20	9	10	1	3	4
Receptors	15	12	10	0	1	2

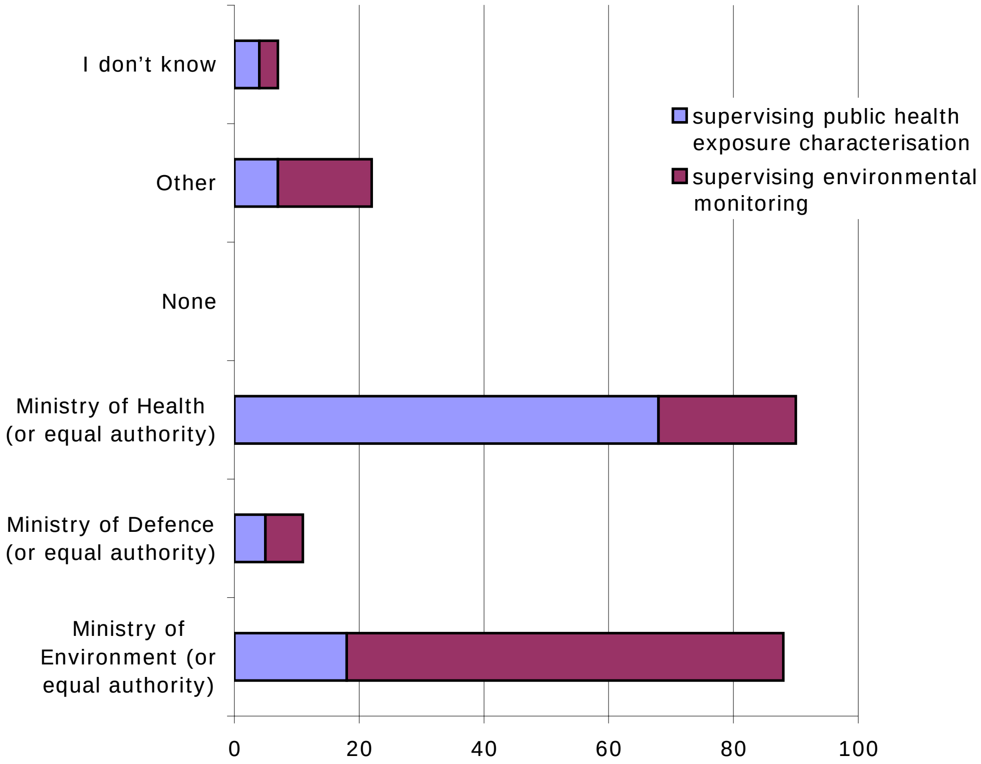
4.3 Environmental monitoring and modelling capabilities in Member States

4.3.1 General information on environmental monitoring in case of major chemical incidents in Member States

When asked if environmental monitoring during and after major chemical incidents is carried out in their country, almost all respondents (75/78) declared that environmental monitoring is done in their country during (69) and after (71) the incident.

In the following countries, environmental monitoring in case of major chemical incidents is supervised by the Ministry of Environment or equal authority and supervising public health exposure characterisation falls under the Ministry of Health or an equivalent institution's responsibilities: Belgium, Bulgaria, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Lithuania, Luxembourg, the Netherlands, United Kingdom. From the data gathered, it can be seen that in some countries (Austria, Cyprus, Czech Republic, Denmark, Hungary, Latvia, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden) division of these responsibilities is not so clearly specified and different institutions are chosen by different respondents from the same country as appropriate supervisors (Figure 4.5).

Figure 4.5 National authorities supervising environmental monitoring and public health exposure characterisation in major chemical incidents in MS



Among other governmental bodies supervising environmental monitoring and public health exposure characterisation, respondents very often listed the Ministry of Interior Affairs, the Ministry of Defence (Civil Protection), the Ministry of Labour and the Ministry of Rural Development and Food. Some research institutes (e.g. RIVM in the Netherlands) and central Agencies or Inspectorates (e.g. Environmental Protection Agency, Inspectorate for Emergency Situation, DWI, EA, Health Protection Agency/NHS in UK) were also mentioned but rather as advisory bodies.

Air, water and soil monitoring at the incident scene is carried out mostly by environmental protection services (for environment and public health protection), fire and rescue services (mainly for public and occupational health protection but also for environment protection) and health protection services, which additionally carry out food/crops monitoring for public and occupational health protection (Table 4.3, Table 4.4). Among other institutions carrying out the monitoring at the incident site, respondents mentioned agriculture and food safety governmental bodies, labour protection agencies, occupational health services and research institutes.

Table 4.3 Bodies carrying out monitoring at the incident scene.

	Response Count (n=78)	**air**	**water**	**Soil**	**crops/ food**	**other**
National Hazmat teams	33	29	25	16	8	4
Fire and rescue services	56	49	22	13	1	6
Environmental protection services	63	47	51	47	17	3
Site operator resources (chemical rescue team)	27	21	16	10	1	0
Health protection services	50	21	22	13	20	2
Other	22	6	6	5	12	3
I don't know	14	2	3	4	12	5
Not applicable	3	1	0	1	2	1

Table 4.4 Purposes of monitoring carried out at the incident scene.

	for public health protection	**for environment protection**	**for occupational health protection**	**Response Count (n=78)**
National Hazmat teams	25	17	14	33
Fire and rescue services	40	26	28	56
Environmental protection services	30	56	9	63
Site operator resources (chemical rescue team)	13	11	10	27
Health protection services	40	6	27	50
Other	10	6	12	22
I don't know	2	1	6	14
Not applicable	0	0	0	3

4.3.2 Monitoring and modelling availability and capability in Member States

Concerning the nature of the monitoring resource availability and the capability, in most of the countries monitoring is carried out within the emergency exclusionary zone, for emergency response and off site for assessing public exposure, mainly as dedicated 24/7 service and in all media (air, water, soil, crops/food) (Figure 4.6, Table 4.5). According to a respondent from the Netherlands some monitoring activities (e.g. asbestos) are outsourced to commercial parties.

Figure 4.6 The nature of the monitoring resource availability and the capability in EU

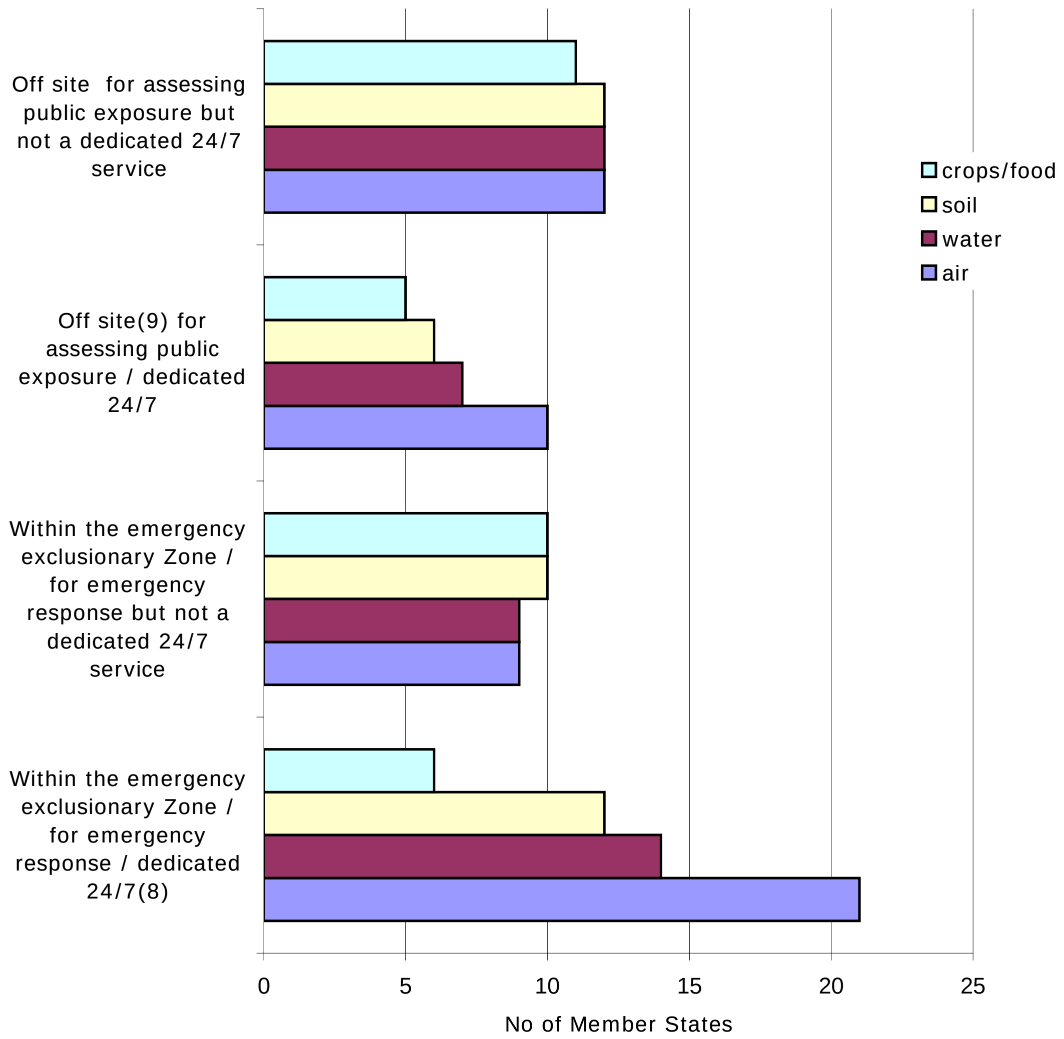


Table 4.5 The nature of the monitoring resource availability and the capability by country.

country	Within the emergency exclusionary Zone / for emergency response								Off site for assessing public exposure							
	dedicated 24/7 service				not a dedicated 24/7 service				dedicated 24/7 service				not a dedicated 24/7 service			
	air	water	soil	crops/food	air	water	soil	crops/food	air	water	soil	crops/food	air	water	soil	crops/food
Austria																
Belgium	√	√	√				√	√	√	√	√				√	√
Bulgaria	√	√														
Cyprus	√				√								√			
Czech Republic	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Denmark	√	√	√	√												
Estonia	√				√	√	√	√					√	√	√	√
Finland	√	√	√													
France	√	√	√			√										
Germany	√	√	√			√	√	√					√	√	√	√
Greece																
Hungary	√								√							
Ireland													√	√		
Italy																
Latvia	√								√							
Lithuania																
Luxembourg	√	√	√	√									√	√	√	
Poland	√								√							
Portugal	√	√	√		√	√	√	√	√	√	√	√	√	√	√	√
Romania	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
Slovakia	√	√					√									
Slovenia	√	√	√					√	√	√			√	√	√	√
Spain	√				√									√	√	√
Sweden	√				√	√	√	√					√	√	√	√
Netherlands	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
United Kingdom	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√

As far as modelling is concerned, all types of models mentioned in the survey (local models, dispersion models provided by meteorological experts and water dispersion modelling) were chosen as available by respondents (Figure 4.7, Table 4.6). Modelling seems to be done mainly for air and water. One of the Dutch respondents also mentioned skin absorption modelling and consumer exposure modelling as an option used.

Figure 4.7 The nature of the modelling availability and the capability in EU

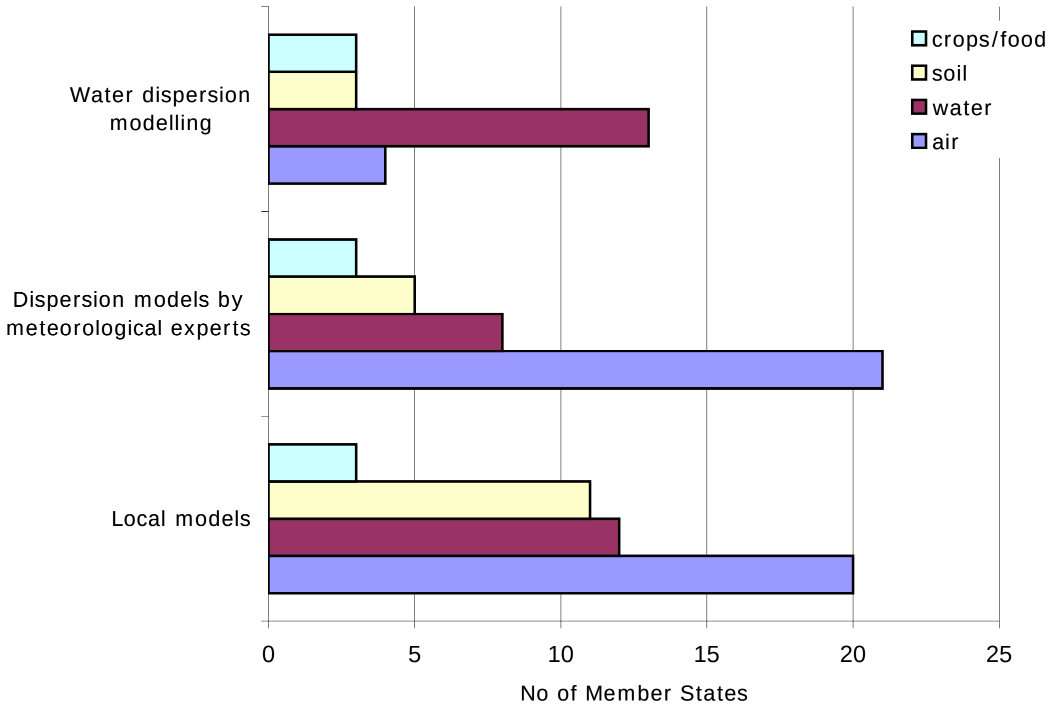


Table 4.6 The nature of the modelling availability and the capability by country.

country	Local models				Dispersion models by meteorological experts				Water dispersion modelling			
	air	water	soil	crops/food	air	water	soil	Crops/food	air	water	soil	crops/food
Austria	√				√							
Belgium	√											
Bulgaria												
Cyprus	√											
Czech Republic	√	√			√	√				√		
Denmark	√	√	√		√	√	√			√		
Estonia	√	√	√	√	√							
Finland					√					√		
France	√				√				√			√
Germany	√	√	√		√					√		
Greece					√							
Hungary	√				√							
Ireland	√											
Italy	√	√	√	√	√					√	√	√
Latvia	√	√			√					√		
Lithuania												
Luxembourg					√					√		
Poland	√				√					√		
Portugal	√	√	√		√	√	√		√	√		
Romania	√	√	√		√	√	√			√		
Slovakia	√	√	√		√	√						
Slovenia			√		√							
Spain	√				√	√						
Sweden	√	√	√		√			√		√	√	
Netherlands	√	√	√		√	√	√	√	√	√		
United Kingdom	√	√	√	√	√	√	√	√	√	√	√	√

In most of the countries, National Hazmat teams supporting exposure assessment are organised within the national or regional fire and rescue service. Respondents from Germany, Portugal, the Netherlands and United Kingdom declared that there are also independent National Hazmat teams in their countries. For the Netherlands, they are referring to the Environmental Incident Service provided by the RIVM. In Romania, only independent units serve as National Hazmat teams, and according to the respondents, there is no such service in Hungary, Ireland, Italy, Luxembourg and Slovakia. A back office service for onsite Hazmat advisors to support exposure assessment is available in most of the countries (Table 4.7).

Table 4.7 Organisation of National Hazmat teams supporting exposure assessment, their activity/output/output receiver and back office service availability in Member States

country	Yes, as separate units	Yes, within national fire and rescue service	No	output / activity description	receiver of their output	Back office service	
						Yes	No
Austria		√		-	-	√	
Belgium		√		This is not really national team. It's a zonal organisation. (Sometimes more than 1 per Province). Each zone has to be able to intervene for chemical incident, including zonage, evacuation, clogging, measurements, recognition and measuring the leaked substance.	-The authority (Communal, provincial, national) -The officer in charge or the local hazmat specialist	√	
Bulgaria		√		securing, monitoring, detection and decontamination of the incident place and the team players	- the national body which is responsible for specific type of incidents	√	
Cyprus(‡)		√		*q not understood*	-Department of environment -General Public	√	√
Czech Republic		√		- Hazmat teams have two parts - stationary labs and mobile labs. The mobile labs are used on scene in case of a chemical incident. They provide chemical survey, sampling, identification, chem analysis or monitoring and support an officer in charge on scene. They use: Raman spectroscopy, IMS, PID, IR spectroscopy, UV-Vis spectroscopy, XRF, GC – techniques (GC, GC-MS, GC-MS-MS). The stationary labs provide analytical confirmation, expertise activities (determination of fires causes) and training of fire fighters. They use Raman spectroscopy, IMS, PID, IR spectroscopy, UV-Vis spectroscopy, XRF, GC – techniques (GC, GC-MS, GC-MS-MS), LC-techniques (LC-MS, LC-MS-MS), HPLC. - Mainly "gas team", but also cooperating with TRINS (transport of Hazmat) - Air monitoring (chemical or radiation), setting of dangerous zone, basis for selection of appropriate protective equipment for first responders, sampling, identification of unknown materials or substances	- Fire units above all - an officer in charge or regional crisis-management authorities. (In case of radiation National Radiation Monitoring Network). - Fire and rescue service - Commander of the intervention or crisis staff (depends on size of incident)	√	
Denmark		√		-	Fire and rescue service, police and ambulance	√	
Estonia		√		- We have regional HAZMAT teams (24/7) for first response - limited air monitoring, leakage stopping and one team with advanced detection capabilities (not 24/7) - identification of most common hazardous gases, measuring concentration of propane, ammonia etc	- residents - Fire and rescue services for initial public health and environmental protection. - incident commander		√

Finland							
France		√		*q not understood*	French Government	√	
Germany	√	√		Sampling and analysing	- Fire Services (local incidents), local government (regional incidents) - fire department, police, administration	√	
Greece		√		In case of an accident or a threatened incident, in the General Secretariat of Civil Protection is convoked the Supporting Team for the management of CBRN Threats and Incidents, in order to supply specialised know-how and scientific information for the management of chemical, biological, radiologic and nuclear incidents.	-		
Hungary			√	-	-	√	
Ireland			√	-	-		√
Italy			√	-	-		√
Latvia		√		Report detection, identification and monitoring results, provide chemical advice to responders.	Initially emergency responders		√
Luxembourg			√	-	-		√
Poland(‡)		√		Report detection, monitoring results	Emergency responders.	√	√
Portugal(‡)	√	√		- Identification of the Hazmat agents, amount, affected area. - Teams with specific chemical intervention equipment to assess, monitor and intervene. Distributed along the country, stationed at and within fire-departments. Gather data for Environment Ministry, to evaluate and produce guidelines. - Reports of incidents and proposals for procedures change and equipment	- Environment Ministry / National Civil Protection Authority - Environment Ministry - Civil Protection Framework	√	√
Romania	√			*q not understood*	operators of hazardous activities		
Slovakia			√	-	-	√	
Slovenia		√		air, water, soil sampling on site, fast risk assessment on site	Ministry of defence, of health, of environment, general public		√
Spain(‡)		√		*q not understood*	*q not understood*	√	√
Sweden		√		*q not understood*	Municipalities	√	
Netherlands	√	√		- monitoring and analysis of chemical incidents - Detection and identification of the hazmat - Fire department can call Hazmat team for support in measuring environmental concentration in the affected area. - identification and monitoring results, provide advise to	- public health services or fire department - The person (mostly from the fire dept.) that asks for it - Fire department and other parties active in Incident management. Data is shared with all participants via a dedicated website called ICAweb.	√	

				responders and government on regional/national level - Identify substances; Give a risk assessment of the situation detection, identification and decontamination, provide advise the responders - On site monitoring, sampling and analysis. Advice to local (fire brigade, public health service) and national authorities (Min. Environment, Min. Health) - It is an expert 24/7 service which can support regional experts on request. They have both sampling and analysing capacity as well as modelling expertise - Concentration measurements, advice - report, detect, identification, advice for the responders - interdepartmental advisory team- Botmi; overall environmental advice to the executive team fight - concentration measurements of toxic products in air; sampling of deposition materials in air / water / soil; directing gas-measurement teams to right position; advising fire brigades, police and health-teams about dangerous goods; warning the inhabitants with sirens to shelter, etcetera... - Advise	- responders and local/national authority - Local Government / Emergency services - emergency responders and the public - Local: City major, chief of fire brigade, Local Hazmat/ health advisors - Either public health advisor hazmat or hazmat expert of fire brigade - Fire brigade, emergency response team - first responders and crisis-management teams - executive team and responsible ministry - Government, mayors, chiefs of police, health and fire brigade - local community where the incident occurs		
United Kingdom	√	√		- Determining response based up on nature of material. - On site screening for harmful substances - Carry out assessment at incidents with support form local and national scientific services - Fire Detection Identification and Monitoring teams respond daily across UK to a range of Hazmat related calls - respond to incidents and provide data for emergency responders and the wider responding community - Local Detection and Identification which is then passed to local responding agencies	- Cat 1 responders - Police, Water Companies etc - Dependent on incident but normally fire commanders for information of multi agency partners - Other Government Agencies and Public - emergency services and government agencies - NHS - Emergency Service and Health representatives - Home office - Scottish Government	√	

(‡) – contradictory answers – information impossible to verify at the survey stage

Hazmat sampling teams are included in national Hazmat teams in Cyprus (‡), Czech Republic, Denmark, Estonia (‡), France, Germany, Poland, Portugal, Slovenia (‡), the Netherlands and United Kingdom (Table 4.8).

Table 4.8 Organisation of Hazmat sampling teams in Member States

country	Yes, within national Hazmat teams	Yes, as separate units	No
Austria		√	
Belgium		√	
Bulgaria			√
Cyprus (‡)	√		√
Czech Republic	√	√	
Denmark	√		
Estonia (‡)	√	√	√
Finland		√	
France	√	√	
Germany	√		
Hungary		√	
Ireland			√
Italy		√	
Latvia			√
Poland	√		
Portugal	√	√	
Romania		√	
Slovakia		√	
Slovenia (‡)	√		√
Spain		√	
Sweden (‡)		√	√
Netherlands	√ (8 answers)	√ (4 answers)	
United Kingdom	√ (8 answers)	√ (2 answers)	

(‡) – contradictory answers – information impossible to verify at the survey stage

Among available sampling resources and equipment 51 respondents chose procedures, 37 specific technical equipment and 29 commercial off the shelf sampling kit. The question was answered by 58 respondents. No information was obtained from: Austria, Bulgaria, Greece, Lithuania, Luxembourg and Romania (Table 4.9, Table 4.10).

Table 4.9 Available sampling resources and equipment

	drinking water	surface water	ground water	soil	air	food	vegetation	debris	particulate matter, powder	Response Count (n=58)
Procedures	43	40	37	38	44	36	33	24	37	51
Commercial off the shelf sampling kit	22	20	20	19	26	15	13	13	17	29
Self made sampling kit	5	5	3	6	6	3	5	0	2	9
Specific technical equipment	30	27	26	24	32	22	20	17	23	37
Other	1	1	1	1	1	1	1	1	1	1

Table 4.10 Available sampling resources and equipment by country

	Procedures	Commercial off the shelf sampling kit	Self made sampling kit	Specific technical equipment
Belgium	air	air		air
Cyprus	air, particulate matter, powder	air, particulate matter, powder		air, particulate matter, powder
Czech Republic	water, soil, air, food, vegetation, debris, particulate matter, powder	water, soil, air, food, vegetation, debris, particulate matter, powder		
Denmark	water, soil, air, food, vegetation			water, soil, air
Estonia	water, soil, air, particulate matter, powder		water, soil, air, particulate matter, powder	water, soil, air, food, vegetation, debris, particulate matter, powder
Finland	water, soil, food, vegetation, particulate matter, powder			
France	water, soil, air, food, vegetation, debris, particulate matter, powder			
Germany	water, soil, air, food, vegetation, debris, particulate matter, powder	water, soil, air, food, vegetation, debris, particulate matter, powder		water, soil, air, food, vegetation, debris, particulate matter, powder
Hungary	air, particulate matter, powder			air, particulate matter, powder
Ireland	water, soil, air, food, vegetation, particulate matter, powder			water, air, food
Italy	water, soil, air, food, vegetation, debris, particulate matter, powder			water, soil, air, food, vegetation, debris, particulate matter, powder
Latvia	water, soil, air, food, vegetation, debris, particulate matter, powder	water, soil, air, food, vegetation, debris, particulate matter, powder		
Poland	water, soil, air, food, vegetation, debris, particulate matter, powder			
Portugal	water, soil, air, food, vegetation, debris, particulate matter, powder		water, soil, air	water, soil, air, food, vegetation, debris, particulate matter, powder
Slovakia	water, soil, air, food, vegetation, particulate matter, powder		water, soil, air, food, vegetation, particulate matter, powder	water, soil, air, food, vegetation, particulate matter, powder
Slovenia	water, soil, air, food, particulate matter, powder	water, soil, air, food		water, soil, air, food
Spain	water, soil, air, food, vegetation, debris, particulate matter, powder	water, soil, air, food, vegetation, debris, particulate matter, powder	water, soil, air, food, vegetation	water, soil, air, food, vegetation, debris, particulate matter, powder
Sweden	water, soil, air, food, vegetation, debris, particulate matter, powder	water, soil, air	air	
Netherlands	water, soil, air, food, vegetation, debris, particulate matter, powder	water, soil, air, food, vegetation, debris, particulate matter, powder	water, soil, air, food, vegetation	water, soil, air, food, vegetation, debris, particulate matter, powder
United Kingdom	water, soil, air, food, vegetation, debris, particulate matter, powder	water, soil, air, food, vegetation, debris, particulate matter, powder	water, food, vegetation	water, soil, air, food, vegetation, debris, particulate matter, powder

Detection and identification equipment availability was specified by 51 respondents. No information was obtained from: Austria, France, Greece, Lithuania, Luxembourg, Romania and Slovenia. It can be seen that in the rest of the countries, detection tubes are the most popular equipment deployed at/near the scene of an incident and also at nearby locations (e.g. sensitive receptors, sheltering place). Other popular techniques/equipment used at/near the scene of an incident are PID, IMS, IR and Raman spectroscopy and GC techniques, and at nearby locations PID, IR spectroscopy and GC techniques are deployed most often, after detection tubes. In general, more equipment is available at/near the scene of an incident than at nearby locations (Table 4.11, Table 4.12). Understandably, national resources are the most extensive but the differences between national, regional and local resources are not very significant (Table 4.11). Among other available techniques that respondents listed are: measurements with chips and electrochemical captors, FPD, Thermal desorption GC-MS, UV, IR and Chemiluminescense techniques within DLI and radioactivity measuring equipment.

According to a Swedish respondent, the complexity of the equipment deployed may differ depending on the region of the country (from simple to more advanced). One of the English respondents familiar with water matrix testing, noted that all water company testing is done off site.

Table 4.11 Resource/equipment available for detection and identification (All acronyms used in tables 4.11 and 4.12 explained below table 4.12)

	equipment deployed at/near scene of incident	**equipment deployed at nearby locations (e.g. sensitive receptors, sheltering place)**	**local resource**	**Regional resource**	**national resource**	**Response Count (n=51)**
Raman spectroscopy	9	2	4	10	16	22
IMS	12	5	10	10	12	24
PID	20	9	11	15	17	31
Detection tubes	29	11	19	17	19	42
IR spectroscopy	11	9	5	17	21	36
UV-Vis spectroscopy	5	5	6	7	11	21
AAS-techniques (FAAS, GFAAS)	2	3	2	5	12	16
XRF	5	5	3	6	13	17
AES	1	2	1	3	8	10
ICP – techniques (ICP-AES, ICP-MS).	4	3	4	8	12	18
GC – techniques (GC, GC-MS, GC-MS-MS)	10	9	8	14	22	34
LC-techniques (LC-MS, LC-MS-MS)	2	5	5	7	14	20
HPLC	4	6	5	7	16	22
Other	6	3	5	6	9	14

Table 4.12 Resource/equipment available for detection and identification by country (All acronyms used in tables 4.11 and 4.12 explained below table 4.12)

country	equipment deployed at / near scene of incident													equipment deployed at nearby locations (e.g. sensitive receptors, sheltering place)												
	Raman spectroscopy	IMS	PID	Detection tubes	IR spectroscopy	UV-Vis spectroscopy	AAS-techniques (FAAS, GFAAS)	XRF	AES	ICP – techniques (ICP-AES, ICP-MS)	GC – techniques (GC, GC-MS, GC-MS-MS)	LC-techniques (LC-MS, LC-MS-MS)	HPLC	Raman spectroscopy	IMS	PID	Detection tubes	IR spectroscopy	UV-Vis spectroscopy	AAS-techniques (FAAS, GFAAS)	XRF	AES	ICP – techniques (ICP-AES, ICP-MS)	GC – techniques (GC, GC-MS, GC-MS-MS)	LC-techniques (LC-MS, LC-MS-MS)	HPLC
Austria																										
Belgium			√	√																						
Bulgaria			√	√												√	√									
Cyprus				√																						
Czech Republic	√	√	√	√	√	√		√			√			√	√	√	√	√	√	√	√	√		√	√	√
Denmark																										
Estonia																										
Finland				√																						
France																										
Germany	√	√	√	√											√	√										
Greece																										
Hungary																										
Ireland				√																						
Italy																										
Latvia																		√								
Lithuania																										
Luxembourg																										
Poland				√	√																					
Portugal		√	√	√																						
Romania																										
Slovakia				√													√									
Slovenia																										
Spain			√	√																						

Sweden		√		√																						
Netherlands	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√	√
United Kingdom	√	√	√	√	√	√				√	√		√	√	√	√	√	√	√					√	√	√

IMS Ion Mobility Spectrometry
PID Photoionisation Detector
IR spectroscopy Infrared spectroscopy
UV-Vis spectroscopy Ultraviolet-visible spectroscopy
AAS-techniques Atomic Absorption Spectrometry techniques
FAAS Flame Atomic Absorption Spectrometry
GFAAS Graphite Furnace Atomic Absorption Spectrometry
XRF X-Ray Fluorescence
AES Atomic Emission Spectroscopy
ICP – techniques Inductively Coupled Plasma techniques
ICP-AES Inductively Coupled Plasma Atomic Emission Spectroscopy
ICP-MS Inductively Coupled Plasma Mass Spectrometry
GC – techniques Gas Chromatography techniques
GC Gas Chromatography
GC-MS Gas Chromatography–Mass Spectrometry
GC-MS-MS Gas Chromatography/tandem Mass Spectrometry
LC-techniques Liquid Chromatography techniques
LC-MS Liquid Chromatography–Mass Spectrometry
LC-MS-MS Liquid Chromatography/tandem Mass Spectrometry
HPLC High-performance liquid chromatography

39 respondents declared that an interdisciplinary procedure for sampling, detection, identification and monitoring is available in their country but slightly more respondents didn't know the answer (35) or skipped this question (6) (Table 4.13, Table 4.14).

Table 4.13 Availability of an interdisciplinary procedure for sampling, detection, identification and monitoring

	air	**water**	**soil**	**food / crops**	**Response Count (n=74)**
Yes	36	31	24	18	39
No	13	13	9	8	14
I don't know	23	25	30	32	35

Table 4.14 Availability of an interdisciplinary procedure for sampling, detection, identification and monitoring by country

	Yes				**No**			
	air	**water**	**soil**	**crop / food**	**air**	**water**	**soil**	**crop / food**
Austria								
Belgium					√	√		
Bulgaria	√	√						
Cyprus	√							
Czech Republic	√	√	√	√				
Denmark								
Estonia (‡)	√	√	√	√	√	√	√	
Finland								
France	√	√	√	√				
Germany	√	√	√					
Hungary	√	√						
Ireland					√	√	√	√
Italy					√	√	√	√
Latvia	√	√	√	√				
Luxembourg								
Poland (‡)	√				√	√	√	√
Portugal (‡)	√	√	√		√	√		
Romania	√	√	√					
Slovakia	√	√	√	√				
Slovenia					√	√	√	√
Spain					√	√	√	√
Sweden(‡)	√	√	√	√	√	√	√	√
Netherlands	√	√	√	√				
United Kingdom	√	√	√	√	√	√	√	√

(‡) – contradictory answers – information impossible to verify at the survey stage

Many respondents didn't know (35) or skipped (22) the question about availability of mobile detection and identification equipment for different matrices. Among 23 respondents that answered this question, 21 (from Belgium, Bulgaria, Czech Republic, Estonia, Finland, Germany, Ireland, Italy, Latvia, Portugal , Spain, Sweden, Netherlands, United Kingdom) declared that mobile detection and identification equipment is NOT available for crop and food, 12 (from Bulgaria, Czech Republic, Estonia, Finland, Ireland, Italy, Portugal , Sweden, Netherlands, United Kingdom) for soil, 9 (from Estonia, Ireland, Italy, Portugal, Sweden, Netherlands, United Kingdom) for water and 5 (from Ireland, Italy, Portugal, Cyprus and Germany) for air.

Almost all the countries, apart from Belgium, Luxembourg and Spain (‡) have a national laboratory network for all media (Table 4.15).

Table 4.15 Does your country have a national laboratory network?

	Yes				No			
	air	**water**	**Soil**	**crop / food**	**air**	**Water**	**soil**	**crop / food**
Austria	√	√	√	√				
Belgium					√	√	√	√
Cyprus	√	√	√	√				
Czech Republic	√	√	√	√				
Denmark	√	√	√	√				
Estonia	√	√	√	√				
Finland	√	√	√	√				
France	√	√	√	√				
Germany	√	√	√	√				
Hungary	√	√						
Ireland	√	√	√	√				
Italy	√	√	√	√				
Latvia	√	√	√	√				
Luxembourg					√	√	√	√
Poland	√	√	√	√				
Portugal	√	√	√	√				
Romania	√	√	√	√				
Slovakia	√	√	√	√				
Slovenia	√		√			√		√
Spain(‡)		√		√	√	√	√	√
Sweden(‡)	√	√	√	√	√		√	
Netherlands	√	√	√	√	,			
United Kingdom	√	√	√	√				

(‡) – contradictory answers – information impossible to verify at the survey stage

According to 37 (n=74) respondents from (Bulgaria, Belgium, Cyprus, Germany, Czech Republic, Estonia, France, Hungary, Ireland, Italy, Latvia, Portugal, Slovakia, Slovenia, Spain, Sweden, Netherlands, United Kingdom), the analysis results from exposure assessment are compared to Acute Exposure Guideline Levels. 12 persons (Belgium, Czech Republic, Estonia, Ireland, Portugal, Slovenia, Sweden, Netherlands, United Kingdom) gave examples of other guidelines: ERPG, AETL, TDI, TWI, BMDL, IDLH, EQSs, SNARLs, National Intervention Values (which are mostly derived from AEGLs; e.g. Dutch: Dutch Intervention Values, VRW, AGW, LBW), European Drinking Water Standards and TLV, MAK or other national occupational exposure limits values. One of Slovenian respondents stated that the results are compared to international standards if available, if not they are most commonly compared to German national values. Other guidance values such AOEL or TDI or a relevant NOAEL or LOAEL are used if a medium or long term exposure is suspected. Only 1 respondent from Czech Republic stated that no comparisons are made. An Austrian respondent encountered the situation in which emergency responders and authorities prefer different threshold values. In his comment, he stated that standardisation of the assessment values would be highly desirable.

Health risk assessment, on the basis of the data derived from DIM[3] activities carried out at an incident site can be undertaken by the fire and rescue service, environmental protection, public health or food safety officials on different country levels depending on incident severity and scale (Table 4.16). Respondents mentioned difficulties in data sharing among various services and lack of official systematic procedures for data sharing among respondents and public health officials carrying out risk assessment.

Table 4.16 Bodies undertaking health risk assessment, on the basis of the data deriving from DIM activities carried on incident site

	local level	**regional level**	**national level**	**Response Count (n=73)**
Fire and rescue service	50	34	21	52
Environmental protection officials	41	40	38	55
Public health officials	38	45	41	60
Food safety officials	24	26	35	42
Other (provide who, e.g. site operator)	5	4	4	6

Possible additional information, gathered during the acute phase of a chemical incident, suitable for exposure assessment including:

- short characterisation of the place of release (closed building, open air etc.)
- potentially exposed population (kind, size)
- potentially exposed grounds / crops / facilities etc.
- type of the substance
- quantity released
- exposed population – health effects
- meteorological (weather) conditions
- observations / notifications (e.g. smell, deposition etc.)
- analytical data

is, as the most complex set of data, recorded by the fire and rescue service in most of the countries. Health services are mostly interested in health effects in the exposed population, its kind and size, and type of a substance released. Environmental protection services gathered mainly analytical data, information on meteorological conditions, potentially exposed grounds / crops / facilities etc., type of the substance and Observations / notifications (e.g. smell, deposition etc.) (Table 4.17). Among other information gathered on site, respondents listed material safety data sheets of industrial products involved in a chemical incident, toxic cloud formation, wind direction and need of evacuation. According to one respondent's comment, in Slovenia as much information as possible is gathered, as there is no unified scope of necessary data specified.

[3] Detection, Identification, Monitoring

Table 4.17 Additional information needed for exposure assessment gathered during the acute phase of a chemical incident by different organisations

	fire and rescue service	**health service**	**environmental protection service**	**site operator**	**Response Count (n=66)**
Short characterisation of the place of release (closed building, open air etc.)	58	14	19	28	62
Potentially exposed population (kind, size)	43	39	18	14	59
Potentially exposed grounds / crops / facilities etc.)	23	19	35	14	50
Type of the substance	58	26	31	30	62
Quantity released	54	19	27	31	62
Exposed population – health effects	26	59	12	8	62
Meteorological (weather) conditions	42	13	35	15	58
Observations / notifications (e.g. smell, deposition etc.)	52	25	31	20	60
Analytical data	29	27	39	13	55
Other (provide below what information)	3	3	2	4	6

Risk mapping systems available in most of the European countries (apart from Cyprus, Lithuania, Luxembourg) provide information on land use (agriculture, residential, industry area etc.), population size, population type (possible identification of susceptible populations near the incident location) and the vulnerable zones (populations at risk/sensitive receptors) (Table 4.18).

Table 4.18 Possibility of gathering information about the exposed areas by the usage of risk mapping (GIS mapping) systems available in EU countries

	Land use (agriculture, residential, industry area etc.)	**Population size**	**Population type (possible identification of susceptible populations near the incident location)**	**The vulnerable zones (populations at risk/sensitive receptors)**	**Not applicable (we do not use risk mapping system)**
Austria	√				
Belgium	√	√			
Bulgaria	√	√	√	√	
Cyprus					√
Czech Republic	√	√	√	√	
Denmark	√				
Estonia	√	√	√		
Finland	√	√	√		
France	√	√	√	√	
Germany	√	√	√	√	
Greece	√	√	√	√	
Ireland (‡)	√	√	√	√	√
Italy			√	√	
Latvia	√	√	√	√	
Lithuania					√
Luxembourg					√
Poland	√	√			

Portugal	√	√	√	√	
Romania	√	√	√	√	
Slovakia	√	√			
Slovenia	√	√	√	√	
Spain(‡)	√	√	√	√	√
Sweden(‡)	√	√		√	√
Netherlands	√	√	√	√	
United Kingdom	√	√	√	√	

(‡) – contradictory answers – information impossible to verify at the survey stage

As far as dispersion models are concerned, both airborne and waterborne dispersion models are available in most European countries (Table 4.19).

Table 4.19 Availability of airborne and water borne dispersion models in EU countries

	airborne dispersion models			water borne dispersion models	
	yes – provided by meteorological experts	**Yes – provided by non meteorological experts**	**no**	**yes**	**no**
Austria	√	√			
Belgium		√			
Bulgaria		√			√
Cyprus	√				
Czech Republic	√	√		√	
Denmark		√			
Estonia		√		√	
Finland	√			√	
France	√	√		√	
Germany	√	√		√	
Hungary	√				
Ireland	√	√			
Italy		√			
Latvia	√			√	
Poland	√	√			
Portugal(‡)	√	√		√	√
Romania		√		√	
Slovakia	√			√	
Slovenia	√			√	
Spain(‡)		√	√	√	√
Sweden	√	√		√	
Netherlands	√	√		√	
United Kingdom	√	√		√	

(‡) – contradictory answers – information impossible to verify at the survey stage

In most of the countries, chemical concentrations in the air/water and deposition can be assessed within the environmental modelling process. Among other possible values to acquire from environmental modelling, respondents mentioned chemical concentrations in soil, food, vegetation, particulate matter and human exposure (chemical doses) through drinking water, food, etc. and also radiation contamination (Table 4.20).

Table 4.20 Outputs of environmental modelling available in EU countries

	Chemical concentrations in the air	Chemical concentrations in water	Deposition	Other [please indicate some examples below]
Austria	√		√	
Belgium	√			
Cyprus	√		√	
Czech Republic	√	√	√	Soil, food, vegetation, particulate matter
Estonia	√	√	√	
Finland	√	√	√	
France	√	√		
Germany	√	√	√	
Greece	√	√	√	
Hungary	√		√	
Ireland	√			
Italy	√	√	√	
Latvia	√	√	√	
Lithuania	√	√		
Poland	√	√	√	
Portugal	√	√	√	
Romania	√	√	√	
Slovakia	√	√		
Slovenia	√	√		
Spain	√	√		
Sweden	√	√	√	
Netherlands	√	√	√	- radiation contamination - Chemical concentrations in soil; Human exposure (chemical doses) through drinking water, food, etc.
United Kingdom	√	√	√	

4.4 Cross border cooperation

The section concerning cross border cooperation was the most poorly answered part of the survey. Probably the number of people with experience in this field in each country is limited and we might not have managed to reach them. Many respondents skipped the questions of this part or chose 'don't know' (46-67, see Table 6.1). Most of them answered only the question on whether there are any agreements on international collaboration in case of a major chemical incident in their country without including a list of the cooperators or cooperation scope. It can be seen, for example, that few respondents are aware of such European tools as the EU Civil Protection Mechanism described within the Task B literature review. One of the German respondents declared that there were no agreements in this field, while the neighbouring countries stated that there were effective agreements, also at first responder level (e.g. Poland). These are the reasons for the poor informative value of this question (Table 4.21).

Table 4.21 Existing agreements on international collaboration in case of a major chemical incident and cooperation scope

	agreements with:	**information/data exchange with:**	**no**	**don't know**
Austria				√
Belgium	Germany, Netherlands			
Bulgaria				√
Cyprus	Greece, Israel, EMEP - LONG-RANGE TRANSBOUNDARY AIR POLLUTION	Greece, Israel, EMEP - LONG-RANGE TRANSBOUNDARY AIR POLLUTION		
Czech Republic	Austria, France, Germany, Hungary, Poland, Romania, Slovakia	France, Germany, Hungary, Poland, Slovakia		
Denmark	√ (countries not specified)			
Estonia	Finland, Latvia, Sweden, Russia			
Finland	√ (countries not specified)			
France	√ (countries not specified)			
Germany			√	√
Greece	Bulgaria, Turkey	Bulgaria, Cyprus		
Hungary				√
Ireland	UK			
Italy	√ (countries not specified)			
Latvia	Estonia, Lithuania	Estonia, Lithuania		
Lithuania				√
Luxembourg	√ (countries not specified)			
Poland	√ (countries not specified)			
Portugal	Spain	All European Union Countries – under EU Civil Protection Mechanism		
Romania	Bulgaria, Hungary			
Slovakia	Austria Czech Republic Hungary Poland Ukraine	Austria Czech Republic Hungary Poland Ukraine		
Slovenia	√ (countries not specified)			
Spain(‡)	√		√	
Sweden(‡)	√		√	
Netherlands	Belgium France Germany Luxembourg The Netherlands United Kingdom, Aruba, Curacao and Sint Maarten (within	Austria Belgium Denmark Finland France Germany Greece Ireland Italy Luxembourg Portugal Spain Sweden		

	Kingdom of the Netherlands)	The Netherlands United Kingdom, Aruba, Curacao and Sint Maarten (within Kingdom of the Netherlands)		
United Kingdom	Scotland & England & N Ireland	Do share data with other Member states		

(‡) – contradictory answers – information impossible to verify at the survey stage

According to 34 respondents that answered the question whether mobile laboratories' functions (available in their country) support the international response to chemical incidents, 50% answered in the affirmative (UK, the Netherlands, Sweden, Slovakia, Portugal, Hungary, France, Finland, Estonia, Czech Republic) and 50% in the negative (respondents from: Spain, Latvia, Italy, Ireland, Denmark, Cyprus, Belgium). 41 respondents didn't know the answer and 5 skipped the question (Figure 4.8). Asked for a brief description of the way in which mobile laboratories support the international response, respondents mentioned:

in the Netherlands:

- special equipment and vehicles including trained staff can be sent on request by UN to any place worldwide[4]. This module, named the Environmental Assessment Module[5] (EAM) is offered by RIVM to (lower) governmental services. The decision for deployment is taken by Ministry of Foreign Affairs and Ministry of Environment. The EAM will mainly be deployed in countries that lack the specialist knowledge or capacity needed to deal with environmental disasters. Sampling, Analysis, Interpretation during environmental incidents; produced information is used to assess the possible risks for exposed people)

in Estonia:

- Environmental protection services own the mobile air laboratories
- rescue service has one mobile detection unit

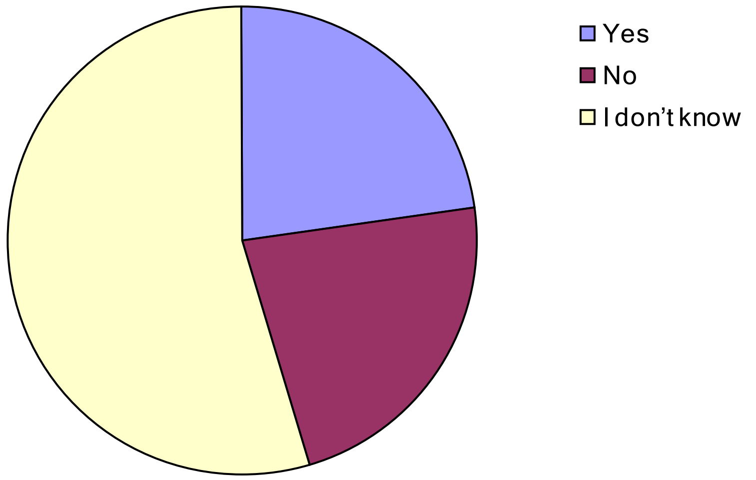
in Finland mobile labs are military units.

According to a Czech Republic respondent, mobile laboratories have not supported any international response to chemical incidents yet. But within international exercises they have taken part in several "incidents". For instance, in connection with European Football Championship in 2012, an agreement between Czech Republic and Poland will be prepared.

[4] United Nations Disaster Assessment and Coordination team http://www.unocha.org/what-we-do/coordination-tools/undac/overview

[5] http://www.rivm.nl/en/accidentsanddisasters/environmental-assessment-module/

Figure 4.8 Do mobile laboratories' functions (available in your country) support the international response to chemical incidents?



As can be seen from the figures 4.9 – 4.13, many survey respondents were unable to answer the question concerning whether they had a risk mapping system showing the neighbouring countries' receptors and questions concerning the comparison of type and usage (in case of an incident) of dispersion models available in their own and neighbouring countries.

Figure 4.9 Do you have a risk mapping (GIS mapping) system which shows receptors (potentially affected persons) in neighbouring countries? (n=74)

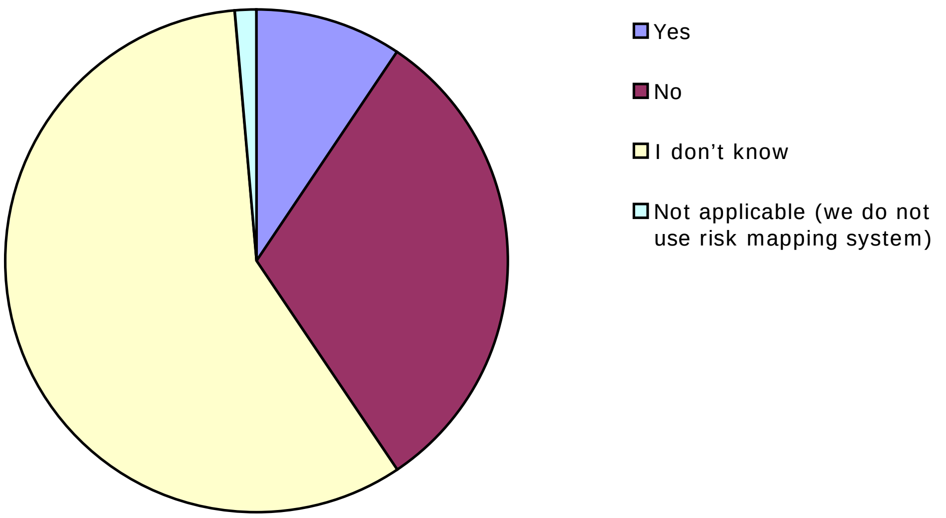


Figure 4.10 Are dispersion models available for your own country and for neighbouring countries? (n=75)

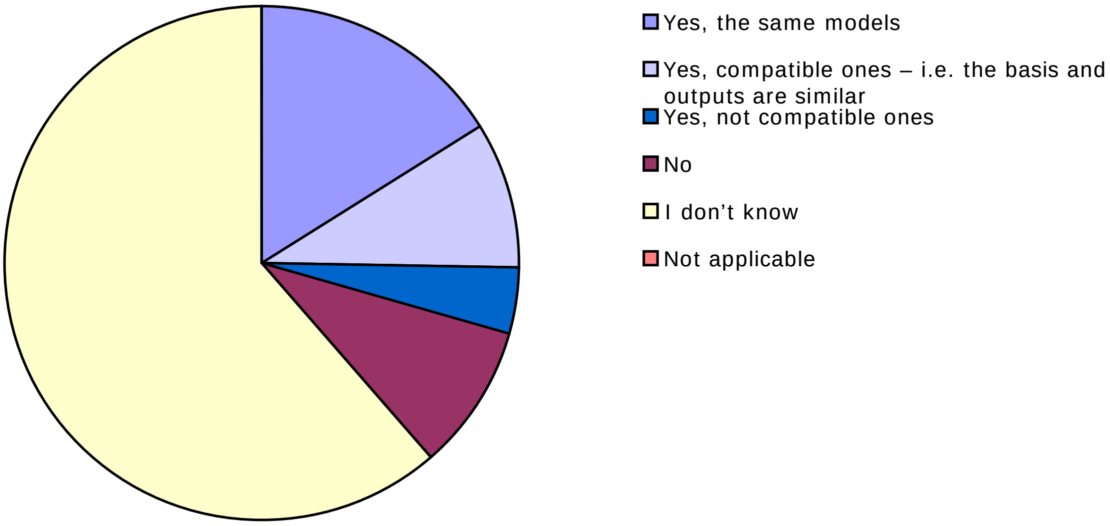


Figure 4.11 Would the "source" country's dispersion modelling be used on both sides of the border? (n=75)

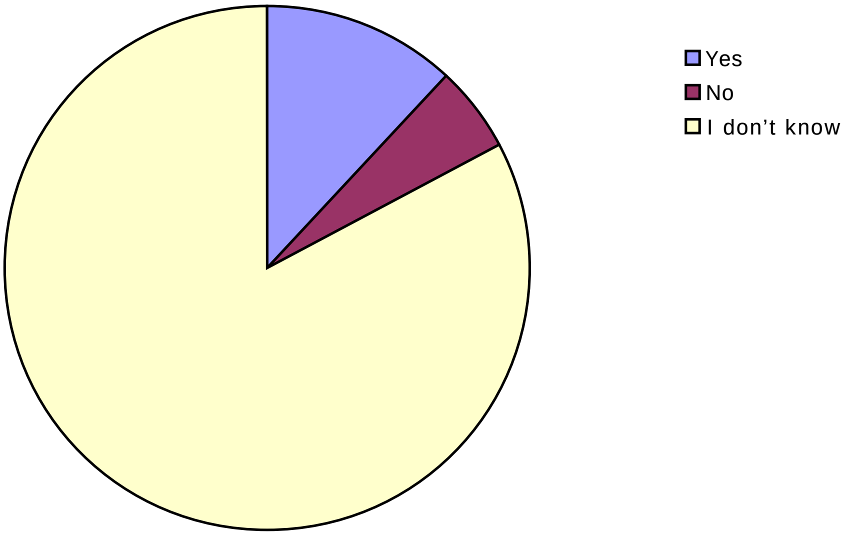


Figure 4.12 Are water borne dispersion models available for your own country and for neighbouring countries? (n=73)

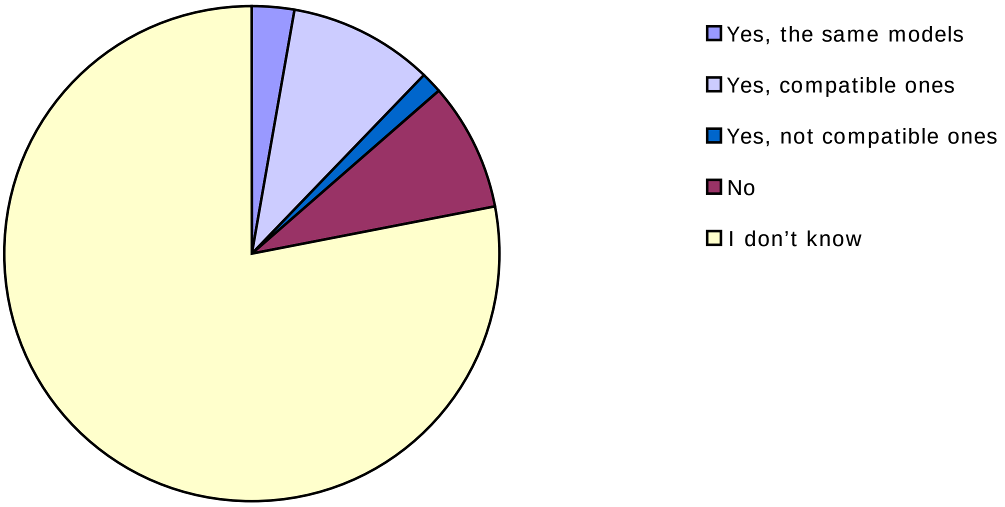
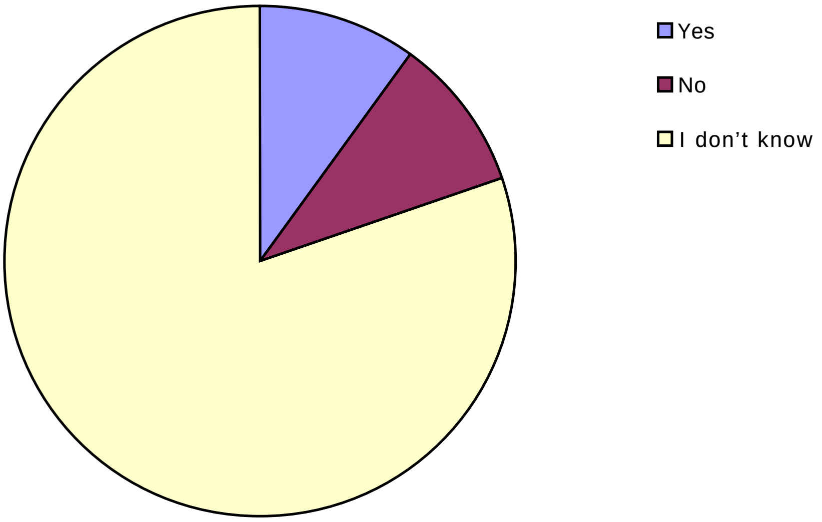


Figure 4.13 Would the "source" country's water borne dispersion modelling be used on both sides of the border? (n=71)



4.5 Interest in an interview and table-top exercise

47 survey respondents were interested in a table-top exercise on chemical incident exposure assessments with representatives from other Member States, and 40 declared their willingness to participate in the interview concerning more detailed information connected with exposure assessment after chemical incidents in their country. Unfortunately, not all of them provided us with their contact details and it was technically impossible to identify them. 21 interviewees from 18 EU countries had to be selected from 36 respondents who provided us with their contact details (Table 4.22, Figure 4.14, Figure 4.15).

Figure 4.14 Respondents interest in table top exercises

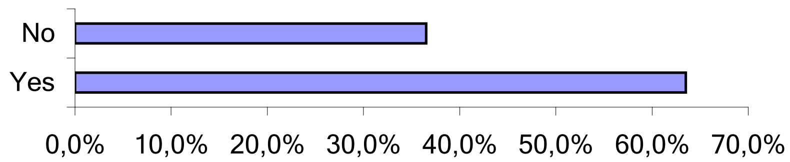


Figure 4.15 Respondents interest in more detailed interview

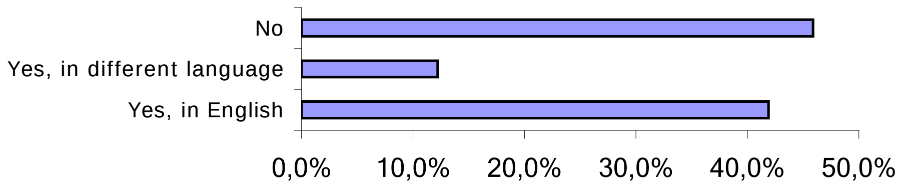


Table 4.22 Respondents interest in CERACI table top exercises and more detailed interview by country

	table-top exercise	**interview**	**didn't include contact details:**
Austria	1	1	1
Belgium	1	1	1
Bulgaria	1	0	0
Cyprus	0	0	0
Czech Republic	1	2	1
Denmark	1	1	1
Estonia	2	0	0
Finland	0	0	0
France	3	3	2
Germany	2	2	2
Greece	2	0	1
Hungary	1	0	1
Ireland	3	2	3
Italy	1	1	1
Latvia	1	1	1
Lithuania	1	1	1
Luxembourg	0	0	0
Malta	0	0	0
Poland	1	1	0
Portugal	4	4	4
Romania	0	0	0
Slovakia	1	1	1
Slovenia	2	2	2
Spain	2	3	2

Sweden	1	0	0
The Netherlands	9	10	8
United Kingdom	6	4	3
Other	0	0	0
total:	**47**	**40**	**36**

As far as the professional background of potential table-top exercise participants is concerned, the biggest groups declaring their willingness to join were from fire and rescue services (38.3%), national government departments or agencies (31.9%) and health services (23.4%). The same groups were also mostly interested in a more detailed interview, 42.5%, 20.0% and 27.5%, respectively (Table 4.23).

Table 4.23 Professional background of the respondents interested in CERACI table top exercises and more detailed interview.

	table-top exercise		**interview**	
National government department/agency	15	31.9%	8	20.0%
Federal or provincial government department/agency	3	6.4%	3	7.5%
Local government department/agency	3	6.4%	3	7.5%
Military	1	2.1%	1	2.5%
Emergency services (Fire services)	18	38.3%	17	42.5%
Emergency services (Ambulance services)	3	6.4%	3	7.5%
Emergency services (Police)	0	0.0%	0	0.0%
Health services	11	23.4%	11	27.5%
Environmental services	5	10.6%	5	12.5%
Other	7	14.9%	8	20.0%
Total	47	100%	40	100%

5 Detailed results by country

To supplement the Task B matrixes, detailed results of the survey questionnaire for separate countries were prepared. Appendix III includes information for 26 Member States (no response from Malta was received). The poorest set of data was received from Greece, Luxembourg and Lithuania.

6 Discussion / input in task D

6.1 Quantitative and qualitative analysis of responses

The complexity of the survey topic and the limited number of experts in this field may explain why the answers to some questions were incomplete. Many responses of the type 'I don't know', and comments such as: 'It's not my field'; 'I chose the answers for only one matrix as I do not know the others' etc. occurred. Moreover, the number of respondents skipping the questions rose throughout the survey, and depended on the increasing complexity and level of detail we asked for (Figure 6.1, Table 6.1). The final part of the survey concerning cross-border cooperation in case of a chemical incident seemed to cause the biggest problem for the respondents as we managed to obtain only few answers on it. Furthermore, the descriptive questions (e.g. 11, 12) requiring writing short texts, were skipped by many respondents.

An attempt to analyse the answers by profession / roles of respondents was made. Due to the different roles in different organisation fulfilled by the respondents and not having clear job descriptions, it was difficult to specify and divide respondents into clear categories. Finally, respondents were grouped into 6 categories: PH advisors / risk assessment coordinators (n=31), fire fighters including Hazmat specialists (n=23), health services (MDs; Toxicologists) (n=11), chemists (n=4), MET services (+GIS) (n=4), government officials – other (n=6). The total number of respondents analysed was 79, as one Lithuanian questionnaire was void. PH advisors / risk assessment coordinators was the group that most completely answered the survey apart from descriptive questions and the cross-border cooperation part. Fire fighters, including Hazmat specialists knew the answers for questions concerning monitoring capabilities, information gathered at scene and GIS systems. Questions about an interdisciplinary procedure for sampling, detection, identification and monitoring, laboratory network and modelling and cross border collaboration were rather poorly answered. The health services group seemed to be better informed in general aspects of monitoring and modelling, data gathered at the scene for health risk assessment purposes and its receiver. Details concerning more detailed aspects of monitoring and modelling and cross-border cooperation questions were skipped most often by them (Table 6.2).

Figure 6.1 Number of not answered (don't know + skipped) questions

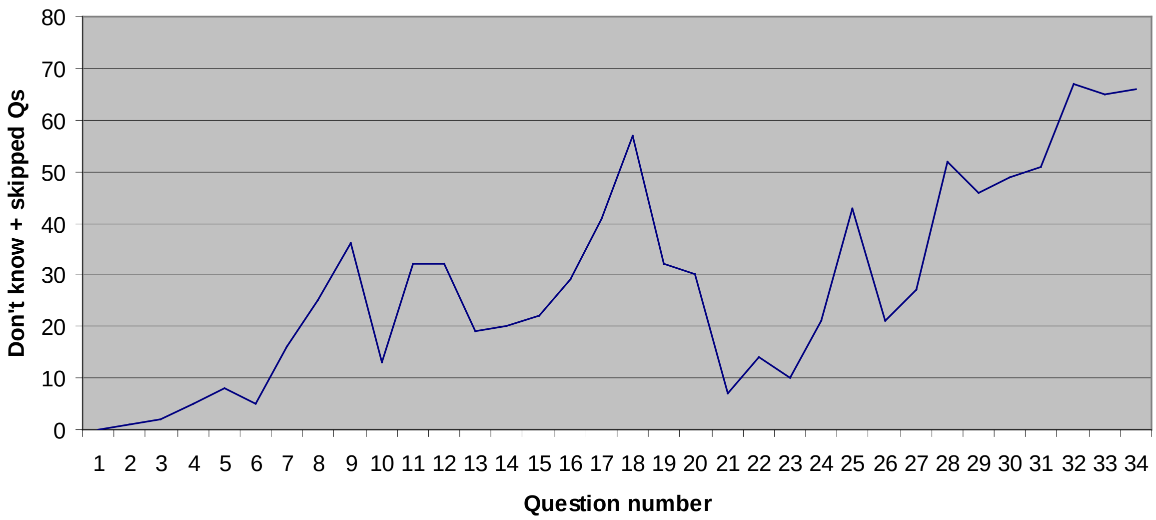


Table 6.1 Number of answered, don't know* and skipped questions

Q No:	Question	Answered	Don't know	Skipped	Don't know + skipped
1	In which country do you work?	80			
2	Organisation type you work for, please choose all which apply:	79		1	1
3	How are you involved in exposure assessment? Please choose all which apply.	78		2	2
4	For an individual to be exposed to a substance, there must be a pathway linking the source to the person (receptor): the source-pathway-receptor model. Please choose which of the following your role in exposure assessment is focused on (can be more than one):	75		5	5
5	Is environmental monitoring during and after major chemical incidents carried out in your country?	78	6	2	8
6	Who are the national authorities supervising environmental monitoring and public health exposure characterisation in major chemical incidents in your country? Please choose all which apply.	79	4	1	5
7	Who carries out monitoring at the incident scene and for what purposes? Please enter all which you feel are relevant.	78	14	2	16
8	Please state the nature of the monitoring resource availability and the capability.	78	23	2	25
9	Please state the nature of the modelling availability and the capability.	77	33	3	36
10	Does your country have national Hazmat teams to support exposure assessment?	78	11	2	13
11	Please briefly describe the output of national Hazmat teams' activity? (descriptive)	48		32	32
12	Who is the receiver of their output? (descriptive)	48		32	32
13	Does your country have back office service for onsite Hazmat advisors to support exposure assessment?	75	14	5	19
14	Does your country have Hazmat sampling teams?	78	18	2	20
15	What resources and equipment does your country have available for sampling?	58		22	22
16	What resource/equipment is available for detection and identification?	51		29	29
17	Does your country have an interdisciplinary procedure for sampling, detection, identification and monitoring?	74	35	6	41
18	For which matrices are mobile detection and identification equipment NOT available? Please choose all which apply.	58	35	22	57
19	Does your country have a national laboratory network?	73	25	7	32
20	When exposure assessment is performed which guidance values are the analysis results compared to (for example Acute Exposure Guideline Levels)?	74	24	6	30
21	Who receives the data deriving from DIM (Detection, Identification, Monitoring) activities carried on incident site (and undertakes health risk assessment)?	73		7	7
22	What additional information (as described below) is gathered during the acute phase of a chemical incident and is needed for exposure assessment and which organisation does this?	66		14	14
23	Is it possible, using risk mapping (GIS mapping) systems available in your country, to gather information about the exposed areas:	70		10	10

24	Are airborne dispersion models available in your country? Please choose all that apply.	75	16	5	21
25	Are water borne dispersion models available in your country?	73	36	7	43
26	If environmental modelling is done in your country, please list what kind of outputs are available? Please choose all which apply.	75	16	5	21
27	Are there arrangements on international collaboration in case of a major chemical incident in your country?	78	25	2	27
28	With which countries have official agreements been signed in this field; which of those include data exchange on environmental and health protection?	28		52	52
29	Do mobile laboratories' functions (available in your country) support the international response to chemical incidents?	75	41	5	46
30	Do you have a risk mapping (GIS mapping) system which shows receptors (potentially affected persons) in neighbouring countries?	74	43	6	49
31	Are dispersion models available for your own country and for neighbouring countries?	75	46	5	51
32	Would the "source" country's dispersion modelling be used on both sides of the border?	75	62	5	67
33	Are water borne dispersion models available for your own country and for neighbouring countries?	72	57	8	65
34	Would the "source" country's water borne dispersion modelling be used on both sides of the border?	71	57	9	66

* don't know questions – questions partly answered (e.g. for one matrix, and not answered for the rest) are included

Table 6.2 Answers by role/job description

Q No:	**Question**	**PH Advisors / coordination (n=31)**		**Fire fighters including Hazmat specialists (n=23)**		**Health services (MDs; Toxicologists) (n=11)**		**chemists (n=4)**		**MET services (+GIS) (n=4)**		**government – other (n=6)**	
		n_1	**%**	n_1	**%**	n_1	**%**	n_1	**%**	n_1	**%**	n_1	%
5	Is environmental monitoring during and after major chemical incidents carried out in your country?	29	**93.5**	23	**100.0**	11	**100.0**	4	**100.0**	3	**75.0**	6	**100.0**
6	Who are the national authorities supervising environmental monitoring and public health exposure characterisation in major chemical incidents in your country? Please choose all which apply.	30	**96.8**	22	**95.7**	11	**100.0**	4	**100.0**	4	**100.0**	6	**100.0**
7	Who carries out monitoring at the incident scene and for what purposes? Please enter all which you feel are relevant.	28	**90.3**	23	**100.0**	11	**100.0**	4	**100.0**	4	**100.0**	6	**100.0**
8	Please state the nature of the monitoring resource availability and the capability.	27	**87.1**	22	**95.7**	8	**72.7**	2	**50.0**	4	**100.0**	6	**100.0**
9	Please state the nature of the modelling availability and the capability.	25	**80.6**	21	**91.3**	10	**90.9**	4	**100.0**	3	**75.0**	3	**50.0**
10	Does your country have national Hazmat teams to support exposure assessment?	25	**80.6**	23	**100.0**	8	**72.7**	2	**50.0**	3	**75.0**	5	**83.3**
11	Please briefly describe the output of national Hazmat teams'	19	**61.3**	17	**73.9**	6	**54.5**	0	**0.0**	1	**25.0**	2	**33.3**

	activity? (descriptive)												
12	Who is the receiver of their output? (descriptive)	18	**58.1**	18	**78.3**	6	**54.5**	0	**0.0**	1	**25.0**	3	**50.0**
13	Does your country have back office service for onsite Hazmat advisors to support exposure assessment?	23	**74.2**	22	**95.7**	8	**72.7**	3	**75.0**	1	**25.0**	2	**33.3**
14	Does your country have Hazmat sampling teams?	21	**67.7**	21	**91.3**	9	**81.8**	2	**50.0**	2	**50.0**	3	**50.0**
15	What resources and equipment does your country have available for sampling?	20	**64.5**	20	**87.0**	9	**81.8**	1	**25.0**	2	**50.0**	6	**100.0**
16	What resource/equipment is available for detection and identification?	20	**64.5**	20	**87.0**	4	**36.4**	1	**25.0**	2	**50.0**	3	**50.0**
17	Does your country have an interdisciplinary procedure for sampling, detection, identification and monitoring?	22	**71.0**	16	**69.6**	8	**72.7**	1	**25.0**	2	**50.0**	5	**83.3**
18	For which matrices are mobile detection and identification equipment NOT available? Please choose all which apply.	11	**35.5**	8	**34.8**	2	**18.2**	0	**0.0**	1	**25.0**	1	**16.7**
19	Does your country have a national laboratory network?	22	**71.0**	16	**69.6**	9	**81.8**	3	**75.0**	4	**100.0**	5	**83.3**
20	When exposure assessment is performed which guidance values are the analysis results compared to (for example Acute Exposure Guideline Levels)?	21	**67.7**	17	**73.9**	7	**63.6**	2	**50.0**	0	**0.0**	3	**50.0**
21	Who receives the data deriving from DIM (Detection, Identification, Monitoring) activities carried on incident site (and undertakes health risk assessment)?	27	**87.1**	23	**100.0**	11	**100.0**	3	**75.0**	4	**100.0**	5	**83.3**
22	What additional information (as described below) is gathered during the acute phase of a chemical incident and is needed for exposure assessment and which organisation does this?	25	**80.6**	21	**91.3**	10	**90.9**	3	**75.0**	2	**50.0**	5	**83.3**
23	Is it possible, using risk mapping (GIS mapping) systems available in your country, to gather information about the exposed areas:	29	**93.5**	21	**91.3**	10	**90.9**	3	**75.0**	3	**75.0**	4	**66.7**
24	Are airborne dispersion models available in your country? Please choose all that apply.	24	**77.4**	17	**73.9**	9	**81.8**	4	**100.0**	3	**75.0**	2	**33.3**
25	Are water borne dispersion models available in your country?	22	**71.0**	6	**26.1**	5	**45.5**	0	**0.0**	2	**50.0**	2	**33.3**
26	If environmental modelling is done in your country, please list what kind of outputs are available? Please choose all which apply.	24	**77.4**	16	**69.6**	10	**90.9**	3	**75.0**	3	**75.0**	4	**66.7**
27	Are there arrangements on international collaboration in case of a major chemical incident in your country?	20	**64.5**	15	**65.2**	7	**63.6**	2	**50.0**	4	**100.0**	3	**50.0**
28	With which countries have official agreements been signed in this field; which of those include data exchange on environmental and health protection?	15	**48.4**	7	**30.4**	3	**27.3**	0	**0.0**	1	**25.0**	1	**16.7**
29	Do mobile laboratories' functions (available in your country) support the international response to chemical incidents?	12	**38.7**	13	**56.5**	3	**27.3**	1	**25.0**	2	**50.0**	2	**33.3**

30	Do you have a risk mapping (GIS mapping) system which shows receptors (potentially affected persons) in neighbouring countries?	11	**35.5**	12	**52.2**	3	**27.3**	2	**50.0**	2	**50.0**	1	**16.7**
31	Are dispersion models available for your own country and for neighbouring countries?	11	**35.5**	8	**34.8**	3	**27.3**	4	**100.0**	1	**25.0**	2	**33.3**
32	Would the “source” country’s dispersion modelling be used on both sides of the border?	5	**16.1**	5	**21.7**	2	**18.2**	0	**0.0**	1	**25.0**	0	**0.0**
33	Are water borne dispersion models available for your own country and for neighbouring countries?	9	**29.0**	4	**17.4**	3	**27.3**	0	**0.0**	0	**0.0**	0	**0.0**
34	Would the “source” country’s water borne dispersion modelling be used on both sides of the border?	8	**25.8**	3	**13.0**	3	**27.3**	0	**0.0**	0	**0.0**	0	**0.0**

n_1 number of respondents that answered the question

6.2 Good practices, critical success and failure factors incorporating / contrasting with Task B identified good practices

6.2.1 Institutional and advisory bodies and emergency services organisation and general cross-border cooperation

Similar to the presence of emergency management centres in all EU countries revealed in the Task B review, all the countries have been identified as having institutions supervising environmental monitoring and public health exposure characterisation in case of a major chemical incident. In 50% of EU countries, environmental monitoring is supervised by the Ministry of Environment or an equivalent authority and public health exposure characterisation by the Ministry of Health or an equivalent institution (*good practice – responsibilities for certain fields are clear*). Nevertheless, very often (50% of countries) the division of these responsibilities is not so clearly specified and different institutions are chosen by different respondents as appropriate supervisors.

Similarly, different services involved in fire and rescue actions carry out monitoring at the incident scene for various purposes (in 23/26 countries - 88%). Only in Cyprus, Finland and Slovakia do environmental services monitor the incident site solely for environmental protection purposes and health services and fire and rescue services solely for health protection purposes.

In such a situation, a clearly specified scope of each institution's responsibilities in exposure assessment (legal acts in force) is crucial. This point was not addressed in the questionnaire / interview. Furthermore, the scope of data gathered on site by each of the respondents and the forms of information exchange between the institutions involved in risk assessment in case of a major chemical incident should be precisely defined. In Poland the set of data gathered on the site of an incident by the fire and rescue service is specified in a legal act, and later reports are transferred electronically to a national database. The Polish environmental services are legally obliged to gather the data on major incidents following Seveso[6] definition which should be common for all European countries. Unfortunately when it comes to data sharing between different institutions problems arise. Difficulties in data sharing among various services and the lack of any official systematic procedure for data sharing among respondents and public health officials carrying out risk assessment were mentioned by the respondents. Taking into account that respondents from 24 (92%) European countries declared that health risk assessment can be undertaken by different bodies on different levels (depending on incident severity), an effective and quick way of information exchange is important. A Dutch solution of sharing the data by all parties active in incident management via a dedicated website called ICAweb seems to be a good practice.

[6] 'major accident` shall mean an occurrence such as a major emission, fire, or explosion resulting from uncontrolled developments in the course of the operation of any establishment covered by this Directive, and leading to serious danger to human health and/or the environment, immediate or delayed, inside or outside the establishment, and involving one or more dangerous substances (Council Directive 96/82/EC of 9 Dec. 1996 on the control of major-accident hazards involving dangerous substances *OJ. L 010, 14/01/1997 P. 0013 - 0033*

In Denmark, incident command is within the trias of the relevant services (Police, Fire Service and Medical Service) which enables efficient information flow and effective decision making.

Information on specialist bodies providing health risk assessment and risk characterisation advice, based upon collated exposure assessment information in the event of an incident mentioned in the Task B report, was verified in the interviews. As project partners managed to interview respondents from only 9 countries, it is difficult to assess if a good practice of one national advisory body is common within the EU. In Germany, France, Latvia and Lithuania, health services/bodies at different levels are lead organisations for the provision of public health advice in case of a chemical incident. In Poland, Belgium and Germany, there is a lack of precise toxicological advice in case of a chemical incident. In Northern Ireland, a few agencies provide advice on different fields: Public Health Agency, Northern Ireland Environment Agency, Department of Agriculture and Rural Development and Local authorities. One advisory body leading in widely understood public health risk assessment consisting of scientists from different fields seems to be a good practice ensuring timely coordinated scientific and technical advice during the response to a chemical incident (such as, Dutch BOT-mi[7], British CRCE or Irish HSA[8]). In Ireland, the Major Emergency Management[9] framework ensures dedicated staff within Principal Response Agencies (PRA) for coordination and communication in emergencies.

Dutch national Hazmat teams, mentioned in the Task B report as a good practice, seem to be also a common practice in the EU, because analogous structures are organised in 19 countries (73%), in 18 (69%) within the fire and rescue service. In 16 countries, a back office service for onsite Hazmat advisors to support exposure assessment is organised. In 11 countries (42%), hazmat sampling teams are included in national Hazmat teams which may positively influence the effectiveness of the whole team (time, standardisation).

Irish first responders are equipped with an instructions set called ERG (Emergency Response Guidebook for first responders) which probably also orders the rescue actions and responsibilities. In the Netherlands, there is a national protocol for Medical Duty Officers in which chemical incidents are included.

Coming to the organisation of emergency services, the same regional boundaries for each emergency response service (Police, Fire, Ambulance) (as in Northern Ireland, Poland) may result in better communication between services.

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[7] www.rijksoverheid.nl/onderwerpen/crises-en-nationale-veiligheid/documenten-en-publicaties/brochures/2010/07/22/folder-nationale-netwerken-voor-crisismanagement.html

[8] http://www.hsa.ie/eng/

[9] http://www.mem.ie/

As far as cross border cooperation is concerned, all 26 countries (100%) have existing agreements on international collaboration in case of a major chemical incident with their neighbours. According to the interviewees, agreements signed, not only at national level (such as the EU Civil Protection Mechanism), but also at regional level, specifying detailed procedures and protocols, are the good practice. According to a Polish interviewee, cooperation during fire and rescue actions including information and data exchange is much easier and more effective with EU neighbouring countries (agreements between the fire and rescue services are signed at regional/first responder level) than with Eastern European countries (Belarus, Ukraine) with which cross-border cooperation agreements are signed only at official national level. Agreements signed at first responder level in Poland (fire and rescue service) specify in detail rescue procedures (described in both sides' languages) used in case of an incident which facilitates cooperation during an emergency. Furthermore, on the operational level, people know each other and their possibilities better. Also regular international training (good practice) of operational staff, mentioned by a Polish interviewee, increases familiarity with neighbouring regions' capabilities, understanding of neighbouring response structures and the number of suitable contacts with peer organisations in neighbouring countries. In Ireland, cross border response conferences are also held regularly. German and Belgium interviewees also mentioned the importance of personal contacts between the incident responders as a key success factor for effective cooperation during an emergency. This is one of the aspects addressed in the Emric+ project in the EU region Maas-Rijn. The aim of this project is to strengthen the cooperation between the fire and rescue services of the three different countries (Germany, Belgium and the Netherlands).

In Ireland contract for accessing specialist advice and services from larger neighbour with more dedicated services and cross border food agency[10] shares advice with public.

The main issues / unfavourable practices:

- responsibilities connected with risk assessment in case of a chemical incident not clearly divided between emergency response management bodies
- poor information and data exchange between emergency responders and risk assessors
- the lack of an official systematic procedure for data sharing among respondents and public health officials carrying out risk assessment
- the lack of one advisory body leading in widely understood public health risk assessment in case of an incident

The common practices across the EU:

- risk assessment in case of a chemical incident done by different emergency response management bodies
- the lack of an official systematic procedure for data sharing among respondents and public health officials carrying out risk assessment

[10] http://www.safefood.eu/About-Us.aspx

- the lack of one advisory body leading in widely understood public health risk assessment in case of an incident
- international cooperation agreements at national level

The good practices for individual MS actions:

- clearly specified scope of each institution's responsibilities in exposure assessment (legal acts in force)
- official protocols and procedures on the responsibilities and cooperation of different emergency services
- incident command within the relevant services (Police, Fire Service and Medical Service) - efficient information flow and effective decision making
- effective information exchange forms/channels – web based service available for experts and emergency services and procedures for managing it (like ICA web – website for experts who join together and support the emergency services with a coordinated advice)

The good practices for sharing between MS:

- international cooperation agreements at national and regional (first responder level)
- regular trainings, conferences, meetings – raising awareness of neighbouring country emergency response capabilities and networking.

6.2.2 Field monitoring

In Task B, all Member States were identified as maintaining fixed air quality monitoring stations. The survey confirmed that in most of the countries (23/88%) monitoring is carried out within the emergency exclusionary zone, for emergency response and off site for assessing public exposure, mainly as dedicated 24/7 service and in all media (air, water, soil, crops/food) (good practice).

In 23 (88%) countries, environmental monitoring is carried out during and after a chemical incident (good practice), only an Austrian respondent declared that monitoring is carried out only during the incident and respondents from Finland and Greece claimed that in their countries environmental monitoring is done only after the incident.

It was revealed during Task B, that most MS have a capability within their fire and rescue services to undertake analysis at the scene of an incident, using Detection, Identification and Monitoring (DIM) equipment. Within the survey, it was confirmed that at the scene monitoring is carried out by fire and rescue services (including national Hazmat teams) (23/88% countries) but also by environmental protection services (24/92% countries), site operator (12/46% countries) and health protection services (22/84% countries).

According to a respondent from the Netherlands, some monitoring activities are outsourced to commercial parties (practice for discussion).

In Sweden, the Netherlands (as identified in Task B) but also in Czech Republic, Estonia, Finland, UK and Poland, mobile field laboratories are available (good practice). Respondents from UK, the Netherlands, Sweden, Slovakia, Portugal, Hungary, France, Finland, Estonia and Czech Republic answered that mobile laboratories' functions (available in their country) (also) support the international response to chemical incidents. Respondents from: Spain, Latvia, Italy, Ireland, Denmark, Cyprus, Belgium stated that their mobile laboratories' functions do not support the international response. In the Netherlands, special equipment and vehicles, including trained staff, can be sent on request by UN to any place worldwide (EAM[11], decision for deployment is taken by Ministry of Foreign Affairs) providing numerous kinds of analysis. In Sweden, mobile labs are available to OPCW[12] and as support in international peace keeping operations.

Many respondents didn't know (35) or skipped (22) the question about availability of mobile detection and identification equipment for different matrices. Among 23 respondents that answered this question, 21 declared that mobile detection and identification equipment is NOT available for crops and food, 12 for soil, 9 for water and 5 (from Ireland, Italy, Portugal – Cyprus and Germany) for air.

Suitable, coherent reference values for risk assessment are needed to achieve a clear and agreed interpretation of public health risks, that can be communicated easily to incident commanders and ensure integrated public health actions and messages. In 18 (69%) countries (Bulgaria, Belgium, Cyprus, Germany, Czech Republic, Estonia, France, Hungary, Ireland, Italy, Latvia, Portugal, Slovakia, Slovenia, Spain, Sweden, Netherlands, United Kingdom), the analysis results from exposure assessment are compared to Acute Exposure Guideline Levels. An Austrian respondent encountered the situation in which emergency responders and authorities prefer different threshold values. In his comment, he stated that standardisation of the assessment values would be highly desirable.

The main issues / unfavourable practices:

- lack of repeated environmental monitoring
- environmental monitoring not carried out both during and after the incident
- the reference values not standardised for risk assessment in case of a chemical incident purposes - emergency responders and authorities use different reference values
- lack of mobile detection and identification equipment

The common practices across the EU:

- repeated environmental monitoring
- environmental monitoring carried out during and after the incident
- the analysis results from exposure assessment are compared to Acute Exposure Guideline Levels
- mobile labs available but only in a few countries do these support the international response to chemical incidents

[11] http://www.rivm.nl/en/accidentsanddisasters/environmental-assessment-module/

[12] Organisation for the Prohibition of Chemical Weapons http://www.opcw.org/

The good practices for individual MS actions:

- environmental monitoring carried out during and after the incident, including the monitoring of shelter areas and other areas relevant to human exposure, especially sensitive populations
- standardisation of the reference values
- availability of mobile labs within first responders' resources

The good practices for sharing between MS:

- outcomes of environmental monitoring carried out in case of an incident understandable for risk assessors on both sides of the border
- standardisation of the reference values
- mobile labs' functions support the international response to chemical incidents

6.2.3 Analytical laboratories

Good practice concerning national reference laboratories, identified in Task B and common in the EU, was confirmed in the survey. According to the survey results, almost all countries (22/85%), apart from Belgium and Luxembourg have a national laboratory network, and most of them, apart from Hungary, Spain and Slovenia, for all media.

According to the survey, most of the countries (15/ 58%), apart from Austria, Belgium, Denmark, Finland, Ireland, Italy, Luxembourg, Slovenia and Spain, have an interdisciplinary procedure for sampling, detection, identification and monitoring and almost all of them, apart from Cyprus for air and water. It enables the situation in which interpretation of the results across border may be similar if scientific rationales are alike.

The main issues / unfavourable practices:

- lack of national reference laboratories

The common practices across the EU:

- a national laboratory network in almost all countries; interdisciplinary procedure for sampling, detection, identification and monitoring

The good practices for individual MS actions:

- a national laboratory network in almost all countries; interdisciplinary procedure for sampling, detection, identification and monitoring

The good practices for sharing between MS:

- a national laboratory network cooperating across border; procedure for sampling, detection, identification and monitoring standardised

6.2.4 Meteorological dispersion models

In 24 countries (92%), local and/or dispersion modelling is available. Local models for air are used in 21 countries, for water in 13 countries, airborne dispersion modelling is available in 23 countries (88%) (in 16 provided by meteorological experts and in 17 by non-meteorological experts). Water borne dispersion modelling is available in 14 countries (54%). By using available models, chemical concentration in the air can be assessed in 23 countries (88%), chemical concentration in water - in 18 countries (69%) and deposition in 16 countries (62%). In the Netherlands, chemical concentration in soil can be assessed and human exposure (which is also possible in Poland).

Some of the interviewees (e.g. from UK) confirmed also their familiarity with worldwide or European meteorological services such as EUMETNET[13] (described in the Task B report) that enable sharing of alerts e.g. for extreme events and alerting in a consistent fashion in most European countries. Moreover in UK Met Office (9 Specialist Centres worldwide for transnational plumes – e.g. Exeter, UK & Toulouse, France e.g. Radiological / volcanic / some forest fire release) operates (good practices).

Concerning the comparison of type and usage (in case of an incident) of dispersion models available in MS and neighbouring countries, respondents from 11 (42%) countries declared that air dispersion models for their own and neighbouring countries are compatible or the same, and respondents from 6 (23%) countries stated the same was true for water borne dispersion models available across border. As many respondents skipped or didn't know the answer (see table 20, q: 31-34) for questions concerning compatibility of models used across the border and the usage of the 'source' country modelling in case of an incident, it is difficult to assess how widespread using compatible modelling is in neighbouring countries in the EU.

The main issues / unfavourable practices:

- modelling not used

The common practices across the EU:

- local and/or dispersion modelling is available in 24 European countries
- specialists and bodies familiar with worldwide or European meteorological services

The good practices for individual MS actions:

- local and/or dispersion modelling is available in 24 European countries
- modelling outcomes easily available for risk assessors from different institutions
- specialists and bodies familiar with worldwide or European meteorological services

The good practices for sharing between MS

- compatible / the same models used by risk assessors on both sides of the border (Met Office: 9 Specialist Centres worldwide for transnational plumes – e.g. Exeter, UK & Toulouse, France)

[13] http://www.meteoalarm.eu/

- modelling outcomes easily available and interpretable for risk assessors from neighbouring countries

6.2.5 Geographical information systems

Geographical information systems (good practice mentioned in Task B) are used by different institutions in 21 countries (81%), Cyprus, Luxembourg and Lithuania declared the lack of GIS systems usage. It is common that the systems used provide information on land use (agriculture, residential, industry area etc.) (21 countries), population size (19 countries), population type (possible identification of susceptible populations near the incident location) (16 countries) and the vulnerable zones (populations at risk/sensitive receptors) (15 countries).

A risk mapping system showing the neighbouring countries' receptors does not seem to be available in MS as most of the respondents skipped this question or chose that it's not available. Only respondents from Portugal, the Netherlands and UK chose both the possibilities that such a system is or is not available in their countries.

The main issues / unfavourable practices:

- GIS not used (Cyprus, Luxembourg, Lithuania)

The common practices across the EU:

- GIS used by different organisations, for their own purposes

The good practices for individual MS actions:

- use of GIS that is compatible with modelling outputs and identifies receptors, in a format that is shared and understood between responders in that MS (ArcGIS used in UK to produce mapping to assist risk characterisation)
- Mapping system in Northern Ireland can work on cross border grid reference system
- Risk mapping system showing the neighbouring countries' receptors

The good practices for sharing between MS:

- use of GIS compatible with modelling outputs and identifying receptors, in a format that is shared and understood between risk assessors and both can use, both countries share data layers on receptors

6.2.6 Compilation of good practices identified and proposed in Tasks B and C

6.2.6.1 Organisation of institutional bodies and emergency services:

- emergency management centres in all Member States:
  - Belgium has the General Directorate Crisis Centre
  - Bulgaria Ministry of Emergency Situations
  - Estonia Rescue and Crisis Management Board

- Netherlands National Crisis Centre
- Romania National Committee for Emergency Situations;

- institutions supervising environmental monitoring and public health exposure characterisation in case of a major chemical incident in all Member States;
- voluntary and civilian assistance for incident and crisis management (Civilian Crisis Management), which includes voluntary fire fighting (Finland, Poland) and recruitment of local people to perform a specified role in their homes, towns or workplaces (Finland);
- Directorate for International Relations and Volunteerism, which recruits volunteers to assist local and national government in the event of a major incident (Greece);
- a quick response Hazmat team service (the Environmental Incident Service/Environmental Assessment Module) set up to co-ordinate environmental monitoring in major chemical incidents in order to conduct exposure assessment. This service undertakes sampling and testing of material collected by the teams deployed. It has hand-held equipment and analytical (field) laboratory capability. Furthermore, it can model the distribution of hazardous substances. During a chemical incident, this service advises the Fire Service on request on the nature of the pollution, the threat it poses to public health and the environment[14] and the consequences (the Netherlands);
- specialist chemically trained fire and rescue services, including:
  - Austrian Fire Brigade Association Urban Search & Rescue (USAR) CBRN - trained to respond to chemical incidents;
  - France HMRT (Hazardous Materials Response Teams);
  - UK HAZMAT (Hazardous Materials Officers and Hazardous Environmental Protection Officers);
  - Italy CBRN Department within the fire and rescue service;
  - Netherlands HAZMAT advisors (AGS);
  - Slovakia – Anti-Gaz Service DIM.
  - Poland – Hazmat teams within FRS; military units (COAS[15])
- specialist chemically trained first responders in ambulance and public health services:
  - Organisations / teams comprising ambulance and/or public heath first responders who have been specially trained to respond to incidents where hazardous substances may be present were identified in a number of Member States, for example:
  - UK - Hazardous Area Response Teams (HART);
  - Belgium – MUG teams;
  - Netherlands - GAGS – public health hazmat advisors;
  - Romania – SMURD / SIAMUD specialist units with rescue capability and can deal with hazardous substances.

[14] www.rivm.nl/en/aboutrivm/organization/mev/imd/running_environmental_accident_service.jsp

[15] http://www.coas.wp.mil.pl/pl/1.html

- Portugal, Spain and France use an international ambulance service coordination organisation called SAMU.

- the ATLAS[16] network - an informal cooperation structure between special intervention Police units in the European Union. Although the current primary aim of the ATLAS network is mutual training for counter terrorism to a common standard, the network would be a means of communicating between Police in EU Member States, particularly in the event of an intentional cross-boundary incident;

- specialist teams or organisations that provide health risk assessment and risk characterisation advice, based upon collated exposure assessment information, in the event of an incident, for example:

  - Netherlands - To ensure timely coordinated scientific and technical advice during the response to an emergency, the Netherlands has erected the Policy Support Team for environmental incidents (BOT-mi). This team, comprising of 8 government institutes and services, advises the local health community, police and fire and rescue service during a chemical incident.

  - UK – The Centre for Radiation Chemical and Environmental Hazards (CRCE) within the HPA provide advice to members of the public, emergency services, local and national government and health authorities.

  - Denmark - strong central back office with a hazmat team, experts on standby - evidence based information on call (DEMA)

  - Belgium – CGM undertakes national health impact assessment in the event of disasters.

  - Poland – Nofer Institute of Occupational Medicine (NIOM) undertakes health risk assessment in the event of an incident (National Poison Information Centre).

- clearly specified scope of each institution's responsibilities in exposure assessment (legal acts in force)

- the same regional boundaries for each emergency response service (Police, Fire, Ambulance) (as in Northern Ireland, Poland) may result in better communication between services;

- official protocols and procedures for different emergency services responsibilities and cooperation;

- Environmental and Civil cooperation arrangements with other Member States, to be used in the event of major incidents;

- The Organisation for Economic Co-operation and Development (OECD) and World Health Organisation (WHO) have produced guidance and manuals which addresses a number of issues concerning chemical incidents and the relationship between different countries including, for example, cross-border co-operation relating to hazardous installations near boundaries;

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[16] ATLAS http://www.jamestown.org/programs/gta/single/?tx_ttnews%5Btt_news%5D=1044&tx_ttnews%5BbackPid%5D=182&no_cache=1

- the accessible 24 hours a day Monitoring and Information Centre (MIC)[17] operated by DG ECHO within Civil Protection Mechanism[18] - it enables appeals for assistance in case of major emergency;
- fire fighting cooperation arrangements between member states (not only at national but first of all at first responder level):
  - Greece - SAR Greek / Turkish International Cooperation Section organised with the assistance of the UN to allow for cross-boundary assistance in the event of a major incident.
  - Spain (Valencia) - created Bomberos Sin Fronteras (Fire fighters without borders), which assists in disaster response worldwide.
  - Poland (with all EU MS at national and first responder level);
- effective information exchange forms/channels – web based service available for experts and emergency services and procedures for managing it (such as ICAweb in the Netherlands)
- regular trainings, conferences, meetings, international projects (such as the Emric+ project) – personal contacts; awareness of neighbouring country emergency response capabilities (Poland, Czech Republic, Ireland, Germany, Belgium, The Netherlands)

6.2.6.2 Meteorological chemical models

- international meteorological organisations:
  - The Network of European Meteorological Services, Economic Interest Group (EUMETNET EIG) - comprises 26 European national meteorological services with the aim to become more efficient in delivering meteorological services in Europe by sharing costs and knowledge and by pooling resources.
  - World Meteorological Organisation (WMO) – specialist agency of the United Nations, comprising 189 member states. Its role includes facilitating worldwide co-operation in the establishment and maintenance of observation networks and promoting the establishment and maintenance of systems for the rapid exchange of meteorological and related information.
  - Volcanic Ash Advisory Centres (VAAC) - Nine Volcanic Ash Advisory Centres around the world are responsible for advising international aviation of the location and movement of clouds of volcanic ash; but they also communicate with public health organisations as required.
  - European Forest Fire Information System (EEFIS) supports the services in charge of the protection of forests against fires in EU countries and provides the European Commission services and the European Parliament with updated and reliable information on wild fires in Europe.

[17] Monitoring and Information Centre http://ec.europa.eu/echo/civil_protection/civil/prote/mic.htm

[18] Civil Protection Mechanism http://ec.europa.eu/echo/civil_protection/civil/prote/mechanism.htm

- specialists and bodies within Member States familiar with worldwide or European meteorological services;
- specialist environmental meteorological sections and organisations within Member States who have the capability to examine the transport and deposition of pollutants, including:
  - Austria - Department of Environmental Meteorology.
  - UK – Environmental Monitoring and Response Centre (EMARC).
  - Bulgaria - Emergency Response System (BERS).
  - Romania - SIMIN - Integrated Meteorological Information System.
  - A number of countries have satellite software systems for automatic detection of forest fires, for example the Bulgaria Aerospace Monitoring Centre;
- local and/or dispersion modelling available in 24 European countries;
- modelling outcomes easily available for risk assessors from different institutions;
- compatible / the same models used by risk assessors on both sides of the border (Met Office: 9 Specialist Centres worldwide for transnational plumes – e.g. Exeter, UK & Toulouse, France);
- modelling outcomes easily available and interpretable for risk assessors from neighbouring countries

6.2.6.3 Field monitoring

- repeated environmental monitoring maintained in almost all Member States;
- environmental monitoring carried out during and after the incident in almost all Member States, including off site monitoring for assessing public exposure in 17 countries
- most Member States have been identified as having a capability within their Fire and Rescue Services to undertake analysis at the scene of an incident, using Detection, Identification and Monitoring (DIM) equipment
- standardisation of the reference values - the analysis results from exposure assessment are compared to Acute Exposure Guideline Levels in most Member States
- availability of mobile labs within first responders' resources - mobile labs available but only in a few countries do these support the international response to chemical incidents. In Sweden and the Netherlands, mobile field laboratories are used both domestically and internationally. They respond as required in the event of major accidents and disasters and in humanitarian operations. They are intended to be placed near the accident area, where they can receive samples for rapid chemical analysis;
- outcomes of environmental monitoring carried out in case of an incident understandable for risk assessors on both sides of the border

6.2.6.4 Analytical laboratories

- a national laboratory network in almost all Member States (the majority of which are maintained by the relevant Environment Agency or governmental Department of Environment);
- a national laboratory network cooperating across border; procedure for sampling, detection, identification and monitoring standardised
- interdisciplinary procedure for sampling, detection, identification and monitoring in most of the Member States;
- National centres providing advice on poisons in the majority of Member States. These centres are generally accessible by health services and public health professionals;

6.2.6.5 Geographical information systems

- GIS used to plot Met Office predictions of plume movement (UK);
- use of GIS that is compatible with modelling outputs and identifies receptors, in a format that is shared and understood between responders in that MS (ArcGIS used in The Environmental Hazards and Emergencies Department (EHE) of the HPA in the UK to produce mapping to assist risk characterisation)
- Mapping system in Northern Ireland can work on cross border grid reference system
- Risk mapping system showing the neighbouring countries' receptors
- use of GIS compatible with modelling outputs and identifying receptors, in a format that is shared and understood between risk assessors; both countries share data layers on receptors

6.3 Potential participants of table-top exercise

Among 47 survey respondents (from 18 European countries) interested in a table-top exercise on chemical incident exposure assessment with other Member States representatives, 36 provided us with their contact details. A complete list of potential table-top exercise participants with their professional background was included in Appendix IV (confidential, only for Project Partners use).

7 Appendix 1 Member States Survey

I. Introduction

Thank you for accessing our survey, which we are conducting as part of a current EU project on Cross-border Exposure characterisation for Risk Assessment in Chemical Incidents (CERACI) (www.rivm.nl/ceraci).

We would be grateful to hear your PERSONAL opinions as a professional/expert. Please note, no individual or organisation will be identified, as all responses are considered confidential according to EU data protection law.

Information from the survey will be used next year in a table-top exercise. If you would like to take part in this exercise please say so in question 35.

The survey will take about 30 minutes to complete. You don't have to fill in the whole questionnaire at once. It is possible to save your answers at any time and complete the rest later if you like.

Your network of professional contacts may also be able to usefully contribute to this survey, so please do share the questionnaire link with other professionals from your organisation or other organisations that can contribute to the project.

Digital copies of CERACI project reports will be available for the survey respondents on request. Please contact us at ceraci@rivm.nl.

Thank you for your help with this project.

Please click 'Next' to begin the survey.

National Institute for Public Health and the Environment
Ministry of Health, Welfare and Sport

Health Protection Agency

NOFER INSTITUTE OF OCCUPATIONAL MEDICINE

ceraci

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II. Examples of major chemical incident scenarios

We are using incident scenarios based on real events for the CERACI project. Please read through them.

1. Buncefield oil depot fire and explosions (11 December 2005, UK)

Description: Three explosions in an oil storage facility (Buncefield depot) with 43 reported injuries, 2000 persons evacuated. Public health concerns regarding large, dense plume.

2. Rupture of a containment reservoir with waste, produced during bauxite refining (5 October 2010, Hungary)

Description: The waste poured through Kolontar and other villages after the bursting of a containment reservoir at the Ajkai Timfoldgyar Zrt plant. Six people were missing. Others suffered burns and eye irritations caused by lead and other corrosive elements in the mud. The flood, estimated at about 700,000 cubic meters (24 million cubic feet), swept cars off roads and damaged bridges and houses, forcing the evacuation of about 400 residents.

While filling in the questionnaire please keep in mind either the above scenarios or events you have most recently been involved in.

III. Your professional background:

1. In which country do you work?

- Austria
- Belgium
- Bulgaria
- Cyprus
- Czech Republic
- Denmark
- Estonia
- Finland
- France
- Germany
- Greece
- Hungary
- Ireland
- Italy
- Latvia
- Lithuania
- Luxembourg
- Malta
- Poland
- Portugal
- Romania
- Slovakia
- Slovenia
- Spain
- Sweden
- The Netherlands
- United Kingdom
- Other

If 'Other' please specify.

2. Organisation type you work for, please choose all which apply:

- National government department/agency
- Federal or provincial government department/agency
- Local government department/agency
- Military
- Emergency services (Fire services)
- Emergency services (Ambulance services)
- Emergency services (Police)
- Health services
- Environmental services
- Other

Please briefly describe your profession:

3. How are you involved in exposure assessment? Please choose all which apply.

	air	water(1)	soil	crops/food	other
Monitoring(2)					
At scene sampling(3)					
Detection and identification(4)					
Data assessing					
Modelling(5)					
Analytical laboratory					
Risk characterisation(6)					
Identification of affected groups					
Coordination of exposure assessment					
Other					

(1)water - here and in the following questions (if not specified) refers to any kind of water (including drinking water, surface water and ground water)
(2)monitoring - continuous or periodic detection process of determining if a given agent is present.
(3)sampling – the collection of a representative amount of material from a given matrix in order to transport, manipulate and eventually analyse the material.
(4)detection and identification – establishing the presence and type of an agent, e.g. sampling matrix, indications (smell etc.), detection equipment, technologies for analysis
(5)modelling - a method based on general models that may be used to predict exposure to a wide range of substances hazardous to health
(6)risk characterisation - synthesising an overall conclusion about risk by summarising and integrating information from the preceding steps in the risk assessment

If you chose 'Other' please briefly describe your role in exposure assessment.

4. For an individual to be exposed to a substance, there must be a pathway linking the source to the person (receptor): the source-pathway-receptor model. Please choose which of the following your role in exposure assessment is focused on (can be more than one):

Source

Pathways

Receptors

IV. Environmental monitoring and modelling capabilities in your country

5. Is environmental monitoring during and after major chemical incidents carried out in your country?

	during	after
Yes		
No		
I don't know		

6. Who are the national authorities supervising environmental monitoring and public health exposure characterisation in major chemical incidents in your country? Please choose all which apply.

	supervising environmental monitoring	supervising public health exposure characterisation
Ministry of Environment (or equal authority)		
Ministry of Defence (or equal authority)		
Ministry of Health (or equal authority)		
None		
Other		
I don't know		

If 'Other' please specify.

7. Who carries out monitoring at the incident scene and for what purposes? Please enter all which you feel are relevant.

	air	water	soil	crops/food	other	for public health protection	for environment protection	for occupational health protection
National Hazmat(7) teams								
Fire and rescue services								
Environmental protection services								
Site operator resources (chemical rescue team)								
Health protection services								
Other								
I don't know								
Not applicable								

(7) Hazmat - hazardous material

If 'Other' please specify.

8. Please state the nature of the monitoring resource availability and the capability.

	air	water	soil	crops/food	other
Within the emergency exclusionary Zone / for emergency response / dedicated 24/7(8)					
Within the emergency exclusionary Zone / for emergency response but not a dedicated 24/7 service					
Off site(9) for assessing public exposure / dedicated 24/7					
Off site for assessing public exposure but not a dedicated 24/7 service					
Other					
I don't know					
Not applicable					

(8)dedicated 24/7 - available 24 hours / 7 days a week
(9)off site - area not considered dangerous (affected area other than hot zone)
[Note there may be dedicated static air quality sites (ambient air monitors) which may not be useful for incident response]

If 'Other' please specify.

9. Please state the nature of the modelling availability and the capability.

	air	water	soil	crops/food	other
Local models					
Dispersion models by meteorological experts					
Water dispersion modelling					
Other					
I don't know					
Not applicable					

If 'Other' please specify.

10. Does your country have national Hazmat teams to support exposure assessment?

- Yes, as separate/independent units
- Yes, within national fire and rescue service
- No
- I don't know

IV. Environmental monitoring and modelling capabilities in your country

11. Please briefly describe the output of national Hazmat teams' activity?

12. Who is the receiver of their output?

13. Does your country have back office service(10) for onsite Hazmat advisors to support exposure assessment?

- Yes
- No
- I don't know

(10)back office service – office supporting technical advice

14. Does your country have Hazmat sampling teams?

- Yes, within national Hazmat teams
- Yes, as separate units
- No
- I don't know,

15. What resources and equipment does your country have available for sampling?

	drinking water	surface water	ground water	soil	air	food	vegetation	debris	particulate matter, powder
Procedures									
Commercial off the shelf sampling kit									
Self made sampling kit									
Specific technical equipment									
Other									

If 'Other' please specify.

16. What resource/equipment is available for detection and identification?

	equipment deployed at/near scene of incident	equipment deployed at nearby locations (e.g. sensitive receptors, sheltering place)	local resource	regional resource	national resource
Raman spectroscopy					
IMS					
PID					
Detection tubes					
IR spectroscopy					
UV-Vis spectroscopy					
AAS-techniques (FAAS, GFAAS)					
XRF					
AES					
ICP – techniques (ICP-AES, ICP-MS).					
GC – techniques (GC, GC-MS, GC-MS-MS)					
LC-techniques (LC-MS, LC-MS-MS)					
HPLC					
Other					

If 'Other' please specify.

17. Does your country have an interdisciplinary procedure for sampling, detection, identification and monitoring?

	air	water	soil	food/crops
Yes				
No				
I don't know				

18. For which matrices are mobile detection and identification equipment NOT available? Please choose all which apply.

- Air
- Soil
- I don't know
- Water
- Crop/food

19. Does your country have a national laboratory network?

	air	water	soil	crop/food
Yes				
No				
I don't know				

20. When exposure assessment is performed which guidance values are the analysis results compared to (for example Acute Exposure Guideline Levels)?

- Acute Exposure Guideline Levels
- Other guidance values [please indicate some examples below]
- No comparisons are made
- I don't know

Please indicate some examples of other guidance values, are they national or international standards?

21. Who receives the data deriving from DIM (Detection, Identification, Monitoring) activities carried on incident site (and undertakes health risk assessment)?

	local level	regional level	national level
Fire and rescue service			
Environmental protection officials			
Public health officials			
Food safety officials			
Other (provide who, e.g. site operator)			

If 'Other' please specify.

22. What additional information (as described below) is gathered during the acute phase of a chemical incident and is needed for exposure assessment and which organisation does this?

	fire and rescue service	health service	environmental protection service	site operator
Short characterisation of the place of release (closed building, open air etc.)				
Potentially exposed population (kind, size)				
Potentially exposed grounds / crops / facilities etc.)				
Type of the substance				
Quantity released				
Exposed population – health effects				
Meteorological (weather) conditions				
Observations / notifications (e.g. smell, deposition etc.)				
Analytical data				
Other (provide below what information)				

If 'Other' please specify.

23. Is it possible, using risk mapping (GIS mapping) systems available in your country, to gather information about the exposed areas:

- Land use (agriculture, residential, industry area etc.)
- Population size
- Population type (possible identification of susceptible populations near the incident location)
- The vulnerable zones (populations at risk/sensitive receptors)
- Not applicable (we do not use risk mapping system)

24. Are airborne dispersion models available in your country? Please choose all that apply.

- yes – provided by meteorological experts
- yes – provided by non meteorological experts
- no
- I don't know

25. Are water borne dispersion models available in your country?

- Yes
- No
- I don't know

26. If environmental modelling is done in your country, please list what kind of outputs are available? Please choose all which apply.

- Chemical concentrations in the air
- Chemical concentrations in water
- Deposition
- Other [please indicate some examples below]
- Not applicable
- I don't know

If 'Other' please indicate some examples.

V. Cross-border cooperation in case of chemical incident

27. Are there arrangements on international collaboration in case of a major chemical incident in your country?

- Yes
- No
- I don’t know

V. Cross-border cooperation in case of chemical incident

28. With which countries have official agreements been signed in this field; which of those include data exchange on environmental and health protection?

	agreements	information/data exchange
Austria		
Belgium		
Bulgaria		
Cyprus		
Czech Republic		
Denmark		
Estonia		
Finland		
France		
Germany		
Greece		
Hungary		
Ireland		
Italy		
Latvia		
Lithuania		
Luxembourg		
Malta		
Poland		
Portugal		
Romania		
Slovakia		
Slovenia		

Spain	◯	◯
Sweden	◯	◯
The Netherlands	◯	◯
United Kingdom	◯	◯
Other	◯	◯

If 'Other' please specify.

29. Do mobile laboratories' functions (available in your country) support the international response to chemical incidents?

- Yes [please describe briefly below in what way]
- No
- I don't know

If 'yes' please describe briefly in what way.

30. Do you have a risk mapping (GIS mapping) system which shows receptors (potentially affected persons) in neighbouring countries?

- Yes
- No
- I don't know
- Not applicable (we do not use risk mapping system)

31. Are dispersion models available for your own country and for neighbouring countries?

- Yes, the same models
- Yes, compatible ones – i.e. the basis and outputs are similar
- Yes, not compatible ones
- No
- I don't know
- Not applicable

32. Would the "source" country's dispersion modelling be used on both sides of the border?

- Yes
- No
- I don't know

33. Are water borne dispersion models available for your own country and for neighbouring countries?

- Yes, the same models
- Yes, compatible ones
- Yes, not compatible ones
- No
- I don't know

34. Would the "source" country's water borne dispersion modelling be used on both sides of the border?

- Yes
- No
- I don't know

VI. Contact details

35. Are you interested in a table-top exercise on chemical incident exposure assessments, with other Member States representatives? (CERACI table-top exercises: for more information please see: https://www.rivm.nl/ceraci)?

- Yes
- No

36. Would you be willing to participate in an interview concerning more detailed information connected with exposure assessment after chemical incidents in your country?

- Yes, in English
- Yes, in different language
- No

Please provide the language you prefer.

37. If you would like more information about this work or to further take part please fill in your contact details below.

Title

Name

Name of organisation

Email address

38. Please keep me informed (using the email address given above) about the CERACI project updates.

- Yes
- No

8 Appendix 2 Interview template

INTERPRETATION AND ORGANISATION

1. Could you describe the information flow in case of a chemical incident in your country? Does the information flow smoothly and according to plan or are there areas where the information doesn't flow well? What are the reasons for poor information flow? *(a brief SWOT analysis of the info flow in their country)*.

2. Could you describe the information flow between your country and neighbouring countries in case of a cross-border chemical incident? Does the information flow smoothly and according to plan or are there areas where the information doesn't flow well? What are the reasons for poor information flow? *(a brief SWOT analysis of the info flow between the countries)*.

3. Do you expect that data shared with neighbouring countries could be misinterpreted due to:

Language	yes	no
Different scientific rationales for monitoring and modelling		
Different rationales for public health decision making – for example different criteria for shelter / evacuate or for warning the public.		
Unfamiliarity with neighbouring regions capabilities *(E.g. sensitivity of equipment versus toxic effect levels. Differing use of source terms / dispersion assumptions. Unfamiliarity with data outputs.)*		
Lack of understanding of neighbouring response structures?		
Lack of suitable contacts with peer organisations in neighbouring countries?		
Different exposure assessment guidance values		
Ask for their suggestions:		

4. Which is the lead organisation for provision of public health advice in case of chemical incident? (and are they the one that gets the data) (differ by air, food, water, land?)

CROSS BORDER

we want to know: if there are any certain plans / protocols / procedures in international agreements for collaboration during major chemical incidents; if not what are the obstacles; communication channels, forms, possibilities and limitations across the border during the incident

5. Does your country have international agreements (or agreements with neighbouring countries) for cross-border interoperability / collaboration during major chemical incidents?
If so, do these include certain plans, protocols, or procedures or are they just general statements of collaboration and help?
If not, does your country have international agreements on general mutual aid?

6. Are the arrangements:

- at the first responder level	
- at a national level	

7. If arrangements are not in place, what are the obstacles or constraints?

8. In case of a cross-border incident, how (*who sends what to whom and when*) are data exchanged in practice?

☐	who sends	to whom	when
For monitoring data			
For modelling data			
For scientific public health interpretation to incident command			
For public messages			

9. Are risk assessors readily able to communicate with colleagues across borders:

	YES	NO
- Able to share plans, information with colleagues in neighbouring countries.		
- Aware of response, particularly public health systems and resources in neighbouring countries.		
- Able to understand the neighbouring countries risk assessment procedures and acute response trigger levels.		
- Able to access translation services with some understanding of public health, science, emergency response.		
- Is the dispersion modelling equivalent and cross validated or the differences are understood and the public health messages on each side of the border are suitably balanced.		
- GIS systems are integrated / maintain some cross border functionality.		
- Are GIS systems capable of accessing / importing dispersion models of neighbouring countries		

- Does your GIS have the capability to show receptors in neighbouring countries?		
- Mobile monitoring units are able / willing to cross borders according to wind direction to make best use of resource.		
- Risk characterisation is integrated on both sides of the border, with an agreed assessment and if possible common messages.		

10. Are there any restrictions on data exchange across borders (e.g. military, legal etc)

At national level some Member States' civil protection responsibilities fall under their Ministry of Defence and as such, their functions are delivered by military personnel.
- o *Ask for examples*

There could be administrative and political implications restricting military personnel crossing Member State's borders to provide exposure monitoring and interoperability assistance.
- o *Ask for examples*

11. Could you give an example of successful exposure assessment in a cross-border chemical incident?

12. Which factors contributed the most to this success?

13. Can you send us these examples / links

DATABASES

14. Which chemical databases do you use for health hazard identification / characterisation purposes?:

ESIS (http://ecb.jrc.ec.europa.eu/esis/)	
HSDB, TOXLINE (http://toxnet.nlm.nih.gov/cgi-bin/sis/htmlgen?HSDB)	
RTECS	
INCHEM (http://www.inchem.org)	
IUCLID (http://iuclid.echa.europa.eu/)	
other (provide examples)	

OTHER PROCESSES FOR EXPOSURE ASSESSMENT

15. Do you have standardised geographical registration of complaints of the effects of chemical incidents (e.g. complaints of odour nuisance, health complaints) YES NO

16. Do you have databases of previous incidents with best practices of exposure assessment YES NO

MONITORING

We want to know: what monitoring equipment is used during chemical incidents, what is continuously monitored, are the monitoring data available for risk assessment

17. What environmental monitoring / analysis equipment is used or commissioned for:

	Air	Water	Deposition / Land
- public health purposes			
- environmental purposes			
- occupational health purposes			

18. Is repeated environmental monitoring available in your country? (We need to specify range / substances monitored etc.)

	YES	NO
- public health purposes		
- environmental purposes		
- occupational health purposes		

19. Please specify the substances continuously monitored for:

- public health purposes
- occupational health purposes
- environmental purposes

20. Who is the 'owner' and who is the recipient of the monitoring data? Who commissions environmental monitoring for exposure assessment?

21. Is the data used / shared to inform public health risk assessment? YES & How? NO

22. Please estimate how long it might take on average to obtain the data? [Allowing for decision to deploy, through travel to site and actual acquisition of the first data set].How is data transferred?

MODELLING

We want to know: Who undertakes modelling, what resources are available, how long will it take before data is provided, what are the location restrictions etc…

23. Is environmental modelling in the case of major chemical incident carried out and by whom (provide the institution name if possible) and for what reasons?

	health assessment	risk assessment	environment	other
fire and rescue services				
health protection services				
environmental protection services				
other (provide who)				

24. What software is used (will need to consider water dispersion / interaction/ fractionation etc)?

25. Where does source term (rate of release) information come from (i.e. is it direct from the incident scene and who provides this)?

26. What are other restrictions e.g. modelling for dense gases, topography and deposition?

27. Are the predicted air concentrations and deposition rates on sensitive receptors with time calculated (e.g. time courses for the mass transport of the plume can be outputted)?

28. Can the model account for ingress of plumes and safety factors for those sheltering.

29. Is airborne dispersion modelling based upon basic meteorological parameters such as wind speed and plume observation or a complex dispersion model accounting for mixing layer, surface topography, plume buoyancy and deposition etc.

30. Can modelling predict the environmental concentrations of a given chemical release? (*Including deposition*)

31. Between member states what is the compatibility between neighbour's models. (*Are risk assessors likely to correctly understand other countries data and suitably characterise the risk?*)

(for explanatory reasons:) Dispersion modelling –
For air, it is understood:

- *Where the plume is going, at various heights and times.*
- *How much dilution / reaction is taking place with time.*
- *The model account for plume density with time and topographical features.*
- *The model can be output with contours for acute exposure reference values.*
- *The model can be scaled using monitoring data.*
- *The model can be scaled using health effect reports.*

For water, it is understood:

- *How will the release interact / degrade and disperse with time.*
- *The model can be output with contours for acute exposure reference values.*
- *The model can be scaled using monitoring data.*
- *The model can be scaled using health effect reports.*

Dear Interviewer,

- please send Task B matrix extract for interviewed country to the Interviewee and ask for (preferably written) comments on its accuracy;

- please send the interview template to the Interviewee before calling them to facilitate the interview for both sides;

- please check Task B matrix extract for interviewed country by yourself before the interview;

- please check the questionnaires for the interviewed countries (first sheet/s is/are personal answers and the next is for the country)
  - please notice that discrepancies in country answers revealed during survey are marked in yellow;

- please check if there are any discrepancies in country matrix and questionnaires and try to explain it during the interview;

- establish expertise and ask relevant questions
  - please avoid blanks, but fill in if an interviewee doesn't know;

- please send me the filled in templates before 18th of November.

All files can be printed with no text loss (interview template - vertically, the rest – horizontally), you don’t have to make any changes.

9 Appendix 3 Detailed results by country

Contradictory answers marked red.

Information updated after CERACI workshops in Amsterdam (19-20th March) and in Warsaw (2-3rd April) for 8 countries:

- AUSTRIA
- FRANCE
- GERMANY
- GREECE
- LATVIA
- LITHUANIA
- POLAND
- PORTUGAL.

Exposure assessment in chemical incident response – AUSTRIA (Response Count: 1)
I. Professional background of the respondent(s)
Environmental meteorologist *(16/34 qs not answered, the weakest part: cross-border)* - working for National government department/agency and Environmental services - involved in exposure assessment by: Modelling, Risk characterisation and Other (air) (We can calculate the toxic distances by accidental release of toxic substances (gases) for the purposes of elaboration of external/internal emergency plans for SEVESO establishments and emergency trainings. And we support the emergency responders with meteorological information by demand.) - focused on: Pathways
II. Environmental monitoring and modelling capabilities in Member States
- environmental monitoring carried out **during and after** major chemical incidents
- the national authorities supervising: - environmental monitoring: Ministry of Environment (or equal authority), Ministry of Defence (or equal authority), Ministry of Health (or equal authority), Environment Agency Austria - public health exposure characterisation: Ministry of Health (or equal authority), Environment Agency Austria
- monitoring at the incident scene carried out by: - National Hazmat teams (for public health, environment and occupational health protection) (matrices: air) - Fire and rescue services (for public health, environment and occupational health protection) (matrices: air) - Environmental protection services (for public health and environment protection) (matrices: air, water, soil) - Site operator resources (chemical rescue team) (for public health and occupational health protection) (matrices: air) - Health protection services (for public and occupational health protection) (matrices: crops/food)
- the nature of the monitoring resource availability and the capability: - Within the emergency exclusionary Zone / for emergency response / dedicated 24/7 (air) - Off site for assessing public exposure but not a dedicated 24/7 service (air, water, soil, crops/food)
- the nature of the modelling availability and the capability: - Local models for air - Dispersion models by meteorological experts for air - Water dispersion modelling for water
- national Hazmat teams to support exposure assessment organised within national fire and rescue service - the output of national Hazmat teams' activity (Make dispersion modelling in order to locate the danger area, coordinate the emergency responders /fire brigade, police, red cross etc./, prepare the information to the public-contact, do the on-site measurements) - the receiver of their output (emergency responders, decision makers, crisis coordination team /regional, federal or national depending on size of event)
- back office service for onsite Hazmat advisors to support exposure assessment - Yes

- Hazmat sampling teams organised as separate units
- resources and equipment available for sampling: - Procedures (air) - Commercial off the shelf sampling kit (air, particulate matter, powder) - Specific technical equipment (air)
- resource/equipment available for detection and identification: (?)
- an interdisciplinary procedure for sampling, detection, identification and monitoring: (?)
- mobile detection and identification equipment NOT available for: (?)
- a national laboratory network exists for air, water, soil and crop/food
- When exposure assessment is performed, the analysis results are compared to: Acute Exposure Guideline Levels and Other guidance values [ERPG, MAK, Our experience have shown that in some cases emergency responders and authorities prefer different threshold values. A standardisation of the assessment values will be highly desirable]
- the data deriving from DIM (Detection, Identification, Monitoring) activities carried on incident site are forwarded to: (and health risk assessment is undertaken by:) - Fire and rescue service, Environmental protection officials and Public health officials at local level - Fire and rescue service and Environmental protection officials and Food safety officials at regional and national level

- additional information gathered during the acute phase of a chemical incident (needed for exposure assessment) by:
- fire and rescue service and site operator
    - Short characterisation of the place of release (closed building, open air etc.)
    - Potentially exposed population (kind, size)
    - Potentially exposed grounds / crops / facilities etc.)
    - Type of the substance
    - Quantity released
    - Exposed population – health effects
    - Meteorological (weather) conditions
    - Observations / notifications (e.g. smell, deposition etc.)
- health service
    - Exposed population – health effects
    - Observations / notifications (e.g. smell, deposition etc.)
- environmental protection service
    - Potentially exposed population (kind, size)
    - Potentially exposed grounds / crops / facilities etc.)
    - Exposed population – health effects
    - Meteorological (weather) conditions
    - Observations / notifications (e.g. smell, deposition etc.)

The fire and rescue service are usually calling at the meteorological office for the needed meteorological information, especially for expected changes in the weather-wind shear, thunderstorm etc.
- using risk mapping (GIS mapping) systems available in Austria it is possible to gather information about: Land use (agriculture, residential, industry area etc.), Population size, Population type (possible identification of susceptible populations near the incident location), The vulnerable zones (populations at risk/sensitive receptors)
- airborne dispersion models available – provided by meteorological and non meteorological experts
- water borne dispersion models available
- available outputs of environmental modelling: - Chemical concentrations in the air, - Chemical concentrations in water, - Deposition
III. Cross-border cooperation in case of chemical incident
- arrangements on international collaboration in case of a major chemical incident (?)
- mobile laboratories' functions (available in your country) do not support/support the international response to chemical incidents (?)
- we have/have not a risk mapping (GIS mapping) system which shows receptors (potentially affected persons) in neighbouring countries (?)
- dispersion models available for Austria and for neighbouring countries - the same models; compatible models
- the "source" country's dispersion modelling will not be used on both sides of the border
- water borne dispersion models available for Austria and for neighbouring countries (?)
- the "source" country's water borne dispersion modelling will/will not be used on both sides of the border (?)

Exposure assessment in chemical incident response - BELGIUM (Response Count: 2+interview)

I. Professional background of the respondent(s)

- Officer in the department of NBC and detection *(13/34 qs not answered / the worst part - modelling)*
    - working for Emergency services (Fire services)
    - involved in exposure assessment by: Monitoring, At scene sampling, Detection and identification and Risk characterisation for air
    - focused on: Source and Receptors
- Fire officer
    - working for Emergency services (Fire services)
    - involved in exposure assessment by: At scene sampling (air, water), Detection and identification (air), Data assessing (air)
    - focused on: Source and Pathways

II. Environmental monitoring and modelling capabilities in Member States

- information flow: First the fire brigade is being called. The police and the fire brigade are going on the spot. When there seems to be an incident with hazardous materials and when the incident is large: Civil Protection is enabled.

- environmental monitoring carried out **during** and **after** major chemical incidents

- the national authorities supervising:
    - environmental monitoring: Ministry of Environment (or equal authority),
    - public health exposure characterisation: Ministry of Health (or equal authority)

- monitoring at the incident scene carried out by:
    - National Hazmat teams (for public health and environment protection) (matrices: air, water)
    - Fire and rescue services (for public health, and environment protection) (matrices: air, water, soil)
    - Environmental protection services (for public health and environment protection) (matrices: air, water, soil)
    - Other (Ministry of work) (for occupational health protection) (matrices: ?)

- the nature of the monitoring resource availability and the capability:
    - Within the emergency exclusionary Zone / for emergency response / dedicated 24/7 (air, water, soil)
    - Within the emergency exclusionary Zone / for emergency response but not a dedicated 24/7 service (soil, crop/food)
    - Off site for assessing public exposure / dedicated 24/7 (air, water, soil)
    - Off site for assessing public exposure but not a dedicated 24/7 service (soil, crops/food, other)
- the monitoring data used / shared to inform public health risk assessment

- the nature of the modelling availability and the capability:
    - Local models for air

Reflex zone depending on the chemical

- national Hazmat teams to support exposure assessment organised within national fire and rescue service
    - the output of national Hazmat teams' activity - This is not really national teams. It's a zonal organisation. (sometimes more than

1 per Province). Each zone has to be able to intervene for chemical incident, including zonage, evacuation, clogging, measurements, recognition and measuring the leaked substance. - the receiver of their output - the authority (Communal, provincial, national); the officer in charge or the local hazmat specialist
- back office service for onsite Hazmat advisors to support exposure assessment – Yes
- Hazmat sampling teams organised as separate units
- resources and equipment available for sampling: - Procedures (air) - Commercial off the shelf sampling kit (air) - Specific technical equipment (air)
- resource/equipment available for detection and identification: - within local resources: Raman spectroscopy, PID, Detection tubes, GC – techniques (GC, GC-MS, GC-MS-MS) - within regional resources: PID, Detection tubes - within national resources: PID, Detection tubes, IR spectroscopy - equipment deployed at/near scene of incident: PID, Detection tubes, Other (Measurements with chips and electrochemical captors) - equipment deployed at nearby locations (e.g. sensitive receptors, sheltering place) -
- an interdisciplinary procedure for sampling, detection, identification and monitoring: NO (air, water)
- mobile detection and identification equipment NOT available for: Crop/food
- No national laboratory network for air, water, soil and crop/food
- When exposure assessment is performed, the analysis results are compared to: Acute Exposure Guideline Levels and Dutch intervention values
- the data deriving from DIM (Detection, Identification, Monitoring) activities carried on incident site are forwarded to: (and health risk assessment is undertaken by:) - Fire and rescue service at local, regional and national level - Environmental protection and Public health officials at regional level - Food safety officials at national level.
- the lead organisation for provision of public health advice in case of chemical incident - When there is a problem with public health the fire brigade will communicate this with the Crisis Centre (Ministry of Home Affairs). There will be no specific toxicological advice.

- additional information gathered during the acute phase of a chemical incident (needed for exposure assessment) by:
- fire and rescue service and site operator
  - Short characterisation of the place of release (closed building, open air etc.)
  - Potentially exposed population (kind, size)
  - Type of the substance
  - Quantity released

- Exposed population – health effects - Meteorological (weather) conditions - Observations / notifications (e.g. smell, deposition etc.) - Analytical data - health service - Potentially exposed population (kind, size) - Exposed population – health effects - Analytical data - environmental protection service - Potentially exposed grounds / crops / facilities etc.) - Analytical data
- using risk mapping (GIS mapping) systems available in Belgium it is possible to gather information about: - Land use (agriculture, residential, industry area etc.) - Population size - Not applicable (we do not use risk mapping system)
- airborne dispersion models available – provided by non meteorological experts
- water borne dispersion models availability (?)
- available outputs of environmental modelling: - Chemical concentrations in the air
- no standardised geographical registration of complaints of the effects of chemical incidents (e.g. complaints of odour nuisance, health complaints) - no databases of previous incidents with good practices of exposure assessment
III. Cross-border cooperation in case of chemical incident
- arrangements on international collaboration in case of a major chemical incident - Yes (with Germany, The Netherlands). There also is the Community mechanism for civil protection. There is an intervention group on the area of CBRN, consisting of teams from Belgium, France, Greece, Spain and Portugal. They can go everywhere in Europe. Agreements signed at first responder level. - arrangements with (?) include information/data exchange on environmental and health protection
- information flow: Liège is special according to the information flow with neighbouring countries. They participate in the Emric+-project. In Liège cross-border chemical incidents are included in municipal and provincial contingency plans. So there is the convention of Mainz (8th March, 1996). When there is a large incident the information flow automatically goes via the Belgium Crisis Centre (Ministry of Home Affairs). When there is a nuclear incident the information flow goes via Brussels. There are good contacts and a good cooperation concerning decontamination and detection between Belgium, Luxembourg and France. On a local scale there are some appointments between neighbouring countries, on a national scale there are not.
- practical data exchange in case of a cross-border incident: An example is the 'Hogevenenfire'. All the information was going to and sending from the Crisis Centre in Liège. A fireman in Eupen had contacts with Maestricht and Aken and was asking for people. The incident

was too large and the communication on the local organisation was a problem. All the information is going to Liège and sending to Brussels following by activation of the Civil Protection. On the field of CBRN nothing is arranged. That is the ambition of the Emric+-project. The governor is the designated person when there is a euregional incident.
- data shared with neighbouring countries could be misinterpreted due to: - Language - Different scientific rationales for monitoring and modelling - Different rationales for public health decision making – for example different criteria for shelter / evacuate or for warning the public. - Unfamiliarity with neighbouring regions capabilities - Lack of understanding of neighbouring response structures - Lack of suitable contacts with peer organisations in neighbouring countries - Different exposure assessment guidance values
- mobile laboratories' functions (available in your country) do not support the international response to chemical incidents - Mobile monitoring units are able / willing to cross borders according to wind direction to make best use of resource.
- we have/have not a risk mapping (GIS mapping) system which shows receptors (potentially affected persons) in neighbouring countries (?)
- comparison of dispersion models available for Belgium and for neighbouring countries (?)
- the "source" country's dispersion modelling will/will not be used on both sides of the border (?)
- water borne dispersion models available for Belgium and for neighbouring countries (?)
- the "source" country's water borne dispersion modelling will/will not be used on both sides of the border (?)
risk assessors are able to share plans, information with colleagues in neighbouring countries, are aware of response, particularly public health systems and resources in neighbouring countries, are able to understand the neighbouring countries risk assessment procedures and acute response trigger levels.
- restrictions on data exchange across borders: At the places where there are NAVO/NATO-basis there could be some restrictions. At the Crisis Centre a representative of the Ministry of Defence is always there. Military personnel crossing borders should not be any problem. A possible problem is the insurances for the materials. This will be arranged differently for the different countries. There could be communication problems (TETRA, P2000) and problems with the language. There is a project in Strassbourg where one has experimented with sign language.

An example of successful exposure assessment in a cross-border chemical incident:
A train accident in Visé: a large cooperation between the firm, the fire-brigade of Maestricht, the fire-brigade of Liège and the Civil Protection.

Exposure assessment in chemical incident response - BULGARIA (Response Count: 1)
I. Professional background of the respondent(s)
- CBRN Expert, dealing with planning and prevention of CBRN accidents - working for Emergency services (Fire services) - involved in exposure assessment by: Monitoring, Detection and identification and Risk characterisation for air and water - focused on: Receptors
II. Environmental monitoring and modelling capabilities in Member States
- environmental monitoring carried out **during** and **after** major chemical incidents
- the national authorities supervising: - environmental monitoring: Ministry of Environment (or equal authority), - public health exposure characterisation: Ministry of Health (or equal authority)
- monitoring at the incident scene carried out by: - Fire and rescue services (for public health, environment and occupational health protection) (matrices: air, water) - Site operator resources (chemical rescue team) (for public health, environment and occupational health protection) (matrices: air, water)
- the nature of the monitoring resource availability and the capability: - Within the emergency exclusionary Zone / for emergency response / dedicated 24/7 (air, water)
- the nature of the modelling availability and the capability (?)
- national Hazmat teams to support exposure assessment organised within national fire and rescue service - the output of national Hazmat teams' activity - securing, monitoring, detection and decontamination of the incident place and the team players - the receiver of their output - the national body which is responsible for specific type of incidents
- back office service for onsite Hazmat advisors to support exposure assessment – YES
- Hazmat sampling teams – NO
- resources and equipment available for sampling (?)
- resource/equipment available for detection and identification: - within local, regional and national resources: PID, Detection tubes; - equipment deployed at/near scene of incident: PID, Detection tubes; - equipment deployed at nearby locations (e.g. sensitive receptors, sheltering place): PID, Detection tubes
- an interdisciplinary procedure for sampling, detection, identification and monitoring: YES (air, water)
- mobile detection and identification equipment NOT available for: Soil, Crop/food
- national laboratory network for air, water, soil and crop/food (?)

- When exposure assessment is performed, the analysis results are compared to: Acute Exposure Guideline Levels
- the data deriving from DIM (Detection, Identification, Monitoring) activities carried on incident site are forwarded to: (and health risk assessment is undertaken by:) - Fire and rescue service, Environmental protection, Public health and Food safety officials at local, regional and national level.

- additional information gathered during the acute phase of a chemical incident (needed for exposure assessment) by:
- fire and rescue service and site operator
  - Short characterisation of the place of release (closed building, open air etc.)
  - Potentially exposed population (kind, size)
  - Potentially exposed grounds / crops / facilities etc.)
  - Type of the substance
  - Quantity released
  - Observations / notifications (e.g. smell, deposition etc.)
  - Analytical data
- health service
  - Exposed population – health effects

- using risk mapping (GIS mapping) systems available in Bulgaria it is possible to gather information about: - Land use (agriculture, residential, industry area etc.) - Population size - Population type (possible identification of susceptible populations near the incident location) - The vulnerable zones (populations at risk/sensitive receptors)
- airborne dispersion models available – provided by non meteorological experts
- water borne dispersion models NOT available
- available outputs of environmental modelling (?)
III. Cross-border cooperation in case of chemical incident
- arrangements on international collaboration in case of a major chemical incident (?)
- mobile laboratories' functions (available in your country) do not support/support the international response to chemical incidents (?)
- we have a risk mapping (GIS mapping) system which shows receptors (potentially affected persons) in neighbouring countries (?)
- dispersion models available for Bulgaria and for neighbouring countries - compatible models – i.e. the basis and outputs are similar
- the "source" country's dispersion modelling will/will not be used on both sides of the border (?)
- water borne dispersion models available for Bulgaria and for neighbouring countries (?)
- the "source" country's water borne dispersion modelling will/will not be used on both sides of the border (?)

Exposure assessment in chemical incident response – CYPRUS (Response count: 3)
I. Professional background of the respondent(s)
- Job description: Occupational Health and Safety - working for National government department/agency - involved in exposure assessment by: Monitoring, At scene sampling, Detection and identification, Data assessing, Modelling, Analytical laboratory, Risk characterisation, Identification of affected groups, Coordination of exposure assessment for air - focused on: Source, Pathway, Receptors - Job description: providing firstly to the incident officer advice on all aspects of public health protection in terms of the potential hazards posed by chemical/environmental releases in the event of an incident. - working for Emergency services (Fire services) - involved in exposure assessment by: Monitoring, Detection and identification, Risk characterisation - focused on: Receptors - Firefighting first responder - working for Emergency services (Fire services) - involved in exposure assessment by: -Other (firefighting first responder) - focused on: Receptors
II. Environmental monitoring and modelling capabilities in Member States
- environmental monitoring carried out **during** and **after** major chemical incidents
- the national authorities supervising: - environmental monitoring: Ministry of Environment (or equal authority), Other - Ministry of Labour - public health exposure characterisation: Ministry of Environment (or equal authority), Ministry of Health (or equal authority), Other - Ministry of Labour
- monitoring at the incident scene carried out by: - Fire and rescue services (for public health protection) (matrices: air) - Environmental protection services (for environment protection) (matrices: ?) - Health protection services (for public health protection) (matrices: air, water, crop/food) - Other (Ministry of Labour, Department of Labour Inspection) (for occupational health protection) (matrices: air, soil)
- the nature of the monitoring resource availability and the capability: - Within the emergency exclusionary Zone / for emergency response / dedicated 24/7 (air) - Within the emergency exclusionary Zone / for emergency response but not a dedicated 24/7 service (air) - Off site for assessing public exposure but not a dedicated 24/7 service (air)
- the nature of the modelling availability and the capability: - Local models for air

- national Hazmat teams to support exposure assessment organised within national fire and rescue service - the output of national Hazmat teams' activity - ? - the receiver of their output - Department of environment, General Public Respondents' teams description: First responders of firefighting personnel as hazmat team; EMAK - Special Unit of the Fire Service dealing with catastrophes / large scale incidents and chemicals.
- back office service for onsite Hazmat advisors to support exposure assessment – YES / NO
- Hazmat sampling teams – within national Hazmat teams / NO
- resources and equipment available for sampling: - Procedures (air, particulate matter, powder) - Commercial off the shelf sampling kit (air, particulate matter, powder) - Specific technical equipment (air, particulate matter, powder)
- resource/equipment available for detection and identification: - within local resources: ? - within regional resources: ? - within national resources: ? - equipment deployed at/near scene of incident: Detection tubes, Other (UV, IR and Chemiluminescense techniques within DLI. The State General Laboratory uses most of the above listed techniques) - equipment deployed at nearby locations (e.g. sensitive receptors, sheltering place) -
- an interdisciplinary procedure for sampling, detection, identification and monitoring: YES (air)
- mobile detection and identification equipment NOT available for: air *(probably mistake)*
- national laboratory network exists for air, water, soil and crop/food
- When exposure assessment is performed, the analysis results are compared to: Acute Exposure Guideline Levels
- the data deriving from DIM (Detection, Identification, Monitoring) activities carried on incident site are forwarded to: (and health risk assessment is undertaken by:) - Fire and rescue service, Environmental protection, Public health and Food safety officials at local, regional and national level.

- additional information gathered during the acute phase of a chemical incident (needed for exposure assessment) by:
- fire and rescue service:
  - Short characterisation of the place of release (closed building, open air etc.)
  - Type of the substance
  - Quantity released
  - Observations / notifications (e.g. smell, deposition etc.)
- health service
  - Exposed population – health effects

- environmental protection service: - Potentially exposed population (kind, size) - Potentially exposed grounds / crops / facilities etc.) - Meteorological (weather) conditions - Analytical data
- using risk mapping (GIS mapping) systems available in Cyprus it is possible to gather information about: - Land use (agriculture, residential, industry area etc.) - Not applicable (we do not use risk mapping system)
- airborne dispersion models available – provided by meteorological experts
- water borne dispersion models NOT available
- available outputs of environmental modelling: - Chemical concentrations in the air - Deposition
III. Cross-border cooperation in case of chemical incident
- arrangements on international collaboration in case of a major chemical incident - YES (with Greece, Israel), + EMEP - LONG-RANGE TRANSBOUNDARY AIR POLLUTION - arrangements with Greece and Israel include information/data exchange on environmental and health protection
- mobile laboratories' functions (available in your country) do not support the international response to chemical incidents
- we do not have a risk mapping (GIS mapping) system which shows receptors (potentially affected persons) in neighbouring countries
- dispersion models not available for Cyprus and for neighbouring countries
- the "source" country's dispersion modelling will/will not be used on both sides of the border (?)
- water borne dispersion models not available for Cyprus and for neighbouring countries
- the "source" country's water borne dispersion modelling will/will not be used on both sides of the border (?)

Exposure assessment in chemical incident response – CZECH REPUBLIC (Response count: 3)
I. Professional background of the respondent(s)
- Job description: manager/advisor: chemical, radiological and biological risks: training, SOPs. methodology, chemical labs and CBRN detection groups, decontamination groups, equipment and instruments etc. *(all qs answered)* - working for Emergency services (Fire services) - involved in exposure assessment by: Data assessing, Risk characterisation, Identification of affected groups, Coordination of exposure assessment for air, water and soil and Modelling for air - focused on: Source, Pathway, Receptors - University professor, head of the Laboratory of Risk Research and Management, expert working for Ministry of Environment *(1/34 qs not answered)* - working for: Other - involved in exposure assessment by: Detection and identification, Modelling, Risk characterisation, Identification of affected groups (air, water) and Risk characterisation also for soil - focused on: Source, Pathway - Officer from population protection department, responsible for CBRN matters. I will describe capabilities of FRS of the Czech republic as a whole. - working for National government department/agency and Emergency services (Fire services) - involved in exposure assessment by: Monitoring, Modelling, Risk characterisation and Identification of affected groups for air; At scene sampling, Detection and identification, Data assessing, Analytical laboratory for air water and soil; Samples of any kind of material are picked on the scene in order to find the cause of the fire. - focused on: Source
II. Environmental monitoring and modelling capabilities in Member States
- environmental monitoring carried out **during** and **after** major chemical incidents
- the national authorities supervising: - environmental monitoring: Ministry of Environment (or equal authority), Ministry of Defence (or equal authority), Other - Fire Rescue Service - public health exposure characterisation: Ministry of Environment (or equal authority), Ministry of Health (or equal authority)
- monitoring at the incident scene carried out by: - National Hazmat teams (for public health, environment and occupational health protection) (matrices: air, water, soil) - Fire and rescue services (for public health, environment and occupational health protection) (matrices: air, water, soil) - Environmental protection services (for public health and environment protection) (matrices: air, water, soil, crops/food) - Site operator resources (chemical rescue team) (for public health, environment and occupational health protection) (matrices: air, water, soil) - Health protection services (for public and occupational health protection) (matrices: water, soil, crops/food)

- Other (Bodies of Agriculture Ministry) (matrices: crops/food)
- the nature of the monitoring resource availability and the capability: - Within the emergency exclusionary Zone / for emergency response / dedicated 24/7 (air, water, soil, crops/food) - Within the emergency exclusionary Zone / for emergency response but not a dedicated 24/7 service (air, water, soil, crops/food) - Off site(9) for assessing public exposure / dedicated 24/7 (air, water, soil, crops/food) - Off site for assessing public exposure but not a dedicated 24/7 service (air, water, soil, crops/food)
- the nature of the modelling availability and the capability: - Local models and Dispersion models by meteorological experts for air and water; Water dispersion modelling for water water models limited to Elbe basin; soil together with underground water
- national Hazmat teams to support exposure assessment organised within national fire and rescue service - the output of national Hazmat teams' activity: - - Hazmat teams have two parts - stationary labs and mobile labs. The mobile labs are used on scene in case of a chemical incident. They provide chemical survey, sampling, identification, chem analysis or monitoring and support an officer in charge on scene. They use instruments stated in first column of the point 16. The stationary labs provide analytical confirmation, expertise activities (determination of fires causes) and training of fire fighters. They use instruments stated in second column of the point 16 - Mainly "gas team", but also cooperating with TRINS (transport of Hazmat - Air monitoring (chemical or radiation), setting of dangerous zone, basis for selection of appropriate protective equipment for first responders, sampling, identification of unknown materials or substances - the receiver of their output - Fire units above all - an officer in charge or regional crisis management authorities. (In case of radiation National Radiation Monitoring Network) / Fire and rescue service / Commander of the intervention or crisis staff (depends on size of incident)
- back office service for onsite Hazmat advisors to support exposure assessment – YES / NO
- Hazmat sampling teams – within national Hazmat teams and as separate units
- resources and equipment available for sampling: - Procedures (drinking, surface and ground water; soil; air; food; vegetation; debris; particulate matter, powder) - Commercial off the shelf sampling kit (drinking, surface and ground water; soil; air; food; vegetation; debris; particulate matter, powder) - Specific technical equipment (drinking, surface and ground water; soil; air; food; vegetation; particulate matter, powder)
- resource/equipment available for detection and identification: - within local, regional and national resources: Raman spectroscopy, IMS, PID, Detection tubes, IR spectroscopy, UV-Vis spectroscopy, AAS-techniques (FAAS, GFAAS), XRF, AES, ICP – techniques (ICP-AES, ICP-MS), GC – techniques (GC, GC-MS, GC-MS-MS); LC-techniques (LC-MS, LC-MS-MS), HPLC and Other (not listed namely) - equipment deployed at/near scene of incident: Raman spectroscopy, IMS, PID, Detection tubes, IR spectroscopy, UV-Vis

spectroscopy, XRF, GC – techniques (GC, GC-MS, GC-MS-MS) - equipment deployed at nearby locations (e.g. sensitive receptors, sheltering place): Raman spectroscopy, IMS, PID, Detection tubes, IR spectroscopy, UV-Vis spectroscopy, AAS-techniques (FAAS, GFAAS), XRF, AES, GC – techniques (GC, GC-MS, GC-MS-MS); LC-techniques (LC-MS, LC-MS-MS), HPLC
- an interdisciplinary procedure for sampling, detection, identification and monitoring: YES (air, water, soil, food/crops)
- mobile detection and identification equipment NOT available for: soil, crops/food
- national laboratory network exists for air, water, soil and crop/food
- When exposure assessment is performed, the analysis results are compared to: Acute Exposure Guideline Levels, Other guidance values (ERPG, AETL) – no comparisons are made
- the data deriving from DIM (Detection, Identification, Monitoring) activities carried on incident site are forwarded to: (and health risk assessment is undertaken by:) - Fire and rescue service, Environmental protection, Public health and Food safety officials at local, regional and national level.

- additional information gathered during the acute phase of a chemical incident (needed for exposure assessment) by:
- fire and rescue service:
  - Short characterisation of the place of release (closed building, open air etc.)
  - Potentially exposed population (kind, size)
  - Potentially exposed grounds / crops / facilities etc.)
  - Type of the substance
  - Quantity released
  - Exposed population – health effects
  - Meteorological (weather) conditions
  - Observations / notifications (e.g. smell, deposition etc.)
  - Analytical data
  - Other (Evacuation)
- health service
  - Potentially exposed population (kind, size)
  - Potentially exposed grounds / crops / facilities etc.)
  - Type of the substance
  - Quantity released
  - Exposed population – health effects
  - Meteorological (weather) conditions
  - Observations / notifications (e.g. smell, deposition etc.)
  - Analytical data
- environmental protection service:
  - Potentially exposed grounds / crops / facilities etc.)

- Type of the substance - Quantity released - Meteorological (weather) conditions - Observations / notifications (e.g. smell, deposition etc.) - Analytical data - site operator: - Short characterisation of the place of release (closed building, open air etc.) - Type of the substance - Quantity released - Meteorological (weather) conditions - Analytical data
- using risk mapping (GIS mapping) systems available in Czech Republic it is possible to gather information about: - Land use (agriculture, residential, industry area etc.) - Population size - Population type (possible identification of susceptible populations near the incident location) - The vulnerable zones (populations at risk/sensitive receptors)
- airborne dispersion models available – provided by meteorological and non meteorological experts
- water borne dispersion models NOT available / available
- available outputs of environmental modelling: - Chemical concentrations in the air - Chemical concentrations in water - Deposition - Other (Soil, food, vegetation, particulate matter)
III. Cross-border cooperation in case of chemical incident
- arrangements on international collaboration in case of a major chemical incident - YES (with Austria, France, Germany, Hungary, Poland, Romania, Slovakia) - information/data exchange on environmental and health protection with Austria, Belgium, Bulgaria, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Poland, Romania, Slovakia, the Netherlands)
- mobile laboratories' functions (available in your country) support the international response to chemical incidents (Mobile laboratories have not supported any international response to chemical incidents yet. But within international exercises they have taken part in several "incidents". For instance in connection with European Football Championship in 2012 an agreement between CZ and Poland will be prepared.)
- we do not / have a risk mapping (GIS mapping) system which shows receptors (potentially affected persons) in neighbouring countries
- dispersion models available for Czech Republic and for neighbouring countries are the same models

- the “source” country’s dispersion modelling will be used on both sides of the border
- water borne dispersion models not available for Czech Republic and for neighbouring countries
- the “source” country’s water borne dispersion modelling will not be used on both sides of the border

Exposure assessment in chemical incident response - DENMARK (Response Count: 2 + interview)
I. Professional background of the respondent(s)
Job description: Advice for incident commanders on hazardous properties of chemical substances; Identification of unknown substances in the lab. - working for National government department/agency - involved in exposure assessment by: Modelling for air - focused on: Source Job description: Chief Fire officer *(16/34 qs not answered)* - working for Emergency services (Fire services) - involved in exposure assessment by: At scene sampling, Detection and identification, Data assessing, Risk characterisation, Identification of affected groups, Coordination of exposure assessment - focused on: Source, Pathways, Receptors
II. Environmental monitoring and modelling capabilities in Member States
- information flow / response organisation: - 98 local municipalities in Denmark in which the Fire Service have the responsibility for handling chemical incidents. The Fire Services has no equipment for identifying the hazards. Identification of hazards is only done by visual inspections (UN numbering, chemical lists of companies). For this a central HazMat team from DEMA can be deployed. Next to a central HazMat team DEMA also provides backoffice expert consulting for e.g. modelling. DEMA also hands out books/procedures about hazardous chemicals for preparation. The Fire Service can call upon DEMA for free. The information DEMA gathers is shared easily with the Fire Services. Cross-border chemical incidents are being handled by DEMA. - Chemical Incidents which have affected water or crops other authorities will step in. The water authority will check the quality of the water (by doing analysis by private laboratories), this is also the case with contamination of crops (Food authority). The information of the analysis results and the advice of the authorities will go to the Fire Service. This is then shared in the incident command and countermeasured will be taken. - The Fire Service works closely together with the Medical Services and the Police in the field. Information is easily shared. The Police are in charge of the risk communication about the Public Health (with support of information of the Medical Team).
- environmental monitoring carried out **during** and **after** major chemical incidents *(advisor claims it's not carried out during incident)*
- the national authorities supervising: - environmental monitoring: Ministry of Environment (or equal authority), Ministry of Defence (or equal authority), Ministry of Health (or equal authority) - public health exposure characterisation: Ministry of Defence (or equal authority), Ministry of Health (or equal authority)
- monitoring at the incident scene carried out by: - National Hazmat teams (for public health, environment and occupational health protection) (matrices: air, water, soil,

crops/food) - Fire and rescue services (for public health, environment and occupational health protection) (matrices: air, water, soil) - Environmental protection services (for public health, environment occupational health protection) (matrices: air, water, soil, crops/food)
- the nature of the monitoring resource availability and the capability: - Within the emergency exclusionary Zone / for emergency response / dedicated 24/7 (air, water, soil, crops/food)
- the nature of the modelling availability and the capability: - Local models and Dispersion models by meteorological experts for air, water and soil; Water dispersion modelling for water
- national Hazmat teams to support exposure assessment organised within national fire and rescue service (1 answer no *from the advisor*) - the output of national Hazmat teams' activity: - - the receiver of their output - Fire and rescue service, police and ambulance
- back office service for onsite Hazmat advisors to support exposure assessment – YES
- Hazmat sampling teams – within national Hazmat teams (Hazmat team samples directly at the source for identification of unknown substances).
- resources and equipment available for sampling: - Procedures (drinking, surface and ground water; soil; air; food; vegetation) - Specific technical equipment (drinking, surface and ground water; soil; air)
- resource/equipment available for detection and identification: - within regional resource: Raman spectroscopy, IMS, PID, Detection tubes, IR spectroscopy, GC – techniques (GC, GC-MS, GC-MS-MS) - within national resource: Raman spectroscopy, IR spectroscopy, XRF, ICP – techniques (ICP-AES, ICP-MS), GC – techniques (GC, GC-MS, GC-MS-MS); LC-techniques (LC-MS, LC-MS-MS) - equipment deployed at/near scene of incident: - - equipment deployed at nearby locations (e.g. sensitive receptors, sheltering place): - Regional can go on-site. National is in central lab.
- an interdisciplinary procedure for sampling, detection, identification and monitoring: ?
- mobile detection and identification equipment NOT available for: ?
- national laboratory network exists for air, water, soil and crop/food
- When exposure assessment is performed, the analysis results are compared to: ?
- the data deriving from DIM (Detection, Identification, Monitoring) activities carried on incident site are forwarded to: (and health risk assessment is undertaken by:) - Fire and rescue service, Environmental protection, Public health and Food safety officials at local, regional and national level.

- additional information gathered during the acute phase of a chemical incident (needed for exposure assessment) by: - fire and rescue service: - Short characterisation of the place of release (closed building, open air etc.) - Type of the substance - Quantity released - health service - Potentially exposed population (kind, size) - Exposed population – health effects
- using risk mapping (GIS mapping) systems available in Denmark it is possible to gather information about: - Land use (agriculture, residential, industry area etc.)
- airborne dispersion models available – provided by non meteorological experts
- water borne dispersion models availability ?
- available outputs of environmental modelling: ?
III. Cross-border cooperation in case of chemical incident
- arrangements on international collaboration in case of a major chemical incident – yes not specified with whom
- mobile laboratories' functions (available in your country) do not support the international response to chemical incidents
- availability of a risk mapping (GIS mapping) system which shows receptors (potentially affected persons) in neighbouring countries ?
- dispersion models available for Denmark and for neighbouring countries ?
- the "source" country's dispersion modelling will / will not be used on both sides of the border ?
- water borne dispersion models available / not available for Denmark and for neighbouring countries ?
- the "source" country's water borne dispersion modelling will / will not be used on both sides of the border ?

Denmark has not experienced large chemical incidents so far. But the Fire Services are also not prepared to react to large chemical incidents. There is no training and no equipment.

Exposure assessment in chemical incident response – ESTONIA (Response Count: 3)
I. Professional background of the respondent(s)
- specialist on ambient air - working for National government department/agency - involved in exposure assessment by: Other (legislation compilation) - focused on: Source - Job description: CBRN detection, decontamination - working for Emergency services (Fire services) - involved in exposure assessment by: Monitoring, At scene sampling for air, water, soil; Detection and identification, Analytical laboratory, Risk characterisation for air - focused on: Source, Pathways - hazmat instructor - working for Emergency services (Fire services) - involved in exposure assessment by: Monitoring, Detection and identification, Risk characterisation for air; At scene sampling for water, soil - focused on: Source
II. Environmental monitoring and modelling capabilities in Member States
- environmental monitoring carried out **during** and **after** major chemical incidents
- the national authorities supervising: - environmental monitoring: Ministry of Environment (or equal authority) - public health exposure characterisation: Ministry of Health (or equal authority), Other (Ministry of Labour)
- monitoring at the incident scene carried out by: - National Hazmat teams (for public health and environment protection) (matrices: air, water, soil) - Fire and rescue services (for public health protection) (matrices: air) - Environmental protection services (for environment protection) (matrices: air, water, soil) - Health protection services (for public health and occupational health protection) (matrices: air, water, soil, crops/food)
- the nature of the monitoring resource availability and the capability: - Within the emergency exclusionary Zone / for emergency response / dedicated 24/7 (air) - Within the emergency exclusionary Zone / for emergency response but not a dedicated 24/7 service (air, water, soil, crops/food) - Off site(9) for assessing public exposure / dedicated 24/7 (air) - Off site for assessing public exposure but not a dedicated 24/7 service (air, water, soil, crops/food)
- the nature of the modelling availability and the capability: - Local models for air, water, soil, crops/food - Dispersion models by meteorological experts for air

- national Hazmat teams to support exposure assessment organised within national fire and rescue
    - the output of national Hazmat teams' activity:
        - We have regional HAZMAT teams (24/7) for first response - limited air monitoring, leakage stopping and one team with advanced detection capabilities (not 24/7)
        - identification of most common hazardous gases, measuring concentration of propane, ammonia etc
    - the receiver of their output - Fire and rescue services for initial public health and environmental protection; incident commander; residents

- back office service for onsite Hazmat advisors to support exposure assessment – NO

- Hazmat sampling teams – within national Hazmat teams and as separate units

- resources and equipment available for sampling:
    - Procedures (surface water; soil; air; particulate matter, powder)
    - Self made sampling kit (surface water; soil; air; particulate matter, powder)
    - Specific technical equipment (drinking, surface and ground water; soil; air; food; vegetation; debris; particulate matter, powder)

- resource/equipment available for detection and identification:
    - within regional resource: Detection tubes
    - within national resources: Raman spectroscopy, IMS, PID, Detection tubes, IR spectroscopy, GC – techniques (GC, GC-MS, GC-MS-MS)
    - equipment deployed at/near scene of incident: ?
    - equipment deployed at nearby locations (e.g. sensitive receptors, sheltering place): ?

- an interdisciplinary procedure for sampling, detection, identification and monitoring: YES/NO for air, water, soil; YES for food/crops

- mobile detection and identification equipment NOT available for: water, soil, crops/food

- national laboratory network exists for air, water, soil and crop/food

- When exposure assessment is performed, the analysis results are compared to: Acute Exposure Guideline Levels and Other guidance values (IDLH, ERPG, TWA 15 min and 8 h)

- the data deriving from DIM (Detection, Identification, Monitoring) activities carried on incident site are forwarded to: (and health risk assessment is undertaken by:)
    - Fire and rescue service at local, regional and national level
    - Environmental protection officials at regional and national level.
    - Public health officials at regional and national level
    - Food safety officials at national level

- additional information gathered during the acute phase of a chemical incident (needed for exposure assessment) by:
    - fire and rescue service:
        - Short characterisation of the place of release (closed building, open air etc.)
        - Potentially exposed population (kind, size)

- Type of the substance - Quantity released - Meteorological (weather) conditions - Observations / notifications (e.g. smell, deposition etc.) - Analytical data - health service - Exposed population – health effects - environmental protection service: - Potentially exposed grounds / crops / facilities etc.) - site operator: - Type of the substance - Quantity released
- using risk mapping (GIS mapping) systems available in Estonia it is possible to gather information about: - Land use (agriculture, residential, industry area etc.) - Population size - Population type (possible identification of susceptible populations near the incident location)
- airborne dispersion models available – provided by non meteorological experts
- water borne dispersion models available
- available outputs of environmental modelling: - Chemical concentrations in the air - Chemical concentrations in water - Deposition
III. Cross-border cooperation in case of chemical incident
- arrangements on international collaboration in case of a major chemical incident – yes with: Finland, Latvia, Sweden and other (Russia) information/data exchange ?
- mobile laboratories' functions (available in your country) support the international response to chemical incidents (Environmental protection services have mobile air laboratories, rescue service has one mobile detection unit)
- availability of a risk mapping (GIS mapping) system which shows receptors (potentially affected persons) in neighbouring countries ?
- dispersion models available for Estonia and for neighbouring countries - the same models
- the "source" country's dispersion modelling will / will not be used on both sides of the border ?
- water borne dispersion models available / not available for Estonia and for neighbouring countries ?
- the "source" country's water borne dispersion modelling will / will not be used on both sides of the border ?

Exposure assessment in chemical incident response – FINLAND (Response Count: 1)
I. Professional background of the respondent(s)
Chemist, main task assessing human exposure to hazardous compounds (9/34 qs not answered) - working for National government department/agency - involved in exposure assessment by: Monitoring, Analytical laboratory (soil, crops/food, other); Identification of affected groups, Coordination of exposure assessment (We do exposure assessment by analyzing concentrations in human matrices) - focused on: Source, Pathways
II. Environmental monitoring and modelling capabilities in Member States
- environmental monitoring carried out **after** major chemical incidents
- the national authorities supervising: - environmental monitoring: Ministry of Environment (or equal authority) - public health exposure characterisation: Ministry of Health (or equal authority)
- monitoring at the incident scene carried out by: - Fire and rescue services (for public health protection) (matrices: air, water, soil) - Site operator resources (chemical rescue team) (for environment protection) (matrices: air, water, soil) - Health protection services (for public health and occupational health protection) (matrices: air, water, soil, crops/food)
- the nature of the monitoring resource availability and the capability: - Within the emergency exclusionary Zone / for emergency response but not a dedicated 24/7 service (air, water, soil)
- the nature of the modelling availability and the capability: - Dispersion models by meteorological experts for air - Water dispersion modelling for water
- national Hazmat teams to support exposure assessment ? - the output of national Hazmat teams' activity: ? - the receiver of their output: ?
- back office service for onsite Hazmat advisors to support exposure assessment – YES
- Hazmat sampling teams – as separate units
- resources and equipment available for sampling: - Procedures (drinking, surface and ground water; soil; food, vegetation; particulate matter, powder) - Commercial off the shelf sampling kit (air; particulate matter, powder)
- resource/equipment available for detection and identification: - within local resources: IR spectroscopy, UV-Vis spectroscopy, AAS-techniques (FAAS, GFAAS), GC – techniques (GC, GC-MS, GC-MS-MS), LC-techniques (LC-MS, LC-MS-MS), HPLC - within regional resource: ICP – techniques (ICP-AES, ICP-MS)

- within national resources: Raman spectroscopy - equipment deployed at/near scene of incident: Detection tubes - equipment deployed at nearby locations (e.g. sensitive receptors, sheltering place): -
- an interdisciplinary procedure for sampling, detection, identification and monitoring: ?
- mobile detection and identification equipment NOT available for: soil, crops/food
- national laboratory network exists for air, water, soil and crop/food
- When exposure assessment is performed, the analysis results are compared to: ?
- the data deriving from DIM (Detection, Identification, Monitoring) activities carried on incident site are forwarded to: (and health risk assessment is undertaken by:) - Fire and rescue service at local level - Environmental protection officials at local, regional and national level - Public health officials at local, regional and national level - Food safety officials at local, regional and national level

- additional information gathered during the acute phase of a chemical incident (needed for exposure assessment) by:
- fire and rescue service:
  - Short characterisation of the place of release (closed building, open air etc.)
  - Potentially exposed population (kind, size)
  - Type of the substance
  - Quantity released
  - Exposed population – health effects
  - Meteorological (weather) conditions
  - Observations / notifications (e.g. smell, deposition etc.)
- health service
  - Potentially exposed population (kind, size)
  - Type of the substance
  - Quantity released
  - Exposed population – health effects
  - Analytical data
- environmental protection service:
  - Short characterisation of the place of release (closed building, open air etc.)
  - Potentially exposed grounds / crops / facilities etc.)
  - Type of the substance
  - Quantity released
  - Meteorological (weather) conditions
  - Observations / notifications (e.g. smell, deposition etc.)

- site operator:
  - Short characterisation of the place of release (closed building, open air etc.)
  - Potentially exposed grounds / crops / facilities etc.)
  - Type of the substance
  - Quantity released
  - Meteorological (weather) conditions
  - Observations / notifications (e.g. smell, deposition etc.)

- using risk mapping (GIS mapping) systems available in Finland it is possible to gather information about:
  - Land use (agriculture, residential, industry area etc.)
  - Population size
  - Population type (possible identification of susceptible populations near the incident location)

- airborne dispersion models available – provided by meteorological experts
- water borne dispersion models available

- available outputs of environmental modelling:
  - Chemical concentrations in the air
  - Chemical concentrations in water
  - Deposition

III. Cross-border cooperation in case of chemical incident
- arrangements on international collaboration in case of a major chemical incident – yes, not specified with whom information/data exchange ?
- mobile laboratories' functions (available in your country) support the international response to chemical incidents (There are mobile labs in the military)
- availability of a risk mapping (GIS mapping) system which shows receptors (potentially affected persons) in neighbouring countries ?
- dispersion models available for Finland and for neighbouring countries - not compatible ones
- the "source" country's dispersion modelling will be used on both sides of the border
- water borne dispersion models available / not available for Finland and for neighbouring countries ?
- the "source" country's water borne dispersion modelling will / will not be used on both sides of the border ?

Exposure assessment in chemical incident response – FRANCE (Response Count: 3+interview)
I. Professional background of the respondent(s)
Job description: During crisis - expertise on response techniques suitable, risk assessment and other tasks directly linked to the incident. *(12/34 qs not answered)* - working for Other - involved in exposure assessment by: Monitoring, At scene sampling, Data assessing, Risk characterisation (air, water, crops/food); Detection and identification, Analytical laboratory, Identification of affected groups, Coordination of exposure assessment (water, crops/food); Modelling (air, water); Other (To give the opinion of Cedre on the response deployed) - focused on: Source, Pathways study engineer, GIS and help decision tool management - working for Environmental services - involved in exposure assessment by: Detection and identification, Data assessing, Modelling, Risk characterisation (air, water); Monitoring (water); - focused on: Receptors national epidemiologist : public health officer involved in preparedness to post-disaster response *(14/34 qs not answered)* - working for National government department/agency, Federal or provincial government department/agency - involved in exposure assessment by: Risk characterisation (air, water; soil, crops/food, other); other (health effects monitoring among exposed population or concerning the area where the event happened) - focused on: Pathways, Receptors
II. Environmental monitoring and modelling capabilities in Member States
- information flow: 1st to arrive is fire services (who'll monitor if acute emergency) and they call local government who calls local environment office (DREAL). Local government calls the regional health authority IRS(?) who has an alert cell. The National Public Health Institute is informed by them. National PH institute, DREAL and INERIS work very closely together in emergency cell in which data gets exchanged. Prefecture has leaded if there is an emergency. There are usually problems with info. flow. The environment institutes don't always give the data to the public health institutes. They are now busy making plans how best to share data.
- environmental monitoring carried out **during** and **after** major chemical incidents
- the national authorities supervising: - environmental monitoring: Ministry of Environment (or equal authority), other (Firemen (Ministry of Interior and for some regions Defence)) - public health exposure characterisation: Ministry of Health (or equal authority), Ministry of Defence (or equal authority)
- monitoring at the incident scene carried out by: - National Hazmat teams (matrices: air, water) - Fire and rescue services (for public health, environment and occupational health protection) (matrices: air, water) - Environmental protection services (for environment protection) (matrices: air, water, soil, crops/food)

- Site operator resources (chemical rescue team) (matrices: air, water, soil)
- Health protection services (for public health and environment protection) (matrices: air, water)
- Other (special team in INERIS in construction) (for public health and environment protection)

- the nature of the monitoring resource availability and the capability:
  - Within the emergency exclusionary Zone / for emergency response / dedicated 24/7 (air, water, soil)
  - Within the emergency exclusionary Zone / for emergency response but not a dedicated 24/7 service (water)
  - Other (biomonitoring in emergency : relevance to be analysed and eventually structured in France) (air, water, soil, crops/food)

- repeated environmental monitoring available for public health purposes (air and water)
- substances continuously monitored for public health purposes in the air: O_3 NO_2 PM black smoke CO
- the 'owner' and the recipient of the monitoring data / commission of environmental monitoring for exposure assessment - local agency of air monitoring owns data and sends to National Public Health Institute, who also receives data on water. Also the regional agencies of the Ministry of health receive data.
- the data used / shared to inform public health risk assessment - to monitor risk. Air quality data is compared with e.g. hospital emergencies, visits to casualty. Water quality is compared with e.g. cases of gastrointeritis.
- time needed to obtain the data - For continuous monitoring data: air data received daily; health data received the day after, sometimes the same day.

- the nature of the modelling availability and the capability:
  - Local models for air, water
  - Dispersion models by meteorological experts for air, water
  - Water dispersion modelling for air, water, crops/food

- environmental modelling in the case of major chemical incident carried out by INERIS working closely with meteorological services for health and risk assessment and environment.
- the model can account for ingress of plumes and safety factors for those sheltering.
- airborne dispersion modelling based upon complex dispersion model accounting for mixing layer, surface topography, plume buoyancy and deposition etc.
- modelling can (probably)predict the environmental concentrations of a given chemical release (Including deposition)

- national Hazmat teams to support exposure assessment organised within national fire and rescue service
  - the output of national Hazmat teams' activity: Civil protection
  - the receiver of their output: French Government

- back office service for onsite Hazmat advisors to support exposure assessment – YES

- Hazmat sampling teams – within national Hazmat teams and as separate units

- resources and equipment available for sampling:
  - Procedures (drinking, surface and ground water; soil; air; food, vegetation; debris; particulate matter, powder)

  I don't know the details of sampling kits availability among different teams : firemen, hazmat team (different services don't know each other)

- resource/equipment available for detection and identification: - within local resources: ? - within regional resource: ? - within national resources: ? - equipment deployed at/near scene of incident: ? - equipment deployed at nearby locations (e.g. sensitive receptors, sheltering place): ?
- an interdisciplinary procedure for sampling, detection, identification and monitoring for air, water, soil, food/crops
- mobile detection and identification equipment NOT available for: ?
- national laboratory network exists for air, water, soil and crop/food
- When exposure assessment is performed, the analysis results are compared to: Acute Exposure Guideline Levels, Other guidance values (examples not provided)
- the data deriving from DIM (Detection, Identification, Monitoring) activities carried on incident site are forwarded to: (and health risk assessment is undertaken by:) - Fire and rescue service at local, regional and national level - Environmental protection officials at local, regional and national level - Public health officials at local, regional and national level - Food safety officials at local, regional and national level current difficulties for data sharing among various services
- the lead organisation for provision of public health advice in case of chemical incident - The local health authority/local government is lead. If the incident takes place at regional level, the Prefecture brings all the parties together. The Prefet is in charge to inform at the national level.

- additional information gathered during the acute phase of a chemical incident (needed for exposure assessment) by:
- fire and rescue service:
    - Short characterisation of the place of release (closed building, open air etc.)
    - Potentially exposed population (kind, size)
    - Type of the substance
    - Observations / notifications (e.g. smell, deposition etc.)
- health service
    - Short characterisation of the place of release (closed building, open air etc.)
    - Potentially exposed population (kind, size)
    - Exposed population – health effects
    - Observations / notifications (e.g. smell, deposition etc.)
- environmental protection service:
    - Short characterisation of the place of release (closed building, open air etc.)
    - Potentially exposed grounds / crops / facilities etc.)

- Type of the substance - Quantity released - Meteorological (weather) conditions - Observations / notifications (e.g. smell, deposition etc.) - site operator: - Short characterisation of the place of release (closed building, open air etc.) - Type of the substance - Quantity released - Observations / notifications (e.g. smell, deposition etc.) local governmental service in charge of the global management of the event in France: prefecture
- using risk mapping (GIS mapping) systems available in France it is possible to gather information about: - Land use (agriculture, residential, industry area etc.) - Population size - Population type (possible identification of susceptible populations near the incident location) - The vulnerable zones (populations at risk/sensitive receptors)
- airborne dispersion models available – provided by meteorological and non meteorological experts
- water borne dispersion models available
- available outputs of environmental modelling: - Chemical concentrations in the air - Chemical concentrations in water
- no standardised geographical registration of complaints of the effects of chemical incidents (e.g. complaints of odour nuisance, health complaints) - databases of previous incidents with good practices of exposure assessment - incidents are registered by Ministry of environment
III. Cross-border cooperation in case of chemical incident
- arrangements on international collaboration in case of a major chemical incident – yes, not specified with whom information/data exchange ?
- in case of a cross-border incident ministries of health would exchange information for scientific public health interpretation to incident command and for public messages
- data shared with neighbouring countries could be misinterpreted due to: - Different scientific rationales for monitoring and modelling - Different rationales for public health decision making – for example different criteria for shelter / evacuate or for warning the public. - Unfamiliarity with neighbouring regions capabilities - Lack of understanding of neighbouring response structures - Lack of suitable contacts with peer organisations in neighbouring countries - Different exposure assessment guidance values

- mobile laboratories' functions (available in your country) support the international response to chemical incidents
- a risk mapping (GIS mapping) system which shows receptors (potentially affected persons) in neighbouring countries not available
- dispersion models available for France and for neighbouring countries - compatible ones – i.e. the basis and outputs are similar
- the "source" country's dispersion modelling will/will not be used on both sides of the border ?
- water borne dispersion models available / not available for France and for neighbouring countries ?
- the "source" country's water borne dispersion modelling will / will not be used on both sides of the border ?
- risk assessors are able to share plans, information with colleagues in neighbouring countries, are able to access translation services with some understanding of public health, science, emergency response. They are not aware of response, particularly public health systems and resources in neighbouring countries.

Exposure assessment in chemical incident response - GERMANY (Response Count: 3+interview)

I. Professional background of the respondent(s)

Job description: My task is the support of the operations headquarters in accidents with chemical, radiological materials. *(10/34 qs not answered)*

- working for Emergency services (Fire services)
- involved in exposure assessment by: At scene sampling (air, water; soil); Detection and identification, Data assessing, Risk characterisation (air)
- focused on: Source

Superior Fire Service Officer/Emergency control and disaster management chief

- working for Emergency services (Fire services), Emergency services (Ambulance services)
- involved in exposure assessment by: At scene sampling, Detection and identification, Data assessing, Modelling, Risk characterisation, Identification of affected groups, Coordination of exposure assessment (air, water; soil)
- focused on: Receptors

Chief CBRN *(6/34 qs not answered)*

- working for Emergency services (Fire services)
- involved in exposure assessment by: Monitoring, At scene sampling, Detection and identification, Data assessing, Modelling (air, water); Analytical laboratory, Risk characterisation, Identification of affected groups, Coordination of exposure assessment (air)
- focused on: Source

II. Environmental monitoring and modelling capabilities in Member States

- information flow: The information flow in case of a chemical incident is in Germany on the different levels (municipality, province, district and the land) regulated in the same way.

In Germany also first the fire brigade is being called. The police and the fire brigade are going on the spot. The emergency room is the central point like in the Netherlands and Belgium. There can always be problems and the information flow can be stopped somewhere, but in general the information flow is well regulated.

- environmental monitoring carried out **during** and **after** major chemical incidents

- the national authorities supervising:
    - environmental monitoring: Ministry of Environment (or equal authority), Ministry of Health (or equal authority)
    - public health exposure characterisation: Ministry of Environment (or equal authority), Ministry of Health (or equal authority)

- monitoring at the incident scene carried out by:
    - National Hazmat teams (for public health, environment and occupational health protection) (matrices: air, water, soil)
    - Fire and rescue services (for public health, environment and occupational health protection) (matrices: air, water, soil)
    - Environmental protection services (for public health and environment protection) (matrices: air, water, soil, crops/food)
    - Site operator resources (chemical rescue team) (for public health and environment protection) (matrices: air, water, soil)

- Health protection services (for public health protection) (matrices: air, water, soil, crops/food)
- the nature of the monitoring resource availability and the capability: - Within the emergency exclusionary Zone / for emergency response / dedicated 24/7 service (air, water, soil) - Within the emergency exclusionary Zone / for emergency response but not a dedicated 24/7 service (water, soil, crops/food) - Off site for assessing public exposure but not a dedicated 24/7 service (air, water, soil, crops/food) - monitoring data used / shared to inform public health risk assessment
- the nature of the modelling availability and the capability: - Local models for air, water, soil - Dispersion models by meteorological experts for air - Water dispersion modelling for water - other for soil, crops/food - environmental modelling in the case of major chemical incident carried out by fire and rescue services for risk assessment and environment - software used: Hommel, ALOHA
- national Hazmat teams to support exposure assessment organised within national fire and rescue service and as separate/independent units - the output of national Hazmat teams' activity: Sampling and analysing - the receiver of their output: Fire Services (local incidents), local government (regional incidents) / fire department, police, administration
- back office service for onsite Hazmat advisors to support exposure assessment – YES
- Hazmat sampling teams – within national Hazmat teams
- resources and equipment available for sampling: - Procedures (drinking, surface and ground water; soil; air; food, vegetation; debris; particulate matter, powder) - Commercial off the shelf sampling kit (drinking, surface and ground water; soil; air; food, vegetation; debris; particulate matter, powder) - Specific technical equipment (drinking, surface and ground water; soil; air; food, vegetation; debris; particulate matter, powder)
- resource/equipment available for detection and identification: - within local resources: IMS, PID, Detection tubes - within regional resource: Raman spectroscopy, IMS, PID, Detection tubes, IR spectroscopy, UV-Vis spectroscopy, AAS-techniques (FAAS, GFAAS), XRF, AES, ICP – techniques (ICP-AES, ICP-MS), GC – techniques (GC, GC-MS, GC-MS-MS), LC-techniques (LC-MS, LC-MS-MS), HPLC

- within national resources: ? - equipment deployed at/near scene of incident: Raman spectroscopy, IMS, PID, Detection tubes - equipment deployed at nearby locations (e.g. sensitive receptors, sheltering place): IMS, PID
- an interdisciplinary procedure for sampling, detection, identification and monitoring for air, water, soil
- mobile detection and identification equipment NOT available for: crop/food
- national laboratory network exists for air, water, soil and crop/food
- When exposure assessment is performed, the analysis results are compared to: Acute Exposure Guideline Levels
- the data deriving from DIM (Detection, Identification, Monitoring) activities carried on incident site are forwarded to: (and health risk assessment is undertaken by:) - Fire and rescue service at local, regional and national level - Environmental protection officials at local, regional and national level - Public health officials at local, regional and national level - Food safety officials at local, regional and national level
- the lead organisation for provision of public health advice in case of chemical incident - On the local scale this will be the municipal health service.

- additional information gathered during the acute phase of a chemical incident (needed for exposure assessment) by:
- fire and rescue service:
    - Short characterisation of the place of release (closed building, open air etc.)
    - Potentially exposed population (kind, size)
    - Potentially exposed grounds / crops / facilities etc.)
    - Type of the substance
    - Quantity released
    - Exposed population – health effects
    - Meteorological (weather) conditions
    - Observations / notifications (e.g. smell, deposition etc.)
    - Analytical data
- health service
    - Short characterisation of the place of release (closed building, open air etc.)
    - Potentially exposed population (kind, size)
    - Potentially exposed grounds / crops / facilities etc.)
    - Type of the substance
    - Quantity released
    - Exposed population – health effects
    - Observations / notifications (e.g. smell, deposition etc.)
    - Analytical data

- environmental protection service:
    - Short characterisation of the place of release (closed building, open air etc.)
    - Potentially exposed population (kind, size)
    - Potentially exposed grounds / crops / facilities etc.)
    - Type of the substance
    - Quantity released
    - Meteorological (weather) conditions
    - Observations / notifications (e.g. smell, deposition etc.)
    - Analytical data
- site operator:
    - Short characterisation of the place of release (closed building, open air etc.)

- using risk mapping (GIS mapping) systems available in Germany it is possible to gather information about:
    - Land use (agriculture, residential, industry area etc.)
    - Population size
    - Population type (possible identification of susceptible populations near the incident location)
    - The vulnerable zones (populations at risk/sensitive receptors)

- airborne dispersion models available – provided by meteorological and non meteorological experts
- water borne dispersion models available

- available outputs of environmental modelling:
    - Chemical concentrations in the air
    - Chemical concentrations in water
    - Deposition
Chemical concentrations in the air (answer from the fire services); other concentrations from other experts / departments.

- no standardized geographical registration of complaints of the effects of chemical incidents (e.g. complaints of odour nuisance, health complaints) - no databases of previous incidents with good practices of exposure assessment
III. Cross-border cooperation in case of chemical incident
- arrangements on international collaboration in case of a major chemical incident – yes (There is an agreement between the Netherlands and the region NordRhein-Westfalen at first responder level. This agreement however is not always ‘filled’ with ‘life’. The Emric+-project probably will change this.) - information/data exchange ?
- information flow: In general there are some appointments and arrangements. In practice however this doesn’t work optimal. With the help of the Emric+-project we hope to give the cooperation between Germany, Belgium and the Netherlands is case of cross-border incidents a new basis. The appointments are on the level of the fire-brigade. In case of CBRN-incidents there are no appointments between the countries.
- data shared with neighbouring countries could be misinterpreted due to:

- Language - Different scientific rationales for monitoring and modelling - Different rationales for public health decision making – for example different criteria for shelter / evacuate or for warning the public. - Unfamiliarity with neighbouring regions capabilities - Lack of understanding of neighbouring response structures - Lack of suitable contacts with peer organisations in neighbouring countries - Different exposure assessment guidance values interviewee suggestion: the above mentioned problems are worked on in the Emric+-project. The aim of the project is to strengthen the cooperation between the countries. Therefore there will be an analysis of the mentioned aspects. Our idea is that in all European cross-border regions small projects like Emric+ will help to strengthen the cross border cooperation. The advantage of these small projects is the fact that the people that need to cooperate in the incident itself will get to know each other. The general appointments on the National Level need to be carry out at the incident spot. This can only work well when the people who need to work together know each other and have already practise together.
- probably no restrictions on data exchange across borders
- mobile laboratories' functions (available in your country) support/do not support the international response to chemical incidents ? - Mobile monitoring units are able / willing to cross borders according to wind direction to make best use of resource.
- a risk mapping (GIS mapping) system which shows receptors (potentially affected persons) in neighbouring countries not available
- dispersion models not available for Germany and for neighbouring countries
- the "source" country's dispersion modelling will not be used on both sides of the border
- water borne dispersion models not available for Germany and for neighbouring countries
- the "source" country's water borne dispersion modelling will not be used on both sides of the border
- risk assessors are able to share plans, information with colleagues in neighbouring countries, are aware of response, particularly public health systems and resources in neighbouring countries, are able to understand the neighbouring countries risk assessment procedures and acute response trigger levels. - Risk characterisation is integrated on both sides of the border, with an agreed assessment and if possible common messages.

An example of successful exposure assessment in a cross-border chemical incident:
A fire in a perfume factory in Kerkrade (in the Netherlands) (a powerpoint-presentation will be mailed). This was a success because the people know each other!

Exposure assessment in chemical incident response – GREECE (Response Count 2)
I. Professional background of the respondent(s)
Chemical engineer expert in risk assessment - working for National government department/agency - involved in exposure assessment by: Modelling, Risk characterisation (air) - focused on: Source studying, planning, organizing and coordinating actions for the prevention of major-accident hazards involving dangerous substances and the response to relevant major accident. *(26/34 qs not answered)* - working for National government department/agency - involved in exposure assessment by: Other (When an accident with hazard releases happens, the Civil Protection Operation Centre is informed and coordinates the actions aiming at emergency response in order to ensure the population and environment protection. Also when a major-accident involving dangerous substances happens, the General Emergency Plan (Major Industrial Accidents Response Plan) (SATAME), which was drown up under the coordination of the General Secretariat for Civil Protection and approved by the General Secretary for Civil Protection, is activated. This plan, among others, refers to the necessary actions of each involved public agency during all steps of the accident.) - focused on: Source, Pathways, Receptors
II. Environmental monitoring and modelling capabilities in Member States
- information flow during chemical incident: Civil Protection, Ministry of Interior, National Chemical Agency
- environmental monitoring carried out **after** major chemical incidents
- the national authorities supervising: - environmental monitoring: Ministry of Environment (or equal authority), Other (Ministry of Rural Development and Food; HQ of Harbour Body-Greek Coast guard) - public health exposure characterisation: Ministry of Health, Social Solidarity and Food (or equal authority), Other (Ministry of Rural Development; HQ of Harbour Body-Greek Coast guard)
- monitoring at the incident scene carried out by: - National Hazmat teams (matrices: air, water, soil, crops/food) - Fire and rescue services (for public health, environment and occupational health protection) - Environmental protection services (for environment protection) - Site operator resources (chemical rescue team) (for occupational health protection) - Health protection services (for public health protection)
- - the nature of the monitoring resource availability and the capability: ?
- the nature of the modelling availability and the capability: - Dispersion models by meteorological experts and experts from National Chemical Agency for air

- national Hazmat teams to support exposure assessment organised within national fire and rescue service - the output of national Hazmat teams' activity: In case of an accident or a threatened incident, in the General Secretariat of Civil Protection is convoked the Supporting Team for the management of CBRN Threats and Incidents, in order to supply specialized know-how and scientific information for the management of chemical, biological, radiological and nuclear incidents. - the receiver of their output: Civil protection and the relevant bodies of Government
- back office service for onsite Hazmat advisors to support exposure assessment – Civil Protection Operations Centre and experts from Agencies
- Hazmat sampling teams – within Fire Service, National Chemical Agency, Atomic Energy Agency and HCDC (Hellenic centre for Diseases Control and Prevention)
- resources and equipment available for sampling: ?
- resource/equipment available for detection and identification: YES from police department
- an interdisciplinary procedure for sampling, detection, identification and monitoring – YES from C.P. National Plan
- mobile detection and identification equipment NOT available for: ?
- national laboratory network exists for air, water, soil and crop/food
- When exposure assessment is performed, the analysis results are compared to: ?
- the data deriving from DIM (Detection, Identification, Monitoring) activities carried on incident site are forwarded to: (and health risk assessment is undertaken by:) - Fire and rescue service at local, regional level - Environmental protection officials at national level - Public health officials at national level - Food safety officials at national level
- additional information gathered during the acute phase of a chemical incident (needed for exposure assessment) by: ?
- using risk mapping (GIS mapping) systems available in Greece it is possible to gather information about: - Land use (agriculture, residential, industry area etc.) - Population size - Population type (possible identification of susceptible populations near the incident location) - The vulnerable zones (populations at risk/sensitive receptors)
- airborne dispersion models available
- water borne dispersion models available
- available outputs of environmental modelling: - Chemical concentrations in the air - Chemical concentrations in water - Deposition
III. Cross-border cooperation in case of chemical incident

- arrangements on international collaboration in case of a major chemical incident with Bulgaria and Turkey - information/data exchange with Bulgaria, Cyprus, Italy
- mobile laboratories' functions (available in your country) do not support the international response to chemical incidents ?
- risk mapping (GIS mapping) system which shows receptors (potentially affected persons) in neighbouring countries – not available
- dispersion models available for Greece and for neighbouring countries - compatible ones – i.e. the basis and outputs are similar
- the "source" country's dispersion modelling will / will not be used on both sides of the border - ?
- water borne dispersion models available for Greece and for neighbouring countries - compatible ones
- the "source" country's water borne dispersion modelling will be used on both sides of the border
An example of successful exposure assessment in cross-border chemical incident: Until now there was no major chemical incident

Exposure assessment in chemical incident response - HUNGARY (Response Count: 2)
I. Professional background of the respondent(s)
Air Quality Reference Centre - working for National government department/agency - involved in exposure assessment by: Monitoring, At scene sampling, Data assessing (air) - focused on: Pathways …… *(13/34 qs not answered)* - working for National government department/agency - involved in exposure assessment by: Monitoring, At scene sampling, Data assessing, Modelling, Analytical laboratory (air) - focused on: Source, Pathways
II. Environmental monitoring and modelling capabilities in Member States
- environmental monitoring carried out **during** and **after** major chemical incidents
- the national authorities supervising: - environmental monitoring: Ministry of Environment (or equal authority) - public health exposure characterisation: Ministry of Health (or equal authority), Ministry of Defence (or equal authority)
- monitoring at the incident scene carried out by: - National Hazmat teams (for public health protection) (matrices: air) - Environmental protection services (for environment protection) (matrices: air, water, soil) - Health protection services (for public and occupational health protection) (matrices: air)
- the nature of the monitoring resource availability and the capability: - Within the emergency exclusionary Zone / for emergency response / dedicated 24/7 service (air) - Off site for assessing public exposure but not a dedicated 24/7 service (air)
- the nature of the modelling availability and the capability: - Local models for air - Dispersion models by meteorological experts for air
- national Hazmat teams to support exposure assessment - NO - the output of national Hazmat teams' activity: ? - the receiver of their output: ?
- back office service for onsite Hazmat advisors to support exposure assessment – YES
- Hazmat sampling teams – as separate units
- resources and equipment available for sampling: - Procedures (air; particulate matter, powder) - Specific technical equipment (air; particulate matter, powder)

- resource/equipment available for detection and identification: - within regional resource: PID, Detection tubes, IR spectroscopy, UV-Vis spectroscopy, AAS-techniques (FAAS, GFAAS), ICP – techniques (ICP-AES, ICP-MS), GC – techniques (GC, GC-MS, GC-MS-MS) - within national resources: Detection tubes, IR spectroscopy, UV-Vis spectroscopy, AAS-techniques (FAAS, GFAAS), - equipment deployed at/near scene of incident: Raman spectroscopy, IMS, PID, Detection tubes - equipment deployed at nearby locations (e.g. sensitive receptors, sheltering place): IMS, PID
- an interdisciplinary procedure for sampling, detection, identification and monitoring for air, water
- mobile detection and identification equipment NOT available for: ?
- national laboratory network exists for air, water
- When exposure assessment is performed, the analysis results are compared to: Acute Exposure Guideline Levels
- the data deriving from DIM (Detection, Identification, Monitoring) activities carried on incident site are forwarded to: (and health risk assessment is undertaken by:) - Fire and rescue service at local, regional and national level - Environmental protection officials at local, regional and national level - Public health officials at local, regional and national level

- additional information gathered during the acute phase of a chemical incident (needed for exposure assessment) by:
- fire and rescue service:
    - Meteorological (weather) conditions
- health service
    - Meteorological (weather) conditions
- environmental protection service:
    - Quantity released
    - Meteorological (weather) conditions
    - Analytical data
- site operator:
    - Meteorological (weather) conditions

- using risk mapping (GIS mapping) systems available in Greece it is possible to gather information about: ?
- airborne dispersion models available - provided by meteorological experts
- water borne dispersion models availability – ?
- available outputs of environmental modelling: - Chemical concentrations in the air - Deposition
III. Cross-border cooperation in case of chemical incident
- arrangements on international collaboration in case of a major chemical incident: ?

- information/data exchange - ?
- mobile laboratories’ functions (available in your country) support the international response to chemical incidents
- availability of a risk mapping (GIS mapping) system which shows receptors (potentially affected persons) in neighbouring countries - ?
- dispersion models available for Hungary and for neighbouring countries - the same models
- the “source” country’s dispersion modelling will / will not be used on both sides of the border - ?
- water borne dispersion models available/not available for Hungary and for neighbouring countries - ?
- the “source” country’s water borne dispersion modelling will / will not be used on both sides of the border ?

Exposure assessment in chemical incident response - IRELAND (Response Count: 3 + 2 interviews)

I. Professional background of the respondent(s)

Meteorologist *(13/34 qs not answered)*

- working for National government department/agency
- involved in exposure assessment by: Data assessing, Modelling (air)
- focused on: Pathways

Medical doctor (Public Health Medicine) *(7/34 qs not answered)*

- working for Health services
- involved in exposure assessment by: Data assessing, Risk characterisation, Identification of affected groups, Coordination of exposure assessment (air, water, soil, crops/food)
- focused on: Source, Pathways, Receptors

……

- working for Emergency services (Fire services)
- involved in exposure assessment by: Detection and identification (air)
- focused on: Source

II. Environmental monitoring and modelling capabilities in Member States

- information flow: Provide on request basic trajectory models for chemical dispersion and meteorological inputs for local dispersion models. Modelling scale is more suitable for radiological or disease vector dispersion modelling. Cross boundary dispersion modelling would typically utilise network of European regional specialist centres - e.g. UK Met Office at Exeter. Information flows well particularly between Met Offices.
- information flow: Incident response would initially be with Fire and Rescue Service / Police and upon escalation to Major Emergency Management 'MEM' framework would have typically a local or national government coordinated response. Comms within first hour may be by Police (Garda), thereafter MEM nominated sole spokesperson.

- environmental monitoring carried out **during** and **after** major chemical incidents

- the national authorities supervising:
  - environmental monitoring: Ministry of Environment (or equal authority)
  - public health exposure characterisation: Ministry of Health (or equal authority)

- monitoring at the incident scene carried out by:
  - Fire and rescue services (matrices: air)
  - Environmental protection services (for public health and environment protection) (matrices: air, water, soil, crops/food)
  - Site operator resources (chemical rescue team) (for occupational health protection)
  - Health protection services (for public and occupational health protection) (matrices: water, crops/food)
  - Other (Teagasc- under the Department of Agriculture a government agency would sample soil and crops, Food Safety Authority, set up by statute reports to the Minister for Health, would sample food as indicated) (for public and occupational

health protection) (matrices: soil, crops/food)
- the nature of the monitoring resource availability and the capability: - Within the emergency exclusionary Zone / for emergency response / dedicated 24/7 service (air) - Off site for assessing public exposure but not a dedicated 24/7 service (air, water, soil, crops/food)
- environmental monitoring / analysis equipment used or commissioned for environmental purposes: AIR (Some Local Authorities and Environmental Protection Agency have Air Quality monitors (PM, SOx, NOx). No dedicated mobile incident response for air quality.); WATER (Environmental Protection Agency); DEPOSITION / LAND (Environmental Protection Agency or Teagasc / Department of Agriculture) - repeated environmental monitoring not available – Possible but no dedicated emergency response continuous monitoring service is routinely available on callout for public, occupational health or environmental purposes. - the substances continuously monitored for public health purposes: SOx, NOx PM - typically data is provided discontinuously - Agency providing / commissioning monitoring data is the owner of the data. Recipients are within MEM framework. - data used / shared to inform public health risk assessment via MEM framework - time needed to obtain the data for risk assessment purposes: No dedicated service. All arrangements are ad hoc. There may be significant delays.
- the nature of the modelling availability and the capability: - Local models for air - environmental modelling in the case of major chemical incident, for risk assessment, carried out by Met Eireann - upon request. Also local models (e.g. ALOHA) available within Emergency Response units in larger Local Authorities with Seveso sites. - software used: No dedicated Met Office small scale resource. ALOHA has been used, particularly in Emergency Planning with Seveso sites. - source term (rate of release) information is provided by Fire and Rescue Service / Site Operator. Typically only used quantitatively for Emergency Planning. - modelling restrictions: Modelling is not a dedicated service and the Met Eireann model scale does not have the granularity for e.g. immediate sheltering area predictions. - the model does not account for ingress of plumes and safety factors for those sheltering. - meteorological dispersion modelling based upon complex dispersion model accounting for mixing layer, surface topography, plume buoyancy and deposition, though limited by 2.5 km grid spacing. - modelling can predict the environmental concentrations of a given chemical release, though limited by 2.5 km grid spacing. Deposition is calculated by Radiation Protection Institute.
- national Hazmat teams to support exposure assessment - NO - the output of national Hazmat teams' activity: ? - the receiver of their output: ?
- back office service for onsite Hazmat advisors to support exposure assessment – NO
- Hazmat sampling teams NO
- resources and equipment available for sampling:

- Procedures (drinking, surface and ground water; soil; air; food, vegetation; particulate matter, powder) - Specific technical equipment (drinking water; air; food, particulate matter, powder)
- resource/equipment available for detection and identification: - within local resources: ? - within regional resource: ? - within national resources: ? - equipment deployed at/near scene of incident: Detection tubes - equipment deployed at nearby locations (e.g. sensitive receptors, sheltering place): ?
- an interdisciplinary procedure for sampling, detection, identification and monitoring NO
- mobile detection and identification equipment NOT available for: air, water, soil, crops/food
- national laboratory network exists for air, water, soil, crops/food
- When exposure assessment is performed, the analysis results are compared to: Acute Exposure Guideline Levels; International standards as per US homeland Security PAC site
- the data deriving from DIM (Detection, Identification, Monitoring) activities carried on incident site are forwarded to: (and health risk assessment is undertaken by:) - Fire and rescue service at local level - Environmental protection officials at local, regional and national level - Public health officials at local, regional and national level - Food safety officials at local, regional and national level - Other (Ad hoc regional or national group may be convened to include public health officials) at regional and national level
the lead organisation for provision of public health advice in case of chemical incident? (and are they the one that gets the data) (differ by air, food, water, land) - Typically defined by MEM framework - PH implications led by HSE. Also Local Authorities, Environmental Protection Agency and Food Safety Authority of Ireland.

- additional information gathered during the acute phase of a chemical incident (needed for exposure assessment) by:
- fire and rescue service:
  - Short characterisation of the place of release (closed building, open air etc.)
  - Potentially exposed population (kind, size)
  - Type of the substance
  - Quantity released
  - Meteorological (weather) conditions
  - Observations / notifications (e.g. smell, deposition etc.)
- health service
  - Potentially exposed population (kind, size)
  - Potentially exposed grounds / crops / facilities etc.)
  - Type of the substance

- Quantity released - Exposed population – health effects - Observations / notifications (e.g. smell, deposition etc.) - Analytical data - environmental protection service: - Short characterisation of the place of release (closed building, open air etc.) - Potentially exposed grounds / crops / facilities etc.) - Type of the substance - Quantity released - Observations / notifications (e.g. smell, deposition etc.) - Analytical data - site operator: - Short characterisation of the place of release (closed building, open air etc.) - Potentially exposed population (kind, size) - Type of the substance - Quantity released - Meteorological (weather) conditions - Observations / notifications (e.g. smell, deposition etc.) - Analytical data Fire and rescue service on site in conjunction with site operator would assess situation, assisted by ERG (Emergency Response Guidebook for first responders) to set the distance for the danger zone etc, a best estimate
- using risk mapping (GIS mapping) systems available in Greece it is possible to gather information about: - Land use (agriculture, residential, industry area etc.) - Population size - Population type (possible identification of susceptible populations near the incident location) - The vulnerable zones (populations at risk/sensitive receptors) - Not applicable (we do not use risk mapping system)
- airborne dispersion models available - provided by meteorological and non meteorological experts (+ 1 answer no)
- water borne dispersion models availability – ?
- available outputs of environmental modelling: - Chemical concentrations in the air
- no standardised geographical registration of complaints of the effects of chemical incidents (e.g. complaints of odour nuisance, health complaints) - no databases of previous incidents with good practices of exposure assessment
III. Cross-border cooperation in case of chemical incident

- arrangements on international collaboration in case of a major chemical incident with United Kingdom (at first responder and national level) - mutual aid + for some services contracts with agencies with more dedicated services (HPA). For Large cross border incidents requiring coordination with UK & EU would take place. - information/data exchange - in case of Met offices - information is shared / accessible.
- information flow: from a Meteorological perspective, information flow is good. Would like to develop a modelling capability on a scale sufficiently granular for most chemical incidents - e.g. on par with UK NAME model and Chemet outputs.
- practical exchange of monitoring data in case of a cross-border incident: Site operator if available, EPA or Local Authority particulate monitoring team (or less common: DIM team if available from Northern Ireland FRS or Irish Military) send data as agreed within MEM framework to HSE for public health. Data send when available. - practical exchange of modelling data in case of a cross-border incident: Met Eireann or local Emergency Response unit, UK Met Office send data to MEM - HSE (RepIreland), PHA (NI), HPA (Eng&Wales). Data send when available. - practical exchange of data in case of a cross-border incident for scientific public health interpretation to incident command - HSE (RepIreland), PHA (NI), HPA (Eng&Wales) send data to MEM - Multiagency Coordination Group. Data send when available. - practical exchange of data in case of a cross-border incident for public messages - As agreed within MEM framework - mandated as a single message / messenger for all agencies send data to media when available.
- Misinterpretation of the data shared with neighbouring countries not expected
- restrictions on data exchange across borders - Detection Identification and Monitoring equipment is mainly held by military in Ireland and would typically deploy for deliberate CBRN rather than monitoring for public health.
- mobile laboratories' functions (available in your country) do not support the international response to chemical incidents - Mobile monitoring units are not able / willing to cross borders according to wind direction to make best use of resource.
- a risk mapping (GIS mapping) system which shows receptors (potentially affected persons) in neighbouring countries NOT available
- dispersion models available for Ireland and for neighbouring countries - NO
- the "source" country's dispersion modelling will not be used on both sides of the border
- water borne dispersion models available/not available for Ireland and for neighbouring countries - ?
- the "source" country's water borne dispersion modelling will / will not be used on both sides of the border ?
- risk assessors are able to share plans, information with colleagues in neighbouring countries, are aware of response, particularly public health systems and resources in neighbouring countries. - Risk characterisation is integrated on both sides of the border, with an agreed assessment and if possible common messages (typically have joint teleconferences to ensure information shared and message agreed) - modelling capability is very different across border, public health messages are less well informed, but similar. - GIS systems are not integrated / do not maintain some cross border functionality.
- the compatibility between neighbour's models - For a transnational plume (e.g. Chernobyl / Volcanoes / some forest fires) modelling is done by Specialist Meteorological centres such as UK EMARC.

An example of successful exposure assessment in a cross-border chemical incident:

Disease vector spread - e.g. foot and mouth and volcano ash. To this success contributed: agreed data validity and public health messages

Exposure assessment in chemical incident response – ITALY (Response count: 2)
I. Professional background of the respondent(s)
Clinical Microbiology (national reference centre for bio-emergency) *(8/34 qs not answered)* - working for Health services and Other - involved in exposure assessment by: Monitoring, At scene sampling, Detection and identification, Modelling, Analytical laboratory (water, crops/food, other) Data assessing, Risk characterisation, Identification of affected groups, Coordination of exposure assessment (other) - focused on: Source, Pathways, Receptors Job descriptions: risk assessment pesticides and chemicals - working for Health services - involved in exposure assessment by: Monitoring, At scene sampling, Detection and identification (air); Data assessing, Modelling, Risk characterisation, Identification of affected groups (air, water, soil, crops/food) Coordination of exposure assessment (air, crops/food) - focused on: Source, Pathways, Receptors
II. Environmental monitoring and modelling capabilities in Member States
- environmental monitoring carried out **during** and **after** major chemical incidents
- the national authorities supervising: - environmental monitoring: Ministry of Environment (or equal authority) - public health exposure characterisation: Ministry of Health (or equal authority)
- monitoring at the incident scene carried out by: - Fire and rescue services (for public health and environment protection) (matrices: air, water) - Environmental protection services (for public health and environment protection) (matrices: air, water, soil, crops/food) - Health protection services (for public and occupational health protection) (matrices: air)
- the nature of the monitoring resource availability and the capability: - Within the emergency exclusionary Zone / for emergency response / dedicated 24/7 service (air, water, soil, crops/food) - Off site for assessing public exposure but not a dedicated 24/7 service (air, water, soil, crops/food)
- the nature of the modelling availability and the capability: - Local models for air, water, soil, crops/food - Dispersion models by meteorological experts for air, water, soil, crops/food - Water dispersion modelling for air, water, soil, crops/food
- national Hazmat teams to support exposure assessment organised as separate/independent units - the output of national Hazmat teams' activity: ? - the receiver of their output: ?

- back office service for onsite Hazmat advisors to support exposure assessment – NO
- Hazmat sampling teams organised as separate units
- resources and equipment available for sampling: - Procedures (drinking, surface and ground water; soil; air; food, vegetation; debris; particulate matter, powder) - Commercial off the shelf sampling kit (drinking, surface and ground water; soil; air; food, vegetation; debris; particulate matter, powder) - Specific technical equipment (drinking, surface and ground water; soil; air; food, vegetation; debris; particulate matter, powder)
- resource/equipment available for detection and identification: - within local resources: IMS, Detection tubes, IR spectroscopy, UV-Vis spectroscopy, XRF, ICP – techniques (ICP-AES, ICP-MS), GC – techniques (GC, GC-MS, GC-MS-MS), LC-techniques (LC-MS, LC-MS-MS), HPLC - within regional resource: IMS, Detection tubes, IR spectroscopy, UV-Vis spectroscopy, XRF, ICP – techniques (ICP-AES, ICP-MS), GC – techniques (GC, GC-MS, GC-MS-MS), LC-techniques (LC-MS, LC-MS-MS), HPLC - within national resources: IMS, Detection tubes, IR spectroscopy, UV-Vis spectroscopy, XRF, ICP – techniques (ICP-AES, ICP-MS), GC – techniques (GC, GC-MS, GC-MS-MS), LC-techniques (LC-MS, LC-MS-MS), HPLC - equipment deployed at/near scene of incident: Detection tubes, HPLC - equipment deployed at nearby locations (e.g. sensitive receptors, sheltering place): HPLC
- an interdisciplinary procedure for sampling, detection, identification and monitoring for air and soil
- mobile detection and identification equipment NOT available for: air, water, soil, crops/food
- national laboratory network exists for air, water, soil
- When exposure assessment is performed, the analysis results are compared to: Acute Exposure Guideline Levels
- the data deriving from DIM (Detection, Identification, Monitoring) activities carried on incident site are forwarded to: (and health risk assessment is undertaken by:) - Environmental protection officials at local, regional and national level - Public health officials at local, regional and national level - Food safety officials at local, regional and national level

- additional information gathered during the acute phase of a chemical incident (needed for exposure assessment) by:
- fire and rescue service:
    - Short characterisation of the place of release (closed building, open air etc.)
    - Type of the substance
    - Quantity released
    - Observations / notifications (e.g. smell, deposition etc.)
- health service
    - Short characterisation of the place of release (closed building, open air etc.)
    - Potentially exposed population (kind, size)

  - Type of the substance
  - Quantity released
  - Exposed population – health effects
  - Observations / notifications (e.g. smell, deposition etc.)
  - Analytical data
- environmental protection service:
  - Short characterisation of the place of release (closed building, open air etc.)
  - Potentially exposed grounds / crops / facilities etc.)
  - Meteorological (weather) conditions
- site operator:
  - Short characterisation of the place of release (closed building, open air etc.)
  - Potentially exposed grounds / crops / facilities etc.)
  - Type of the substance
  - Quantity released
  - Observations / notifications (e.g. smell, deposition etc.)

- using risk mapping (GIS mapping) systems available in Greece it is possible to gather information about:
  - Land use (agriculture, residential, industry area etc.)
  - Population size
  - Population type (possible identification of susceptible populations near the incident location)
  - The vulnerable zones (populations at risk/sensitive receptors)

- airborne dispersion models available - provided by meteorological and non meteorological experts

- water borne dispersion models available

- available outputs of environmental modelling:
  - Chemical concentrations in the air
  - Chemical concentrations in water
  - Deposition

III. Cross-border cooperation in case of chemical incident

- arrangements on international collaboration in case of a major chemical incident YES (not specified with whom)
- information/data exchange - ?

- mobile laboratories' functions (available in your country) do not support the international response to chemical incidents

- a risk mapping (GIS mapping) system which shows receptors (potentially affected persons) in neighbouring countries ?

- dispersion models available for Italy and for neighbouring countries - the same models

- the "source" country's dispersion modelling will be used on both sides of the border

- water borne dispersion models available for Italy and for neighbouring countries - the same models / not compatible ones

- the "source" country's water borne dispersion modelling will / will not be used on both sides of the border YES/NO

Exposure assessment in chemical incident response - LATVIA (Response count: 1+interview)
I. Professional background of the respondent(s)
Job description: civil defence to protect inhabitant from chemical accidents *(5/34 qs not answered)* - working for Emergency services (Fire services) - involved in exposure assessment by: Detection and identification, Data assessing, Modelling (air) - focused on: Source
II. Environmental monitoring and modelling capabilities in Member States
the information flow in case of a chemical incident: The State fire and rescue service (SFRS) territorial unit informs the Operational management board of SFRS, the local State Police unit, ambulance service, environment service and the chief of local Government in case of a chemical incident in according to the State civil protection plan. The Operational management board of SFRS report to the chief of SFRS and Minister of Interior. The Minister of Interior informs the Prime Minister. The Prime Minister calls together The Crisis Management Council in the case of the regional or state of chemical incident. This the information flow occurs easily and according to plan
- environmental monitoring carried out **during** and **after** major chemical incidents
- the national authorities supervising: - environmental monitoring: Ministry of Environment (or equal authority), Ministry of Health (or equal authority) - public health exposure characterisation: Ministry of Environment (or equal authority), Ministry of Health (or equal authority)
- monitoring at the incident scene carried out by: - Fire and rescue services (for public and occupational health protection) (matrices: air) - Environmental protection services (for public health and environment protection) (matrices: air, water, soil) - Site operator resources (chemical rescue team) (matrices: air)
- the nature of the monitoring resource availability and the capability: - Within the emergency exclusionary Zone / for emergency response / dedicated 24/7 service (air) - Within the emergency exclusionary Zone / for emergency response but not a dedicated 24/7 service (water, soil) - Off site for assessing public exposure / dedicated 24/7 (air)
- repeated environmental monitoring available; done by Ministry of Health (public health purposes), Ministry of the Environment (for environmental and occupational health purposes); dangerous chemical substances – continuously monitored - the 'owner' of the monitoring data - Ministry of the Environment. - data used / shared to inform public health risk assessment - from 1-2 hours and more to obtain the data
- the nature of the modelling availability and the capability: - Local models for air, water - Dispersion models by meteorological experts for air - Water dispersion modelling for water

- environmental modelling in the case of major chemical incident carried out by health protection services (health assessment), fire and rescue services (risk assessment), environmental protection services (environment) - software used: ALOHA (Areal Locations of Hazardous Atmospheres); program developed by the U.S. Environmental Protection Agency. This program includes database of 77 acutely toxic and 63 flammable and volatile substances, and this program can be used for objects which are subject to the relevant U.S. Law. Program allows an approximate risk and consequence analysis. This program has been simplified as much as possible, which allows you to get an immediate picture of the chemical distribution. - source term (rate of release) information come from the incident scene and the operational manager provides this. - modelling restrictions: the increasing number of new substances. - the predicted air concentrations and deposition rates on sensitive receptors with time are not calculated - the model can not account for ingress of plumes and safety factors for those sheltering - modelling can not predict the environmental concentrations of a given chemical release (Including deposition) - risk assessors from neighbouring countries are likely to correctly understand other countries data and suitably characterise the risk
- national Hazmat teams to support exposure assessment organised within national fire and rescue service - the output of national Hazmat teams' activity: Report detection, identification and monitoring results, provide chemical advice to responders. - the receiver of their output: Initially emergency responders
- back office service for onsite Hazmat advisors to support exposure assessment – NO
- Hazmat sampling teams: YES, as separate units
- resources and equipment available for sampling: - Procedures (drinking, surface and ground water; soil; air; food, vegetation; debris; particulate matter, powder) - Commercial off the shelf sampling kit (drinking, surface and ground water; soil; air; food, vegetation; debris; particulate matter, powder)
- resource/equipment available for detection and identification: - within local resources: - - within regional resources: IR spectroscopy - within national resources: IR spectroscopy, UV-Vis spectroscopy, AAS-techniques (FAAS, GFAAS), GC – techniques (GC, GC-MS, GC-MS-MS), LC-techniques (LC-MS, LC-MS-MS), HPLC - equipment deployed at/near scene of incident: - - equipment deployed at nearby locations (e.g. sensitive receptors, sheltering place): IR spectroscopy
- an interdisciplinary procedure for sampling, detection, identification and monitoring for air, water, soil, food/crops
- mobile detection and identification equipment NOT available for: crops/food
- national laboratory network exists for air, water, soil, crops/food
- When exposure assessment is performed, the analysis results are compared to: Acute Exposure Guideline Levels
- the data deriving from DIM (Detection, Identification, Monitoring) activities carried on incident site are forwarded to: (and health risk assessment is undertaken by:)

- Public health officials at national level
- the lead organisation for provision of public health advice in case of chemical incident – Ministry of Health
- additional information gathered during the acute phase of a chemical incident (needed for exposure assessment) by: - fire and rescue service: - Short characterisation of the place of release (closed building, open air etc.) - Potentially exposed population (kind, size) - Analytical data - health service - Potentially exposed population (kind, size) - Exposed population – health effects - Analytical data - environmental protection service: - Type of the substance - Quantity released - Meteorological (weather) conditions - Observations / notifications (e.g. smell, deposition etc.) - Analytical data - site operator: - Potentially exposed population (kind, size) - Potentially exposed grounds / crops / facilities etc.) - Type of the substance - Quantity released - Observations / notifications (e.g. smell, deposition etc.) - Analytical data
- using risk mapping (GIS mapping) systems available in Greece it is possible to gather information about: - Land use (agriculture, residential, industry area etc.) - Population size - Population type (possible identification of susceptible populations near the incident location) - The vulnerable zones (populations at risk/sensitive receptors)
- airborne dispersion models available - provided by meteorological experts
- water borne dispersion models available
- available outputs of environmental modelling: - Chemical concentrations in the air - Chemical concentrations in water - Deposition

- no standardised geographical registration of complaints of the effects of chemical incidents (e.g. complaints of odour nuisance, health complaints) - databases of previous incidents with good practices of exposure assessment –YES
III. Cross-border cooperation in case of chemical incident
- arrangements on international collaboration in case of a major chemical incident with Estonia, Lithuania, Russia and Belarus. These agreements contain procedures, plans and general statements of collaboration and help (agreements at the first respondent level and national level). - information/data exchange with Estonia, Lithuania, Sweden and Belarus
- information flow: The State fire and rescue service (SFRS) territorial unit informs the Operational management board of SFRS, the local State Police unit, ambulance service, environment service and the chief of local Government in case of a cross - border chemical incident. The Operational management board of SFRS report to the chief of SFRS, Minister of Interior and the operational management board in affected country. The Minister of Interior informs the Prime Minister. The Prime Minister calls together The Crisis Management Council. The Ministry of Foreign informs the embassy of affected country about chemical disaster. The information flow occurs easily and according to plan.
- practical exchange of monitoring data in case of a cross-border incident: SFRS sends data to the operational management board in affected country immediately. - practical exchange of modelling data in case of a cross-border incident: National armed forces send data to the operational management board in affected country during the emergency. - practical exchange of data in case of a cross-border incident for scientific public health interpretation to incident command: Ministries of Health exchange the data during the emergency. - practical exchange of data in case of a cross-border incident for public messages: Ministries of Foreign Affairs exchange the data during the emergency.
- data shared with neighbouring countries could be misinterpreted due to: - Language - Different scientific rationales for monitoring and modelling - Unfamiliarity with neighbouring regions capabilities - Lack of understanding of neighbouring response structures - Lack of suitable contacts with peer organisations in neighbouring countries - Different exposure assessment guidance values - interviewees' suggestion: We need to organise more international exercises.
- restrictions on data exchange across borders - Military information; The some specific data (dangerous object, maps) exchanges with Russia and Belarus.
- mobile laboratories' functions (available in your country) do not support the international response to chemical incidents - Mobile monitoring units are not able / willing to cross borders according to wind direction to make best use of resource.
- a risk mapping (GIS mapping) system which shows receptors (potentially affected persons) in neighbouring countries ?
- dispersion models available for Latvia and for neighbouring countries - ?

- the “source” country’s dispersion modelling will not be used on both sides of the border
- water borne dispersion models available for Latvia and for neighbouring countries - ?
- the “source” country’s water borne dispersion modelling will / will not be used on both sides of the border ?
- risk assessors are able to share plans, information with colleagues in neighbouring countries. - risk assessors are not aware of response, particularly public health systems and resources in neighbouring countries, are not able to understand the neighbouring countries risk assessment procedures and acute response trigger levels, are not able to access translation services with some understanding of public health, science, emergency response. - dispersion modelling is not equivalent and cross validated / the differences are not understood and the public health messages on each side of the border are not suitably balanced. - GIS systems are not integrated / do not maintain some cross border functionality. - GIS systems are not capable of accessing / importing dispersion models of neighbouring countries - GIS have not the capability to show receptors in neighbouring countries - Risk characterisation is not integrated on both sides of the border, with an agreed assessment and if possible common messages.
An example of successful exposure assessment in a cross-border chemical incident: We had only one a cross - border chemical incident - oil products pollution in the Daugava river from Belarus. November 3, 1990 Novopolotsk chemical factory "Polimir" leaked into the environment for about 24 tons of Addiction. As a factory employee negligence, as well as fatal randomness due to toxic substance in the local river came the Daugava River, which destroyed large quantities of fish and other aquatic animals such as Belarus, as well as Latvian territory. The accident was successfully liquidated. Factors contributing to the success: the good international cooperation for the support of technical equipment and expert and information exchange.

Exposure assessment in chemical incident response – LITHUANIA (Response Count: 2 - second respondent skipped all the questions+interview)
I. Professional background of the respondent(s)
advice on all aspects of public health protection in case of chemical emergency. *(14/34 qs not answered)* - working for National government department/agency, Health services - involved in exposure assessment by: Data assessing, Identification of affected groups, Coordination of exposure assessment, Risk characterisation (matrices: air, water, soil, crops food) - focused on: Source, Pathways and Receptors
II. Environmental monitoring and modelling capabilities in Member States
Information flow: The fire & rescue service will inform officer on duty of Centre for Health emergencies. He will inform the centre director & the relevant official. The relevant official will organise the public health care activities e.g.: coordination of hospital care. The poison control centre is part of Centre for Health emergencies. Health risk assessment is partly done by the fire service partly by the Centre for health emergencies. The municipal Public Health bureaus are responsible for health monitoring after the event. There are 11 Public health centres at County level. It depends on the severity of the incident, whether they are involved. There is a new document for emergency risk assessment in Lithuanian National Health System (already put into practice). They've done a lot of exercises and information flow is not a problem.
- environmental monitoring carried out **during and after** major chemical incidents
- the national authorities supervising: - environmental monitoring: Ministry of Environment (or equal authority) - public health exposure characterisation: Ministry of Health (or equal authority)
- monitoring at the incident scene carried out by: - Environmental protection services (for public health and environment protection) (matrices: air, water, soil) - Health protection services (for public health protection) (matrices: air) - Other (State Food and Veterinary service) (for public health protection) (matrices: water, food/crops)
- the nature of the monitoring resource availability and the capability: (?)
- the nature of the modelling availability and the capability: (?)
- national Hazmat teams to support exposure assessment – responsibility of fire fighters
- back office service for onsite Hazmat advisors to support exposure assessment (?)
- Hazmat sampling teams within national Hazmat teams
- resources and equipment available for sampling: (?)
- resource/equipment available for detection and identification: (?)
- an interdisciplinary procedure for sampling, detection, identification and monitoring: (?)

- mobile detection and identification equipment NOT available for (?)
- a national laboratory network exists/ does not exist (?)
- When exposure assessment is performed, the analysis results are compared to (?)
- the data deriving from DIM (Detection, Identification, Monitoring) activities carried on incident site are forwarded to: (and health risk assessment is undertaken by:) - Public health officials at national level
- the lead organisation for provision of public health advice in case of chemical incident- Municipal Centre for Public Health or county Public Health Centre depending on severity

- additional information gathered during the acute phase of a chemical incident (needed for exposure assessment) by:
- fire and rescue service
  - Short characterisation of the place of release (closed building, open air etc.)
  - Type of the substance
  - Quantity released
  - Meteorological (weather) conditions
  - Observations / notifications (e.g. smell, deposition etc.)
- health service
  - Potentially exposed population (kind, size)
  - Type of the substance
  - Exposed population – health effects
  - Meteorological (weather) conditions
  - Observations / notifications (e.g. smell, deposition etc.)
  - Analytical data
- environmental protection service
  - Type of the substance
  - Meteorological (weather) conditions
  - Observations / notifications (e.g. smell, deposition etc.)
- site operator (?)

- using risk mapping (GIS mapping) systems available in Lithuania it is possible to gather information about: Not applicable (we do not use risk mapping system)
- airborne dispersion models available (?)
- water borne dispersion models are available/not available in Lithuania (?)
- available outputs of environmental modelling: - Chemical concentrations in the air and water
- standardised geographical registration of complaints of the effects of chemical incidents (e.g. complaints of odour nuisance, health

complaints) – YES (The public can ask questions and file complaints at the County Public Health Centre. The country level gets support from national level where necessary. The public can also call the officer on duty at the Centre for Health Emergencies of the Ministry of Health where the interviewee works. The registers are at national and county level) - no databases of previous incidents with good practices of exposure assessment - There is a chemical incident register per county Public Health Centre, though not with good practices. Emergency Prevention Division is informed by the county Centres
III. Cross-border cooperation in case of chemical incident
- arrangements on international collaboration in case of a major chemical incident: yes with Russia, Belarus, Hungary, Poland, Germany, Ukraine, Sweden, Latvia
- information flow coordinated by the fire and rescue service at national level (Ministry of the Interior)
- data shared with neighbouring countries could be misinterpreted due to: - Different scientific rationales for monitoring and modelling - Different rationales for public health decision making – for example different criteria for shelter / evacuate or for warning the public. - Unfamiliarity with neighbouring regions capabilities - Lack of understanding of neighbouring response structures - Lack of suitable contacts with peer organisations in neighbouring countries - Different exposure assessment guidance values
- mobile laboratories' functions (available in Lithuania) support the international response to chemical incidents (?)
- we have/have not a risk mapping (GIS mapping) system which shows receptors (potentially affected persons) in neighbouring countries (?)
- dispersion models available/not available for Lithuania and for neighbouring countries(?)
- the "source" country's dispersion modelling will/will not be used on both sides of the border (?)
- water borne dispersion models available/not available for Lithuania and for neighbouring countries: compatible ones (?)
- the "source" country's water borne dispersion modelling will/will be used on both sides of the border (?)
- risk assessors are able to share plans, information with colleagues in neighbouring countries

Exposure assessment in chemical incident response – LUXEMBOURG (Response Count: 1)
I. Professional background of the respondent(s)
Person involved in crisis prevention, crisis response preparation, coordination in crisis situation - working for National government department/agency - involved in exposure assessment by: Detection and identification, Modelling, Risk characterisation and Coordination of exposure assessment (matrices: air, water, soil, crops food and other) - focused on: (?)
II. Environmental monitoring and modelling capabilities in Member States
- environmental monitoring carried out **during and after** major chemical incidents
- the national authorities supervising: - environmental monitoring: Ministry of Environment (or equal authority) - public health exposure characterisation: Ministry of Health (or equal authority)
- monitoring at the incident scene carried out by: - Fire and rescue services (for public and occupational health) (matrices: air, water, soil and other) - Environmental protection services (for public health and environment protection) (matrices: air, water, soil and other) - Health protection services (for public and occupational health protection) (matrices: air, water, soil, crops/food and other)
- the nature of the monitoring resource availability and the capability: - Within the emergency exclusionary Zone / for emergency response but not a dedicated 24/7 service (matrices: air, water, soil, crops food and other) - Off site for assessing public exposure but not a dedicated 24/7 service (matrices: air, water, soil and other)
- the nature of the modelling availability and the capability: - Dispersion models by meteorological experts for air - Water dispersion modelling for water - Not applicable for soil and food/crops
- lack of national Hazmat teams to support exposure assessment within national fire and rescue service
- lack of back office service for onsite Hazmat advisors to support exposure assessment
- Hazmat sampling teams (?)
- resources and equipment available for sampling: (?)
- resource/equipment available for detection and identification: (?)
- an interdisciplinary procedure for sampling, detection, identification and monitoring: (?)
- mobile detection and identification equipment NOT available for (?)
- a national laboratory network **does not** exist for air, water, soil, crops/food

- When exposure assessment is performed, the analysis results are compared to (?)
- the data deriving from DIM (Detection, Identification, Monitoring) activities carried on incident site are forwarded to (and health risk assessment is undertaken by): (?)
- additional information gathered during the acute phase of a chemical incident (needed for exposure assessment) by: (?)
- using risk mapping (GIS mapping) systems available in Luxembourg it is possible to gather information about: Not applicable (we do not use risk mapping system)
- airborne dispersion models available/not available (?)
- water borne dispersion models are available/not available in Luxembourg (?)
- available outputs of environmental modelling (?)
III. Cross-border cooperation in case of chemical incident
- arrangements on international collaboration in case of a major chemical incident: - exist Countries: (?)
- mobile laboratories' functions (available in Luxembourg) support the international response to chemical incidents (?)
- we **have not** a risk mapping (GIS mapping) system which shows receptors (potentially affected persons) in neighbouring countries
- dispersion models available/not available for Luxembourg and for neighbouring countries(?)
- the "source" country's dispersion modelling will/will not be used on both sides of the border (?)
- water borne dispersion models available/not available for Luxembourg and for neighbouring countries: compatible ones (?)
- the "source" country's water borne dispersion modelling will/will be used on both sides of the border (?)

Exposure assessment in chemical incident response – POLAND (Response Count: 2+interview)
I. Professional background of the respondent(s)
specialist in operating department and fireman: - working for Emergency services (Fire services) and other - involved in exposure assessment by: Monitoring and Risk characterisation (matrices: air), Modelling (matrices: water, soil, crops food) - focused on: Source and Receptors
II. Environmental monitoring and modelling capabilities in Member States
- two level communication - on first respondents level and administrative level (decisions made on site by first respondents - FRS is in charge of the whole action) - FRS informs (if needed - victims) the local Police, ambulance service and environment service - in case of major accidents - local crisis management centres inform local authority and crisis management centre on the national level - good information flow
- environmental monitoring carried out **during and after** major chemical incidents
- the national authorities supervising: - environmental monitoring and public health exposure characterisation: Ministry of Environment (or equal authority), Ministry of Health (or equal authority)
- monitoring at the incident scene carried out by: - National Hazmat teams (for public health) (matrices: air) - Fire and rescue services (for public health) (matrices: air, water, soil) - Environmental protection services (for public health and environment protection) (matrices: air, water, soil) - Health protection services (for occupational health protection) (matrices: air, water, soil, crops/food) - Not applicable - Other
- the nature of the monitoring resource availability and the capability: - Within the emergency exclusionary Zone / for emergency response / dedicated 24/7(matrices: air) - Off site for assessing public exposure / dedicated 24/7(matrices: air)
- repeated environmental monitoring done by GIS (Chief Sanitary Inspectorate under Ministry of Health) (for occupational health purposes), GIOS (Chief Inspectorate of Environmental Protection under Ministry of Environment) (for environment and public health purposes); they own the data - GIS continuously monitors carcinogens; dangerous substances with OELs (occupational health purposes); GIOS - sulphur, nitrogen and carbon oxides; benzene; ozone; dust PM10, PM2,5; Pb; Arsene; Cadmium; Nickel; benzo(a)pyrene (for public health purposes) and sulphur, nitrogen and carbon oxides; ozone (for environmental purposes)

- the nature of the modelling availability and the capability: - Local models for air - Dispersion models by meteorological experts for air - Water dispersion modelling for water - environmental modelling in the case of major chemical incident carried out by fire and rescue services (risk assessment), environmental protection services (environment) / health assessment - if biological threat - sanitary inspection (for chemical incidents - lack of methodology and procedures - but would be desirable) - software used: among others ALOHA (Areal Locations of Hazardous Atmospheres) - source term (rate of release) information come from the incident scene and is provided by operational staff (manager)
- national Hazmat teams to support exposure assessment within national fire and rescue service - the output of national Hazmat teams' activity: Report detection, monitoring results; hazmat teams is a part of fire service - the receiver of their output: emergency responders
- back office service for onsite Hazmat advisors to support exposure assessment NO
- Hazmat sampling teams within national Hazmat teams
- resources and equipment available for sampling: - Procedures for drinking water, surface water, ground water, soil, air, food, vegetation, debris and particulate matter, powder - Specific technical equipment for drinking water, surface water, ground water, soil, air.
- resource/equipment available for detection and identification: - within local resources: Detection tubes - regional resources: Raman spectroscopy, PID, Detection tubes, IR spectroscopy, UV-Vis spectroscopy, AAS-techniques (FAAS, GFAAS), AES, ICP–techniques (ICP-AES, ICP-MS), GC-techniques (GC, GC-MS, GC-MS-MS), HPLC - within national resources: PID, IR spectroscopy, HPLC - equipment deployed at/near scene of incident: Raman spectroscopy, Detection tubes, IR spectroscopy - equipment deployed at nearby locations: Raman spectroscopy, Detection tubes, IR spectroscopy
- an interdisciplinary procedure for sampling, detection, identification and monitoring: - exists for air, soil - does not exist for water, food/crops
- mobile detection and identification equipment NOT available for: soil, crops/food
- a national laboratory network exists for air, water, soil, crops/food
- When exposure assessment is performed, the analysis results are compared to (?)
- the data deriving from DIM (Detection, Identification, Monitoring) activities carried on incident site are forwarded to: (and health risk assessment is undertaken by:) - Fire and rescue service at local, regional level - Environmental protection officials at local, regional and national level - Public health officials at regional level

- Food safety officials at regional level

- additional information gathered during the acute phase of a chemical incident (needed for exposure assessment) by:
- fire and rescue service
    - Short characterisation of the place of release (closed building, open air etc.)
    - Potentially exposed population (kind, size)
    - Potentially exposed grounds / crops / facilities etc.
    - Type of the substance
    - Quantity released
    - Exposed population – health effects
    - Meteorological (weather) conditions
    - Observations / notifications (e.g. smell, deposition etc.)
    - Analytical data
- health service
    - Potentially exposed population (kind, size)
    - Type of the substance
    - Quantity released
    - Exposed population – health effects
    - Observations / notifications (e.g. smell, deposition etc.)
    - Analytical data
- environmental protection service
    - Potentially exposed grounds / crops / facilities etc.
    - Type of the substance
    - Quantity released
    - Meteorological (weather) conditions
    - Observations / notifications (e.g. smell, deposition etc.)
    - Analytical data
- site operator
    - Type of the substance
    - Quantity released
    - Exposed population – health effects

- using risk mapping (GIS mapping) systems available in Poland it is possible to gather information about: Land use (agriculture, residential, industry area etc.), Population size
- airborne dispersion models available – provided by meteorological and non meteorological experts
- water borne dispersion models are available/not available in Poland

- available outputs of environmental modelling: - Chemical concentrations in the air and water - Deposition
- standardised geographical registration of complaints of the effects of chemical incidents (e.g. complaints of odour nuisance, health complaints) not available - databases of previous incidents with good practices of exposure assessment – databases YES (KCKRiOL, GIOS) (but with no good practises analysis)
III. Cross-border cooperation in case of chemical incident
- arrangements on international collaboration in case of a major chemical incident: - with all neighbouring countries including certain procedures of collaboration; - plans and protocols prepared in both languages / procedures continuously trained by firefighters; agreements with EU countries at first respondent level, with Ukraine and Belarus at national level
- information flow: In case of a cross - border chemical incident the local crisis management centre receives the information from FRS respondents and reports to the national crisis management centre (KCKRiOL) - good information flow
- data shared with neighbouring countries could be misinterpreted due to: - Different rationales for public health decision making – for example different criteria for shelter / evacuate or for warning the public - Different exposure assessment guidance values
- mobile laboratories' functions (available in Poland) support the international response to chemical incidents (?) - Mobile monitoring units are able / willing to cross borders according to wind direction to make best use of resource.
- we do **not have** a risk mapping (GIS mapping) system which shows receptors (potentially affected persons) in neighbouring countries
- dispersion models available/not available for Poland and for neighbouring countries(?)
- the "source" country's dispersion modelling will/will not be used on both sides of the border (?)
- water borne dispersion models available/not available for Poland and for neighbouring countries: compatible ones (?)
- the "source" country's water borne dispersion modelling will/will be used on both sides of the border (?)
- risk assessors are able to share plans, information with colleagues in neighbouring countries, are aware of response, particularly public health systems and resources in neighbouring countries, are able to understand the neighbouring countries risk assessment procedures and acute response trigger levels
- dispersion modelling is not equivalent and cross validated / the differences are not understood and the public health messages on each side of the border may not be suitably balanced.

Exposure assessment in chemical incident response – PORTUGAL (Response Count:4)

I. Professional background of the respondent(s)

Volunteer Firefighter / IT Consultant for the Volunteer Fire Service *(1/34 qs not answered)*
- working for Emergency services (Fire services) and Emergency services (Ambulance services)
- involved in exposure assessment by: Monitoring, Detection and identification (matrices: air), Modelling and Risk characterisation (matrices: air, water, soil)
- focused on: Source, Pathways and Receptors

Volunteer Firefighter *(0/34 qs not answered)*
- working for Emergency services (Fire services)
- involved in exposure assessment by: Detection and identification (matrices: air), Risk characterisation (matrices: air, water, soil)
- focused on: Source

Safety Engineer; Emergency Manager *(5/34 qs not answered)*
- working for Military, Emergency services (Fire services) and Other
- involved in exposure assessment by: Detection and identification and Risk characterisation (matrices: air, water, soil), Modelling and Identification of affected groups (matrices: air)
- focused on: Source, Pathways

Planning Officer in Fire Department: *(10/34 qs not answered)*
- working for Emergency services (Fire services)
- involved in exposure assessment by: At scene sampling, Risk characterisation (matrices: air, water, soil), Detection and identification and Coordination of exposure assessment (matrices: air, water, soil, crops/food), Identification of affected groups (matrices: air, water)
- focused on: Source and Receptors

II. Environmental monitoring and modelling capabilities in Member States

- environmental monitoring carried out **during and after** major chemical incidents

- the national authorities supervising:
  - environmental monitoring: Ministry of Environment (or equal authority), Ministry of Defence (or equal authority), Ministry of Health (or equal authority) and Other
  - public health exposure characterisation: Ministry of Environment (or equal authority), Ministry of Health (or equal authority) and Other
  - Other: Civil Protection Agents; Some Official Institutes for certain cases (radiological survey, for example)

- monitoring at the incident scene carried out by:
  - National Hazmat(7) teams (for public health, occupational health and environment protection) (matrices: air, water, soil, crops/food)
  - Fire and rescue services (for public health, occupational health and environment protection) (matrices: air, water, soil)

- Environmental protection services (for public health, occupational health and environment protection) (matrices: air, water, soil, crops/food) - Site operator resources (chemical rescue team) (for public health and environment protection) (matrices: air, water) - Health protection services (for environment and occupational health protection) (matrices: air, water, soil, crops/food) - Other (Food Safety and Economy Authority; Labour Ministry)(for public health protection) (matrices: crops/food)
- the nature of the monitoring resource availability and the capability: - Within the emergency exclusionary Zone / for emergency response / dedicated 24/7(matrices: air, water, soil) - Within the emergency exclusionary Zone / for emergency response but not a dedicated 24/7 service (matrices: air, water, soil, crops/food) - Off site for assessing public exposure / dedicated 24/7(matrices: air, water, soil, crops/food and other) - Off site for assessing public exposure but not a dedicated 24/7 service(matrices: air, water, soil, crops/food and other)
- the nature of the modelling availability and the capability: - Local models for air, water, soil - Dispersion models by meteorological experts for air, water and soil - Water dispersion modelling for air and water
- national Hazmat teams to support exposure assessment as separate/independent units and within national fire and rescue service - the output of national Hazmat teams' activity: Identification of the Hazmat agents, amount, affected area; Teams with specific chemical intervention equipment to assess, monitor and intervene. Distributed along the country, stationed at and within fire-departments. Gather data for Environment Ministry, to evaluate and produce guidelines; Reports of incidents and proposals for procedures change and equipment - the receiver of their output: Environment Ministry / National Civil Protection Authority
- back office service for onsite Hazmat advisors to support exposure assessment YES
- Hazmat sampling teams within national Hazmat teams and as separate units
- resources and equipment available for sampling: - Procedures and Specific technical equipment for drinking water, surface water, ground water, soil, air, food, vegetation debris and particulate matter, powder - Self made sampling kit for drinking water, soil, air
- resource/equipment available for detection and identification: - within local and regional resources: IMS - within national resources: Raman spectroscopy, IMS, IR spectroscopy, GC – techniques (GC, GC-MS, GC-MS-MS) - equipment deployed at/near scene of incident: IMS, PID, Detection tubes - equipment deployed at nearby locations (e.g. sensitive receptors, sheltering place): Detection tubes
- an interdisciplinary procedure for sampling, detection, identification and monitoring: - exists for air, water, soil
- mobile detection and identification equipment NOT available for: air, water, soil, crops/food
- a national laboratory network exists for air, water, soil, crops/food

- When exposure assessment is performed, the analysis results are compared to: Acute Exposure Guideline Levels (TLV for workplace assessment as national standard)
- the data deriving from DIM (Detection, Identification, Monitoring) activities carried on incident site are forwarded to: (and health risk assessment is undertaken by:) - Fire and rescue service, Environmental protection officials, Public health officials at local, regional and national level - Food safety officials at regional and national level

- additional information gathered during the acute phase of a chemical incident (needed for exposure assessment) by:
- fire and rescue service
  - Short characterisation of the place of release (closed building, open air etc.)
  - Potentially exposed population (kind, size)
  - Potentially exposed grounds / crops / facilities etc.)
  - Type of the substance
  - Quantity released
  - Exposed population – health effects
  - Meteorological (weather) conditions
  - Observations / notifications (e.g. smell, deposition etc.)
- health service
  - Potentially exposed population (kind, size)
  - Potentially exposed grounds / crops / facilities etc.)
  - Type of the substance
  - Exposed population – health effects
  - Analytical data
- environmental protection service
  - Potentially exposed population (kind, size)
  - Potentially exposed grounds / crops / facilities etc.)
  - Type of the substance
  - Quantity released
  - Exposed population – health effects
  - Meteorological (weather) conditions
  - Observations / notifications (e.g. smell, deposition etc.)
  - Analytical data
- site operator
  - Short characterisation of the place of release (closed building, open air etc.)
  - Type of the substance
  - Quantity released
  - Meteorological (weather) conditions

- Observations / notifications (e.g. smell, deposition etc.)
- using risk mapping (GIS mapping) systems available in Portugal it is possible to gather information about: Land use (agriculture, residential, industry area etc.), Population size, Population type (possible identification of susceptible populations near the incident location), The vulnerable zones (populations at risk/sensitive receptors)
- airborne dispersion models available – provided by meteorological and non meteorological experts
- water borne dispersion models are available in Portugal
- available outputs of environmental modelling: - Chemical concentrations in the air and water - Deposition
III. Cross-border cooperation in case of chemical incident
- arrangements on international collaboration in case of a major chemical incident: - exist countries: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Poland, Malta, Portugal, Romania, Slovakia, , Sweden, The Netherlands, United Kingdom, Slovenia (information/data exchange), Spain and Other (European Union County's - EU Civil Protection Mechanism) (agreements and information/data exchange)
- mobile laboratories' functions (available in Portugal) support the international response to chemical incidents
- we have a risk mapping (GIS mapping) system which shows receptors (potentially affected persons) in neighbouring countries
- dispersion models available for Portugal and for neighbouring countries
- the “source” country's dispersion modelling will be used on both sides of the border
- water borne dispersion models available for Portugal and for neighbouring countries: compatible ones
- the “source” country's water borne dispersion modelling will be used on both sides of the border

Exposure assessment in chemical incident response – ROMANIA (Response Count:1)

I. Professional background of the respondent(s)

Advisor (Seveso Directive and TEIA Helsinki Convention)

- working for National government department/agency
- involved in exposure assessment by: Coordination of exposure assessment (matrices: air, water, soil)
- focused on: Source and Pathways

II. Environmental monitoring and modelling capabilities in Member States

- environmental monitoring carried out **during** and **after** major chemical incidents

- the national authorities supervising:
  - environmental and public health exposure monitoring: Ministry of Environment (or equal authority) and Ministry of Health (or equal authority)
  - Other: Environmental Protection Agency, Inspectorate for Emergency Situation

- monitoring at the incident scene carried out by:
  - Fire and rescue services (for public health and environment protection) (matrices: ?)
  - Environmental protection services and Site operator resources (chemical rescue team) (for public and occupational health protection, environment protection) (matrices: air, water, soil)
  - Health protection services (for public and occupational health protection) (matrices: air, water, soil, crops/food)

- the nature of the monitoring resource availability and the capability:
  - Within the emergency exclusionary Zone / for emergency response / dedicated 24/7 (matrices: air, water, soil, crops/food)
  - Within the emergency exclusionary Zone / for emergency response but not a dedicated 24/7 service (matrices: air, water, soil, crops/food)
  - Off site(9) for assessing public exposure / dedicated 24/7 (matrices: air, water, soil, crops/food)
  - Off site for assessing public exposure but not a dedicated 24/7 service (matrices: air, water, soil, crops/food)

- the nature of the modelling availability and the capability:
  - Local models for air, water, soil
  - Dispersion models by meteorological experts for air, water and soil
  - Water dispersion modelling for water

- national Hazmat teams to support exposure assessment as separate/independent units
  - the output of national Hazmat teams' activity: The team HAZMAT is for to respond to incidents involving hazardous materials that could threaten the health and safety of our citizens as well as their property and the environment
  - the receiver of their output: operators of hazardous activities

- back office service for onsite Hazmat advisors to support exposure assessment (?)

- Hazmat sampling teams as separate units

- resources and equipment available for sampling: (?)
- resource/equipment available for detection and identification: (?)
- an interdisciplinary procedure for sampling, detection, identification and monitoring exists for air, water, soil
- mobile detection and identification equipment NOT available for: ?
- a national laboratory network exists for air, water, soil
- When exposure assessment is performed, the analysis results are compared to: (?)
- the data deriving from DIM (Detection, Identification, Monitoring) activities carried on incident site are forwarded to: (and health risk assessment is undertaken by:) - Fire and rescue service, Environmental protection officials, Public health officials and Food safety officials local, regional level and national level
- additional information gathered during the acute phase of a chemical incident (needed for exposure assessment) by: - fire and rescue service and environmental protection service - Short characterisation of the place of release (closed building, open air etc.) - Potentially exposed population (kind, size) - Potentially exposed grounds / crops / facilities etc.) - Type of the substance - Quantity released - Exposed population – health effects - Meteorological (weather) conditions - Observations / notifications (e.g. smell, deposition etc.) - health service and site operator - Potentially exposed grounds / crops / facilities etc.) - Type of the substance - Short characterisation of the place of release (closed building, open air etc.) - Potentially exposed population (kind, size) - Potentially exposed grounds / crops / facilities etc.) - Type of the substance - Quantity released - Exposed population – health effects - Observations / notifications (e.g. smell, deposition etc.)
- using risk mapping (GIS mapping) systems available in Romania it is possible to gather information about: Land use (agriculture, residential, industry area etc.), Population size, Population type (possible identification of susceptible populations near the incident location), The vulnerable zones (populations at risk/sensitive receptors)
- airborne dispersion models available – provided by non meteorological experts

- water borne dispersion models are available in Romania.
- available outputs of environmental modelling: - Chemical concentrations in the air and water - Deposition
III. Cross-border cooperation in case of chemical incident
- arrangements on international collaboration in case of a major chemical incident: - exist countries: Bulgaria (agreements)
- mobile laboratories' functions (available in Romania) support the international response to chemical incidents (?)
- we have/have not a risk mapping (GIS mapping) system which shows receptors (potentially affected persons) in neighbouring countries (?)
- dispersion models available/not available for Romania and for neighbouring countries (?)
- the "source" country's dispersion modelling will/will not be used on both sides of the border (?)
- water borne dispersion models available/not available for Romania and for neighbouring countries: the same models (?)
- the "source" country's water borne dispersion modelling will/will not be used on both sides of the border (?)

Exposure assessment in chemical incident response – SLOVAKIA (Response Count:1)
I. Professional background of the respondent(s)
safety and risk specialist (Fire protection; Nuclear Power Plants) *(1/34 qs not answered)* - working for Environmental services - involved in exposure assessment by: Data assessing (matrices: air, water and other), Modelling and Risk characterisation (matrices: air, water, soil and other) - Other: Halon alternative gas monitoring (matrices: air) - focused on: Source and Pathways
II. Environmental monitoring and modelling capabilities in Member States
- environmental monitoring carried out **during and after** major chemical incidents
- the national authorities supervising: - environmental monitoring: Ministry of Health (or equal authority) - Other: Ministry of interior
- monitoring at the incident scene carried out by: - Fire and rescue services (for ?) (matrices: air, water, soil, crops/food and other) - Environmental protection services (for environment protection) (matrices: ?) - Health protection services (for public and occupational health protection) matrices: air, water, soil, crops/food and other)
- the nature of the monitoring resource availability and the capability: - Within the emergency exclusionary Zone / for emergency response / dedicated 24/7(8) (matrices: air, water and other) - Within the emergency exclusionary Zone / for emergency response but not a dedicated 24/7 service (matrices: soil and other)
- the nature of the modelling availability and the capability: - Local models for air, water, soil and other - Dispersion models by meteorological experts for air, water and other
- lack of national Hazmat teams to support exposure assessment
- back office service for onsite Hazmat advisors to support exposure assessment
- Hazmat sampling teams as separate units
- resources and equipment available for sampling: - Procedures, Self made sampling kit and Specific technical equipment for drinking water, surface water, ground water, soil, air, food, vegetation and particulate matter, powder
- resource/equipment available for detection and identification: - within local resources: IMS and Detection tubes - within regional resources: Detection tubes and IR spectroscopy

- within national resources: Detection tubes - equipment deployed at/near scene of incident: Detection tubes - equipment deployed at nearby locations (e.g. sensitive receptors, sheltering place): Detection tubes
- an interdisciplinary procedure for sampling, detection, identification and monitoring: - exists for air, water, soil and food/crops
- mobile detection and identification equipment NOT available for: (?)
- a national laboratory network exists for air, water, soil, crops/food
- When exposure assessment is performed, the analysis results are compared to: Acute Exposure Guideline Levels
- the data deriving from DIM (Detection, Identification, Monitoring) activities carried on incident site are forwarded to: (and health risk assessment is undertaken by:) - Fire and rescue service at local and regional level - Environmental protection officials, Public health officials at regional and national level

- additional information gathered during the acute phase of a chemical incident (needed for exposure assessment) by:
- fire and rescue service
  - Short characterisation of the place of release (closed building, open air etc.)
  - Potentially exposed population (kind, size)
  - Type of the substance
  - Quantity released
  - Exposed population – health effects
  - Meteorological (weather) conditions
  - Observations / notifications (e.g. smell, deposition etc.)
  - Analytical data
- health service
  - Potentially exposed population (kind, size)
  - Type of the substance
  - Exposed population – health effects
  - Analytical data
- environmental protection service
  - Potentially exposed grounds / crops / facilities etc.)
  - Type of the substance
- site operator
  - Short characterisation of the place of release (closed building, open air etc.)
  - Potentially exposed population (kind, size)
  - Potentially exposed grounds / crops / facilities etc.)
  - Type of the substance
  - Quantity released

- Exposed population – health effects - Meteorological (weather) conditions - Observations / notifications (e.g. smell, deposition etc.) - Analytical data
- using risk mapping (GIS mapping) systems available in Slovakia it is possible to gather information about: Land use (agriculture, residential, industry area etc.), Population size
- airborne dispersion models available – provided by meteorological experts
- water borne dispersion models are available in Slovakia.
- available outputs of environmental modelling: - Chemical concentrations in the air and water
III. Cross-border cooperation in case of chemical incident
- arrangements on international collaboration in case of a major chemical incident: - exist countries: Austria, Czech Republic, Hungary, Poland and Ukraine (agreements and information/data exchange)
- mobile laboratories' functions (available in Slovakia) support the international response to chemical incidents (Mobile units).
- we do not have a risk mapping (GIS mapping) system which shows receptors (potentially affected persons) in neighbouring countries
- dispersion models not available for Slovakia and for neighbouring countries
- the "source" country's dispersion modelling will/will not be used on both sides of the border (?)
- water borne dispersion models available for Slovakia and for neighbouring countries: the same models
- the "source" country's water borne dispersion modelling will/will not be used on both sides of the border (?)

Exposure assessment in chemical incident response – SLOVENIA (Response Count: 2)
I. Professional background of the respondent(s)
Medical toxicologist *(19/34 qs not answered)* - working for Health services - involved in exposure assessment by: Risk characterisation (matrices: air, water, soil, crops/food and other) Other: assessment of exposure from contaminated consumer products - focused on: Source and Receptors Public Health Physician *(19/34 qs not answered)* - working for Health services - involved in exposure assessment by: : Monitoring, Detection and identification (matrices: water, crops/food), Data assessing (matrices: air, water, soil, crops/food), Analytical laboratory (matrices: water, crops/food and other), Risk characterisation and Identification of affected groups (matrices: air, water, soil, crops/food and other) - focused on: Source, Pathways and Receptors
II. Environmental monitoring and modelling capabilities in Member States
- environmental monitoring carried out **during and after** major chemical incidents
- the national authorities supervising: - environmental monitoring: Ministry of Environment (or equal authority), Ministry of Defence (or equal authority) - public health exposure characterisation: Ministry of Health (or equal authority)
- monitoring at the incident scene carried out by: - National Hazmat teams (for public health and environment protection) (matrices: air, water, soil) - Environmental protection services (for public health and environment protection) (matrices: air, soil) - Site operator resources (chemical rescue team) (for occupational health protection) (matrices:?) - Health protection services (for public health and environment protection) (matrices: water, soil, crop/food) - Other (Inspectorate for agriculture and food and National institute of public health) (for ?) (matrices: crops/food)
- the nature of the monitoring resource availability and the capability: - Within the emergency exclusionary Zone / for emergency response / dedicated 24/7(8) (matrices: air, water, soil) - Within the emergency exclusionary Zone / for emergency response but not a dedicated 24/7 service (matrices: crops/food) - Off site for assessing public exposure / dedicated 24/7(matrices: air, water) - Off site for assessing public exposure but not a dedicated 24/7 service (matrices: air, water, soil, crops/food and other)
- the nature of the modelling availability and the capability: - Local models for soil - Dispersion models by meteorological experts for air
- national Hazmat teams to support exposure assessment organised within national fire and rescue service - the output of national Hazmat teams' activity: air, water, soil sampling on site, fast risk assessment on site

- the receiver of their output: Ministry of defence, of health, of environment, general public
- lack of back office service for onsite Hazmat advisors to support exposure assessment
- Hazmat sampling teams within national Hazmat teams - lack of Hazmat sampling teams
- resources and equipment available for sampling: - Procedures for drinking water, surface water, ground water, soil, air, food and particulate matter, powder - Commercial off the shelf sampling kit and Specific technical equipment for drinking water, surface water, ground water, soil, air and food
- resource/equipment available for detection and identification: - within local resources: ? - within regional resources: ? - within national resources: ? - equipment deployed at/near scene of incident: ? - equipment deployed at nearby locations (e.g. sensitive receptors, sheltering place): ?
- an interdisciplinary procedure for sampling, detection, identification and monitoring: - does not exist for air, water, soil and food/crops
- mobile detection and identification equipment NOT available for: ?
- a national laboratory network exists for air, soil - a national laboratory network does not exist for water, crops/food
- When exposure assessment is performed, the analysis results are compared to: Acute Exposure Guideline Levels (The results are compared to international standards if available, if not they are most commonly compared to German standards. Other guidance values such AOEL or TDI or a relevant NOAEL or LOAEL are used if a medium or long term exposure is suspected.)
- the data deriving from DIM (Detection, Identification, Monitoring) activities carried on incident site are forwarded to: (and health risk assessment is undertaken by:) - Environmental protection officials, Public health officials and Food safety officials at regional and national level - Other at local, regional and national level – To my knowledge there is no systematic procedure, but would help immensely if there was one. When public health officials are asked to carry out risk assessment we do not receive data automatically.
- additional information gathered during the acute phase of a chemical incident (needed for exposure assessment) by: - fire and rescue service - Short characterisation of the place of release (closed building, open air etc.) - Potentially exposed population (kind, size) - Potentially exposed grounds / crops / facilities etc.) - Type of the substance - Quantity released - Meteorological (weather) conditions - Observations / notifications (e.g. smell, deposition etc.)

- health service
    - Potentially exposed population (kind, size)
    - Potentially exposed grounds / crops / facilities etc.)
    - Type of the substance
    - Quantity released
    - Exposed population – health effects
    - Meteorological (weather) conditions
    - Observations / notifications (e.g. smell, deposition etc.)
    - Analytical data
- environmental protection service
    - Potentially exposed grounds / crops / facilities etc.)
    - Type of the substance
    - Quantity released
    - Meteorological (weather) conditions
    - Observations / notifications (e.g. smell, deposition etc.)
    - Analytical data
- site operator
    - Short characterisation of the place of release (closed building, open air etc.)
    - Potentially exposed population (kind, size)
    - Potentially exposed grounds / crops / facilities etc.)
    - Type of the substance
    - Quantity released
    - Observations / notifications (e.g. smell, deposition etc.)

As much as possible is gathered, but as there is no systematic procedure in place the sources of information vary.

- using risk mapping (GIS mapping) systems available in Slovenia it is possible to gather information about: Land use (agriculture, residential, industry area etc.), Population size, Population type (possible identification of susceptible populations near the incident location),The vulnerable zones (populations at risk/sensitive receptors)

- airborne dispersion models available – provided by meteorological experts

- water borne dispersion models are available in Slovenia.

- available outputs of environmental modelling:
    - Chemical concentrations in the air and water

III. Cross-border cooperation in case of chemical incident

- arrangements on international collaboration in case of a major chemical incident:
    - exist

countries: ?

- mobile laboratories' functions (available in Slovenia) support the international response to chemical incidents (?)

- we have/have not a risk mapping (GIS mapping) system which shows receptors (potentially affected persons) in neighbouring countries (?)
- dispersion models available for Slovenia and for neighbouring countries (?)
- the “source” country’s dispersion modelling will/will not be used on both sides of the border (?)
- water borne dispersion models not available for Slovenia and for neighbouring countries
- the “source” country’s water borne dispersion modelling will not be used on both sides of the border

Exposure assessment in chemical incident response – SPAIN (Response Count: 3+interview)

I. Professional background of the respondent(s)

Fire Officer *(13/34 qs not answered)*

- working for Emergency services (Fire services)
- involved in exposure assessment by: other - Work on the scene of incidents as fire chief. However, with operational purposes – making some modelling scenarios.
- focused on: Source and Receptors

Training Coordinator of the 112 Emergency Number *(16/34 qs not answered)*

- working for Federal or provincial government department/agency
- involved in exposure assessment by: Training other emergency professionals about the chemical hazards and the risk that suppose for the populated areas to live very near to these dangerous industries.
- focused on: Pathways and Receptors

Person collaborating with local civil protection service

- working for Emergency services (Ambulance services), Health services and Other
- involved in exposure assessment by: At scene sampling, Data assessing, Risk characterisation, Identification of affected groups, Coordination of exposure assessment (matrices: Other)
- focused on: Source, Pathways

II. Environmental monitoring and modelling capabilities in Member States

- information flow: 3 levels of emergencies: First level if municipality can deal with the emergency itself. Second level if the public is affected and it goes over provincial boundaries. Third level if the emergency is of national interest. The fire commander is in charge of incident at level 1 and 2. For level 3, the local government scales up to national government who delegate to the Military unit of emergencies if necessary. Only fire fighters can monitor and take samples, not environmental agencies. They inform the plant director and activate emergency plans. They establish safety distances, evacuation and give recommendations. Public health officials and police will provide information at a community centre. They are all under command of fire brigade. Response time is short and information flows well. Civil protection centre is called if it's a SEVESO incident and information goes to firefighters via TETRA. The flow of information is less good if 112 operator is not specialist in chemicals. Operator has standard check list.

- environmental monitoring carried out **during** and **after** major chemical incidents

- the national authorities supervising:
    - environmental monitoring and public health exposure characterisation: Ministry of Environment (or equal authority), Ministry of Health (or equal authority) and Other (Local government municipality or district)

- monitoring at the incident scene carried out by:
    - Fire and rescue services (for public health, environment protection and occupational health protection) (matrices: air and Other - Fire control and avoid a possible domino effect)
    - Environmental protection services (for environment protection) (matrices: air, water, soil)

- Health protection services (for public health and occupational health protection) (matrices: water, crops/food)
- Other (for public health, environment protection and occupational health protection) (matrices: air, water, soil)

- the nature of the monitoring resource availability and the capability:
    - Within the emergency exclusionary Zone / for emergency response / dedicated 24/7(8) (matrices: air)
    - Within the emergency exclusionary Zone / for emergency response but not a dedicated 24/7 service (matrices: air)
    - Off site for assessing public exposure but not a dedicated 24/7 service (matrices: water, soil, crops/food)
- environmental monitoring / analysis equipment used or commissioned for public health and environmental purposes: AIR (special catalytic cells for NH_3, Cl, SO_2, CO_2, combustibles etc and photoionisation detectors); for water and land monitoring is only done for forensic studies
- repeated environmental monitoring not carried out
- monitoring data generally just used by fire services, if necessary they share with health services

- the nature of the modelling availability and the capability:
    - Local models for air
    - Dispersion models by meteorological experts for air
    - Water dispersion modelling for water

- lack of national Hazmat teams to support exposure assessment
- national Hazmat teams to support exposure assessment organised within national fire and rescue service
    - the output of national Hazmat teams' activity: ?
    - the receiver of their output: ?

- back office service for onsite Hazmat advisors to support exposure assessment
- lack of back office service for onsite Hazmat advisors to support exposure assessment

- Hazmat sampling teams organised as separate units

- resources and equipment available for sampling:
    - Procedures for drinking water, surface water, ground water, soil, air, food, vegetation, debris and particulate matter, powder
    - Commercial off the shelf sampling kit for drinking water, surface water, ground water, soil, air, food, vegetation, debris and particulate matter, powder
    - Self made sampling kit for air for drinking water, soil, air, food, vegetation
    - Specific technical equipment for drinking water, surface water, ground water, soil, air, food, vegetation, debris and particulate matter, powder

- resource/equipment available for detection and identification:
    - within local resources: PID, Detection tubes
    - within regional resources and national resources: Raman spectroscopy, IMS, PID, Detection tubes, IR spectroscopy, UV-Vis spectroscopy, AAS-techniques (FAAS, GFAAS), XRF, AES, ICP – techniques (ICP-AES, ICP-MS), GC – techniques (GC, GC-

MS, GC-MS-MS), LC-techniques (LC-MS, LC-MS-MS) and HPLC - equipment deployed at/near scene of incident: PID, Detection tubes - equipment deployed at nearby locations (e.g. sensitive receptors, sheltering place): ?
- an interdisciplinary procedure for sampling, detection, identification and monitoring **does not exist** for air, water, soil and food/crops
- mobile detection and identification equipment NOT available for: crops/food
- a national laboratory network exists for water and crops/food - a national laboratory network does not exist for air, water, soil and crops/food
- When exposure assessment is performed, the analysis results are compared to: Acute Exposure Guideline Levels (national rules for chemical hazards but are not adequately monitored compliance)
- the data deriving from DIM (Detection, Identification, Monitoring) activities carried on incident site are forwarded to: (and health risk assessment is undertaken by:) - Fire and rescue service at local level - Environmental protection officials, Public health officials and Food safety officials at local, regional and national level

- additional information gathered during the acute phase of a chemical incident (needed for exposure assessment) by:
- fire and rescue service and environmental protection service
    - Short characterisation of the place of release (closed building, open air etc.)
    - Type of the substance
    - Quantity released
    - Exposed population – health effects
    - Meteorological (weather) conditions
    - Observations / notifications (e.g. smell, deposition etc.)
    - Other
- health service
    - Type of the substance
    - Exposed population – health effects
    - Meteorological (weather) conditions
    - Other
- site operator
    - Short characterisation of the place of release (closed building, open air etc.)
    - Type of the substance
    - Analytical data
    - Other
Other: In any event it was seen to be done.
Toxic cloud formation, wind direction and need of evacuation.

- the lead organisation for provision of public health advice in case of chemical incident - An expert from the facility/plant or a

university is sent to command post to give advice to fire commander
- using risk mapping (GIS mapping) systems available in Spain it is possible to gather information about: - Land use (agriculture, residential, industry area etc.), - Population size, - Population type (possible identification of susceptible populations near the incident location), - The vulnerable zones (populations at risk/sensitive receptors), - Not applicable (we do not use risk mapping system)
- airborne dispersion models available – provided by non meteorological experts / not available
- water borne dispersion models are not / are available in Spain
- available outputs of environmental modelling: - Chemical concentrations in the air and water - Not applicable
- no standardised geographical registration of complaints of the effects of chemical incidents (e.g. complaints of odour nuisance, health complaints) - no databases of previous incidents with good practices of exposure assessment
III. Cross-border cooperation in case of chemical incident
- arrangements on international collaboration in case of a major chemical incident exist / do not exist Policy areas relating to Civil Protection (Civil Defence)
- information flow: Little experience of this. As Spain and France are separated by the Pyrenees, an incident affecting both sides is less likely. No agreements with France or Spain. In the case of cross-border collaboration with Portugal during forest fires, the information flow was poor. No experience with France.
- data shared with neighbouring countries could be misinterpreted due to: - Language - Different scientific rationales for monitoring and modelling - Different rationales for public health decision making – for example different criteria for shelter / evacuate or for warning the public. - Unfamiliarity with neighbouring regions capabilities Lack of understanding of neighbouring response structures - Lack of suitable contacts with peer organisations in neighbouring countries
- mobile laboratories' functions (available in Spain) do not support the international response to chemical incidents
- we do not have a risk mapping (GIS mapping) system which shows receptors (potentially affected persons) in neighbouring countries - we do not use risk mapping system
- dispersion models not available for Spain and for neighbouring countries
- the "source" country's dispersion modelling will not be used on both sides of the border
- water borne dispersion models not available for Spain and for neighbouring countries

- the “source” country’s water borne dispersion modelling will not be used on both sides of the border

Exposure assessment in chemical incident response – SWEDEN (Response Count: 2)
I. Professional background of the respondent(s)
Project Manager (Counter-measures in major chemical accidents/releases) - working for National government department/agency - involved in exposure assessment by: Modelling, , Risk characterisation, Identification of affected groups (matrices: air) and Analytical laboratory (matrices: Other - development of methods) - focused on: Source, Pathways and Receptors
II. Environmental monitoring and modelling capabilities in Member States
- environmental monitoring carried out **during and after** major chemical incidents
- the national authorities supervising: - environmental monitoring and public health exposure characterisation: Ministry of Environment (or equal authority), Ministry of Defence (or equal authority), Ministry of Health (or equal authority) and Other (Local government municipality or district)
- monitoring at the incident scene carried out by: - Fire and rescue services (for?) (matrices: air) - Environmental protection services (for public health and environment protection) (matrices: air, water, soil, crops/food) - Health protection services (for public health and occupational health protection) (matrices: ?) - Other (Occupational health services) (for occupational health protection) (matrices:?)
- the nature of the monitoring resource availability and the capability: - Within the emergency exclusionary Zone / for emergency response / dedicated 24/7(8) (matrices: air) - Within the emergency exclusionary Zone / for emergency response but not a dedicated 24/7 service (matrices: air, water, soil, crops/food) - Off site for assessing public exposure but not a dedicated 24/7 service (matrices: air, water, soil, crops/food)
- the nature of the modelling availability and the capability: - Local models for air, water and soil - Dispersion models by meteorological experts for air and crops/food - Water dispersion modelling for water and soil
- national Hazmat teams to support exposure assessment organised within national fire and rescue service - the output of national Hazmat teams' activity: Normal rescue service fortified by special resources stored at several locations in Sweden - the receiver of their output: Municipalities
- back office service for onsite Hazmat advisors to support exposure assessment
- Hazmat sampling teams organised as separate units - lack of Hazmat sampling teams

- resources and equipment available for sampling:
  - Procedures for drinking water, surface water, ground water, soil, air, food and vegetation
  - Commercial off the shelf sampling kit for drinking water, surface water, ground water, soil, air
  - Self made sampling kit for air
  - Other (Provided to Hazmat by other services and agencies) for drinking water, surface water, ground water, soil, air, food, vegetation, debris and particulate matter, powder

- resource/equipment available for detection and identification:
  - within local resources: ?
  - within regional resources: IMS, PID, IR spectroscopy
  - within national resources: Raman spectroscopy, IMS, PID, Detection tubes, IR spectroscopy, UV-Vis spectroscopy, AAS-techniques (FAAS, GFAAS), XRF, AES, ICP – techniques (ICP-AES, ICP-MS), GC – techniques (GC, GC-MS, GC-MS-MS)

  Other: Some equipment at local and regional level. Could be advances or primitive depending on region.
  - equipment deployed at/near scene of incident: IMS, Detection tubes and Other (FPD)
  - equipment deployed at nearby locations (e.g. sensitive receptors, sheltering place): ?

- an interdisciplinary procedure for sampling, detection, identification and monitoring:
  - exists for air, water, soil and food/crops
  - does not exist for air, water, soil and food/crops

- mobile detection and identification equipment NOT available for: water, soil, crops/food

- a national laboratory network exists for air, water, soil and crops/food
- a national laboratory network does not exist for air and soil

- When exposure assessment is performed, the analysis results are compared to: Acute Exposure Guideline Levels e.g.: National occupational health limits

- the data deriving from DIM (Detection, Identification, Monitoring) activities carried on incident site are forwarded to: (and health risk assessment is undertaken by:)
  - Fire and rescue service, Environmental protection officials, Public health officials and Food safety officials at local level
  - Environmental protection officials, Public health officials and Food safety officials at regional and national level

- additional information gathered during the acute phase of a chemical incident (needed for exposure assessment) by:
  - fire and rescue service and environmental protection service
    - Short characterisation of the place of release (closed building, open air etc.)
    - Potentially exposed population (kind, size)
    - Potentially exposed grounds / crops / facilities etc.)
    - Type of the substance
    - Quantity released
    - Exposed population – health effects
    - Meteorological (weather) conditions
    - Observations / notifications (e.g. smell, deposition etc.)

- Analytical data - health service - Potentially exposed population (kind, size) - Potentially exposed grounds / crops / facilities etc.) - Type of the substance - Quantity released - Exposed population – health effects - Meteorological (weather) conditions - Observations / notifications (e.g. smell, deposition etc.) - Analytical data - site operator - Short characterisation of the place of release (closed building, open air etc.) - Meteorological (weather) conditions - Observations / notifications (e.g. smell, deposition etc.)
- using risk mapping (GIS mapping) systems available in Sweden it is possible to gather information about: - Land use (agriculture, residential, industry area etc.), - Population size, - The vulnerable zones (populations at risk/sensitive receptors), - Not applicable (we do not use risk mapping system)
- airborne dispersion models available – provided by meteorological and non meteorological experts
- water borne dispersion models are available in Sweden.
- available outputs of environmental modelling: - Chemical concentrations in the air and water - Deposition
III. Cross-border cooperation in case of chemical incident
- arrangements on international collaboration in case of a major chemical incident: - exist - do not exist countries: Other (agreements and information/data exchange), but not specified
- mobile laboratories' functions (available in Sweden) support the international response to chemical incidents: Reported and available to OPCW and as support in international peace keeping operations
- we do not have a risk mapping (GIS mapping) system which shows receptors (potentially affected persons) in neighbouring countries
- dispersion models available for Sweden and for neighbouring countries - compatible ones – i.e. the basis and outputs are similar
- the "source" country's dispersion modelling will/will not be used on both sides of the border (?)
- water borne dispersion models available for Sweden and for neighbouring countries (?)

- the “source” country’s water borne dispersion modelling will/will not be used on both sides of the border (?)

Exposure assessment in chemical incident response – THE NETHERLANDS (Response Count: 13)
I. Professional background of the respondent(s)
crisis coordination; gather information and prepare advise on national level (for minister of Health); - working for National government department/agency - involved in exposure assessment by: Other - using result of assessment done by expert institution as input for advise/decision making (matrices: air, water, soil, crops food and other) - focused on: Receptors Emergency response backoffice team; Quantitative risk analysis for industrial plants, pipelines in land-use planning framework; Development of QRA methodology; Helpdesk support of competent authorities; *(14/34 qs not answered)* - working for National government department/agency - involved in exposure assessment by: Modelling, Risk characterisation (matrices: air) - focused on: Source, Pathways Environmental Coordinator water crisis - working for National government department/agency - involved in exposure assessment by: Monitoring, Detection and identification, Data assessing, Analytical laboratory, Modelling (matrices: water) - focused on: Source, Pathways and Receptors Person working in Environmental Protection Agency *(5/34 qs not answered)* - working for National government department/agency, Federal or provincial government department/agency, Local government department/agency, Emergency services (Fire services), Environmental services - involved in exposure assessment by: Monitoring, Data assessing and Identification of affected groups for air, At scene sampling, Detection and identification for air, water, soil, Modelling, Risk characterisation and Coordination of exposure assessment for air and water - focused on: Source, Pathways
environmental health physician *(7/34 qs not answered)* - working for Local government department/agency, Health services - involved in exposure assessment by: Monitoring, At scene sampling and Modelling for air, Data assessing, Risk characterisation and Identification of affected groups for air, water, soil - focused on: Source, Pathways and Receptors Assessing and managing HAZMAT protocols and incidents *(8/34 qs not answered)* - working for Local government department/agency, Health services - involved in exposure assessment by Modelling, Data assessing and Coordination of exposure assessment for air, Risk characterisation and Identification of affected groups for air, water, soil - focused on: Source, Pathways Toxicologist /Health physicist at the Dutch Poisons Information Centre *(6/34 qs not answered)*

- working for National government department/agency, Health services - involved in exposure assessment by: Risk characterisation, Identification of affected groups, Coordination of exposure assessment and other - deriving exposure area and severity from symptoms in humans and animals, reported to the DPIC; advising on (medical) management of patients and measures to prevent (further) exposure and reduce harm (matrices: air, water, soil, crops food and other) - focused on: Pathways and Receptors Toxicologist, Health Advisor HazMat. Involved in risk assessment for the general public and pre-hospital medical care in case of chemical accidents *(7/34 qs not answered)* - working for Health services - involved in exposure assessment by: Risk characterisation, Identification of affected groups, Coordination of exposure assessment (matrices: air, water, soil, crops food) and other - Biological monitoring of components in air if applicable - focused on: Source, Pathways and Receptors public health advisor; toxicologist; occupational hygienist - working for Health services - involved in exposure assessment by: Monitoring, Detection and identification for air, crops/food and other, At scene sampling, Modelling, Analytical laboratory and Risk characterisation for air and other, Detection and identification for air, water, crops/food and other, Data assessing for air and water, Identification of affected groups, Coordination of exposure assessment and other - Biological monitoring (matrices: air, water, soil, crops food and other) - focused on: Source, Pathways and Receptors
Hazmat specialist *(8/34 qs not answered)* - working for Emergency services (Fire services) - involved in exposure assessment by: At scene sampling, Identification of affected groups, Coordination of exposure assessment (matrices: air, water, soil), Modelling for air - focused on: Source, Pathways Chief/manager - working for Emergency services (Fire services) - involved in exposure assessment by: Detection and identification, Modelling for air, water, Risk characterisation, Coordination of exposure assessment for other (Operational Crisismanagement) - focused on: Source, Pathways and Receptors Hazmat officer/engineer at National Hazardous Materials Network / National Environmental Incident Team - working for Emergency services (Fire services) - involved in exposure assessment by: Detection and identification, Modelling, Identification of affected groups, Coordination of exposure assessment for air and water, Risk characterisation for air, water, soil - focused on: Source and Receptors Section head Fire Services; CBRNe-Advisor - working for National government department/agency, Emergency services (Fire services) - involved in exposure assessment by: Monitoring, At scene sampling, Detection and identification for air, water, soil,

Modelling and Identification of affected groups for air, Coordination of exposure assessment, Risk characterisation (matrices: air, water, soil, crops food) - focused on: Source
II. Environmental monitoring and modelling capabilities in Member States
- environmental monitoring carried out **during and after** major chemical incidents
- the national authorities supervising: - environmental monitoring: Ministry of Environment (or equal authority) and other (Gouvernment of de province, RIVM) - public health exposure characterisation: Ministry of Health (or equal authority)
monitoring at the incident scene carried out by: - National Hazmat teams (for public health, occupational and environment protection) (matrices: air, water, soil, food/crops and other) - Fire and rescue services (for public health, occupational and environment protection) (matrices: air, water, soil) - Environmental protection services (for public health, occupational and environment protection) (matrices: air, water, soil, food/crops) - Site operator resources (chemical rescue team) (for public health and environment protection) (matrices: air, water, soil) - Health protection services (for public health and occupational protection) (matrices: air, water, soil, food/crops) - Other (State Food and Veterinary service) (for public health and occupational protection) (matrices: air, food/crops and other) Other: Food & Consumer goods authority (agency), RIVM-MOD, consumer products, kindergarten playing toys, asbestos fibres by commercial party/ workers exposure by commercial party, foods standards agency
- the nature of the monitoring resource availability and the capability: - Within the emergency exclusionary Zone / for emergency response / dedicated 24/7(matrices: air, water, soil, crops/food and other) - Within the emergency exclusionary Zone / for emergency response but not a dedicated 24/7 service (matrices: air, water, soil, crops/food) - Off site for assessing public exposure / dedicated 24/7(matrices: air, water, soil, crops/food) - Off site for assessing public exposure but not a dedicated 24/7 service (matrices: air, water, soil, crops/food) - Other (some monitoring activities are outsources to commercial parties) (matrices: air and other)
- the nature of the modelling availability and the capability: - Local models for air, water, soil and other - Dispersion models by meteorological experts for air, water, soil, food/crops and other - Water dispersion modelling for air, water - Other (EFFECTS, Skin absorption modelling and consumer exposure modelling) for air, water, soil, food/crops and other
- national Hazmat teams to support exposure assessment as separate/independent units and within national fire and rescue service - the output of national Hazmat teams' activity: monitoring and analysis of chemical incidents; Detection and identification of

the hazmat, Fire department can call Hazmat team for support in measuring environmental concentration in the affected area. identification and monitoring results, provide advise to responders and government on regional/national level; detection, identification and decontamination, provide advise the responders; On site monitoring, sampling and analysis. Advice to local (fire brigade, public health service) and national authorities (Min. Environment, Min. Health); Identify substances; Give a risk assessment of the situation. It is an expert 24/7 service which can support regional experts on request. They have both sampling and analysing capacity as well as modelling expertise; Concentration measurements, advice; interdepartmental advisory team- Botmi; overall environmental advice to the executive team fight; concentration measurements of toxic products in air; sampling of deposition materials in air / water / soil; directing gas-measurement teams to right position; advising firebrigades, police and health-teams about dangerous goods; warning the inhabitants with sirens to shelter, etcetera.....; report, detect, identification, advice for the responders - the receiver of their output: operators of hazardous activities: public health services or fire department; Fire department and other parties active in Incident management. Data is shared with all participants via a dedicated website called ICAweb; The person (mostly from the fire dept.) that asks for it; responders and local/national authority; Local Government / Emergency services; emergency responders and the public; Either public health advisor hazmat or hazmat expert of fire brigade; Local: City major, chief of fire brigade, Local Hazmat/health advisors; Fire brigade, emergency response team; first responders and crisismanagement teams; executive team and responsible ministry; local community where the incident occurs; Government, mayors, chiefs of police, health and firebrigade
- back office service for onsite Hazmat advisors to support exposure assessment
- Hazmat sampling teams within national Hazmat teams and as separate units
- resources and equipment available for sampling: - Procedures for drinking water, surface water, ground water, soil, air, food, vegetation, debris and particulate matter, powder - Commercial off the shelf sampling kit for drinking water, surface water, ground water, soil, air, food, vegetation, debris and particulate matter, powder - Self made sampling kit for drinking water, surface water, ground water, soil, air, food, vegetation - Specific technical equipment for drinking water, surface water, ground water, soil, air, food, vegetation, debris and particulate matter, powder
- resource/equipment available for detection and identification: - within local resources: IMS, PID, Detection tubes, XRF, ICP – techniques (ICP-AES, ICP-MS), GC – techniques (GC, GC-MS, GC-MS-MS), LC-techniques (LC-MS, LC-MS-MS) and other - regional resources: Raman spectroscopy IMS, PID, IR spectroscopy, Detection tubes, UV-Vis spectroscopy, XRF, ICP – techniques (ICP-AES, ICP-MS), GC – techniques (GC, GC-MS, GC-MS-MS), LC-techniques (LC-MS, LC-MS-MS) and other - within national resources: Raman spectroscopy IMS, PID, IR spectroscopy, Detection tubes, UV-Vis spectroscopy, AES, XRF, AAS-techniques (FAAS, GFAAS)AES, ICP – techniques (ICP-AES, ICP-MS), GC – techniques (GC, GC-MS, GC-MS-MS), LC-techniques (LC-MS, LC-MS-MS), HPLC and other - equipment deployed at/near scene of incident: Raman spectroscopy IMS, PID, IR spectroscopy, Detection tubes, UV-Vis

spectroscopy, AES, XRF, AAS-techniques (FAAS, GFAAS)AES, ICP – techniques (ICP-AES, ICP-MS), GC – techniques (GC, GC-MS, GC-MS-MS), LC-techniques (LC-MS, LC-MS-MS), HPLC and other - equipment deployed at nearby locations: Raman spectroscopy IMS, PID, IR spectroscopy, Detection tubes, UV-Vis spectroscopy, AES, XRF, AAS-techniques (FAAS, GFAAS)AES, ICP – techniques (ICP-AES, ICP-MS), GC – techniques (GC, GC-MS, GC-MS-MS), LC-techniques (LC-MS, LC-MS-MS), HPLC and other Other - I checked the equipment I know of, but there is probably more available; radio activity measuring equipment; Thermal desorption GC-MS; NMR/specialty, dioxins
- an interdisciplinary procedure for sampling, detection, identification and monitoring do not exist / exist for air, water, soil, crops/food ?
- mobile detection and identification equipment NOT available for: water, soil, crops/food
- a national laboratory network exists for air, water, soil, crops/food
- When exposure assessment is performed, the analysis results are compared to Acute Exposure Guideline Levels, Other guidance values (Dutch Intervention Values; IDLH, Workplace standards (TLV, TWA etc), AEGL,(acute) toxic concentrations preferably in humans from scientific literature, national Dutch limit values (VRW, AGW, LBW); Alarmerings Grenswaarde; National Intervention Values, which are mostly derived from AEGL's; National Standards for workers and general public)
- the data deriving from DIM (Detection, Identification, Monitoring) activities carried on incident site are forwarded to: (and health risk assessment is undertaken by:) - Fire and rescue service - Environmental protection officials - Public health officials at national level - Food safety officials - Other (provide who, e.g. site operator) - level depending on how severe the incident is

- additional information gathered during the acute phase of a chemical incident (needed for exposure assessment) by:
- fire and rescue service and environmental protection service
    - Short characterisation of the place of release (closed building, open air etc.)
    - Potentially exposed population (kind, size)
    - Potentially exposed grounds / crops / facilities etc.)
    - Type of the substance
    - Quantity released
    - Exposed population – health effects
    - Meteorological (weather) conditions
    - Observations / notifications (e.g. smell, deposition etc.)
    - Analytical data
- health service and site operator
    - Short characterisation of the place of release (closed building, open air etc.)
    - Potentially exposed population (kind, size)

- Potentially exposed grounds / crops / facilities etc.) - Type of the substance - Quantity released - Exposed population – health effects - Meteorological (weather) conditions - Observations / notifications (e.g. smell, deposition etc.) - Analytical data - Other (Material safety data sheets of industrial products involved in chemical incidents; Samples for biomonitoring)
- using risk mapping (GIS mapping) systems available in The Netherlands it is possible to gather information about: Land use (agriculture, residential, industry area etc.), Population size, Population type (possible identification of susceptible populations near the incident location), The vulnerable zones (populations at risk/sensitive receptors)
- airborne dispersion models available provided by meteorological and non meteorological experts
- water borne dispersion models are available in The Netherlands
- available outputs of environmental modelling: - Chemical concentrations in the air and water - Deposition - Other (Chemical concentrations in soil; Human exposure (chemical doses) through drinking water, food, etc.; radiation contamination)
III. Cross-border cooperation in case of chemical incident
- arrangements on international collaboration in case of a major chemical incident exist Countries: Austria, Bulgaria, Denmark, Finland, , Greece, Ireland, Italy, Portugal, Spain, Sweden (information/data exchange), Belgium, France, Germany, Luxembourg, The Netherlands, United Kingdom, Other (Aruba, Curacao and Sint Maarten (within Kingdom of the Netherlands)) (agreements and information/data exchange)
mobile laboratories' functions (available in NL) support the international response to chemical incidents - Facilities used for assistance in International Response Activities (e.g. WHO, EU and others) - Identification - All kinds of analysis with the mobile laboratory of RIVM - Special equipment and vehicles including trained staff can be sent on request by UN to any place worldwide. Decision for deployment is taken by Ministry of Foreign Affairs - UN and CBRN collaboration - UNDAC team - EIS is a service offered by the RIVM to (lower) governmental services. It performs: Sampling Analysis, Interpretation during environmental incidents. The produced information is used to assess the possible risks for exposed people Main scope: Civilian exposure
- we have / have not a risk mapping (GIS mapping) system which shows receptors (potentially affected persons) in neighbouring

countries - we a risk mapping (GIS mapping) system which shows receptors (potentially affected persons) in neighbouring countries
- dispersion models available for The Netherlands and for neighbouring countries: compatible ones – i.e. the basis and outputs are similar and not compatible ones
- the “source” country’s dispersion modelling will / will not be used on both sides of the border - the “source” country’s dispersion modelling be used on both sides of the border
- water borne dispersion models available for The Netherlands and for neighbouring countries: compatible ones
- the “source” country’s water borne dispersion modelling will be used on both sides of the border

Exposure assessment in chemical incident response UNITED KINGDOM (Response Count: 17+interview)
I. Professional background of the respondent(s)
Major Accident Risk Assessment *(almost all answers skipped or don't know / answered q 9, 13)* - working for National government department/agency - involved in exposure assessment by: Modelling and Risk characterisation for air - focused on: Source CBRN Advisor *(cross-border part not answered)* - working for National government department/agency, Emergency services (Fire services, Ambulance services, Police) - involved in exposure assessment by: Other (More involved in planning to ensure gaps etc in multi agency capability are addressed) - focused on: - Scientific Advisor to fire service and Emergency Planner with the Environment Agency *(10/34 qs not answered)* - working for National government department/agency, Environmental services - involved in exposure assessment by: Monitoring, At scene sampling, Detection and identification for air and water; Modelling for air - focused on: Source, Pathways, Receptors Scottish Environment Protection Agency - analytical and advisory service. Health Protection Scotland - advice on all aspects of public health protection in terms of the potential hazards posed by chemical/environmental releases. *(almost all questions answered; cross-border part only 1 q answered)* - working for National government department/agency, Health services, Environmental services - involved in exposure assessment by: Detection and identification, Data assessing, Identification of affected groups, Coordination of exposure assessment for air, water, soil and crops/food; Monitoring, At scene sampling, Analytical laboratory and Risk characterisation for air, water and soil; Modelling for air and water - focused on: Source, Pathways, Receptors
Fire Hazmat Officer *(almost all questions answered; cross-border part only 1 q answered)(8/34 qs not answered)* - working for Emergency services (Fire services) - involved in exposure assessment by: Detection and identification for air and water; At scene sampling, Data assessing and Risk characterisation for air, water and soil - focused on: Source, Pathways, Receptors ………… *(almost all questions answered; cross-border not answered)* - working for Emergency services (Fire services) - involved in exposure assessment by: Monitoring, At scene sampling, Detection and identification for air - focused on: Source, Pathways, Receptors

Ambulance advisor to the emergency preparedness response and resilience Department of Health *(almost all questions answered; cross-border not answered)* - working for National government department/agency, Emergency services (Ambulance services), Health services - involved in exposure assessment by: Coordination of exposure assessment for other - community impact and health of those affected - focused on: Pathways, Receptors aim to anticipate and prevent the adverse effects of acute and chronic exposure to non infectious environmental hazards and support health protection units and other agencies to protect public health *(almost all questions answered; cross-border not answered)(11/34 qs not answered)* - working for Other - involved in exposure assessment by: Data assessing, Risk characterisation, Identification of affected groups, Coordination of exposure assessment for air, water, soil and other (assessing impact of exposure on wider public health and identifying vulnerable or sensitive groups) - focused on: Pathways, Receptors Sector Manager *(almost all questions answered; cross-border not answered)* - working for Emergency services (Ambulance services) - involved in exposure assessment by: Identification of affected groups, Coordination of exposure assessment for air, water, soil and crops/food - focused on: Source, Pathways, Receptors CBRN/Hazardous Area Response Team Manager *(almost all questions answered))(6/34 qs not answered)* - working for Emergency services (Ambulance services) - involved in exposure assessment by: Detection and identification for air and Other - patient assessment - focused on: Source
Drinking Water Regulator *(many qs answered)* - working for National government department/agency - involved in exposure assessment by: Data assessing for water - focused on: Source, Pathways, Receptors Head of Quality and Compliance, Water Company *(quite a few qs answered)* - working for National government department/agency - involved in exposure assessment by: Monitoring, At scene sampling, Detection and identification, Data assessing, Analytical laboratory, Risk characterisation for water - focused on: Source, Pathways Provide public health advice on water quality incidents which include chemical contamination *(almost all questions answered; cross-border not answered)* - working for Other - involved in exposure assessment by: Monitoring, At scene sampling, Detection and identification, Data assessing, Modelling, Analytical laboratory, Risk characterisation, Identification of affected groups for water

- focused on: Source, Pathways
Principal scientist, environmental contaminants *(few qs answered)* - working for National government department/agency - involved in exposure assessment by: Monitoring, Detection and identification, Analytical laboratory for crops/food - focused on: Pathways, Receptors environmental health *(quite a few qs answered)* - working for Local government department/agency - involved in exposure assessment by: Identification of affected groups for air, water, soil, crops/food; Data assessing, Risk characterisation for air, water ad soil; Monitoring for water and soil; At scene sampling for soil, crops/food - focused on: Source, Pathways, Receptors chemist *(few qs answered)* - working for National government department/agency - involved in exposure assessment by: Analytical laboratory for water, soil, crops/food - focused on: Source, Pathways Govt. policy & science in relation to environmental contaminants in food *(few qs answered)* - working for National government department/agency, Environmental services - involved in exposure assessment by: Data assessing, Risk characterisation, Coordination of exposure assessment for air, water, soil, crops/food - focused on: -
II. Environmental monitoring and modelling capabilities in Member States
- information flow: Fire and Rescue services share alerts with emergency, environmental and health agencies as necessary. For incidents with off site impacts, work closely with Police who would chair Multi-agency Coordinating Groups if needed. FRS share information via coordinating groups / upon request to other responding agencies.
- environmental monitoring carried out **during** and **after** major chemical incidents
- the national authorities supervising: - environmental monitoring: Ministry of Environment (or equal authority), Ministry of Health (or equal authority) and other - public health exposure characterisation: Ministry of Health (or equal authority), Ministry of Environment (or equal authority) and other (Other: Home Office / Regulators such as DWI, EA may be involved in assessing monitoring needs for water quality/raw water quality in a serious chemical incident. The Health Protection Agency/NHS would give guidance on exposure assessments / Local authorities, food standards Agency, health Protection Agency, Environment Agency)

monitoring at the incident scene carried out by: - National Hazmat teams (for public and occupational health, environment protection) (matrices: air, water, soil, food/crops and other/not specified) - Fire and rescue services (for public, occupational health and environment protection) (matrices: air, water, soil, other/not specified) - Environmental protection services (for environment, public and occupational health protection) (matrices: air, water, soil, food/crops, other) - Site operator resources (chemical rescue team) (for public, occupational health and environment protection) (matrices: air, water, soil, crops/food) - Health protection services (for public, occupational health and environment protection) (matrices: air, water, soil, food/crops) - Other (Department of Agriculture, Water company, Food Standards Agency; Local Authorities) (for public, occupational health and environment protection) (matrices: air, water, food/crops and other)
- the nature of the monitoring resource availability and the capability: - Within the emergency exclusionary Zone / for emergency response / dedicated 24/7(matrices: air, water, soil, crops/food and other) - Within the emergency exclusionary Zone / for emergency response but not a dedicated 24/7 service (matrices: air, water, soil, crops/food and other) - Off site for assessing public exposure / dedicated 24/7(matrices: air, water, soil, crops/food and other) - Off site for assessing public exposure but not a dedicated 24/7 service (matrices: air, water, soil, crops/food and other) other: chemical / biological 'white powder' agents and incidents
- environmental monitoring / analysis equipment used or commissioned for public occupational health and environmental purposes: - AIR - HazMat DIM in hot zone: GC-MS + electrochemical sensors + colorimetric ('Draeger') tubes. - Air Quality Cell: gas phase FTIR + Laser scattering particulate monitoring + lab testing - WATER - Environment Agency + Water companies' lab testing - generally sampling + lab testing. - DEPOSITION / LAND - HazMat DIM: FTIR identification. - AQC: Environment Agency sampling + lab testing - repeated environmental monitoring available for public and occupational health and environmental purposes - substances monitored / techniques used: HazMat DIM: GC-MS AMU 45 to 300 & boiling point <250C + liquids and solid identification by FTIR; AQC: SOx, NOx by chemiluminsence to ppb. Gaseous components by FTIR to ppm, particulate matter. - the 'owner' and the recipient of the monitoring data; commission of environmental monitoring for exposure assessment: - HazMat DIM: Fire and Rescue Service -> Multi-agency coordination group. - Air Quality Cell (AQC) in England and Wales: Environment Agency to AQC - Airborne Hazards Advice Cell (AHAC) in Scotland: SEPA Scottish Environmental Protection Agency to AHAC

- the data are used / shared to inform public health risk assessment (identification, estimation of source term, estimation of population exposure) - time needed to obtain the data: - HazMAt DIM: 30 min travel + 30 min on site preparation + up to 30 min data available - AQC: 4 hours to deploy + 2 hours typical minimum data acquisition.
- the nature of the modelling availability and the capability: - Local models for air, water, soil, crops/food - Dispersion models by meteorological experts for air, water, soil, crops/food and other - Water dispersion modelling for air, water and soil - Other (Predictive dispersion modelling for land use planning purpose) - environmental modelling in the case of major chemical incident carried out for risk assessment by Met Office - software used: NAME II for Chemets - source term (rate of release) information is provided by Fire and Rescue Service / Site operator - modelling restrictions: does not currently account for dense gases / topography - predicted air concentrations and deposition rates on sensitive receptors are calculated with time - the model can not account for ingress of plumes and safety factors for those sheltering - airborne dispersion modelling is based complex dispersion model accounting for mixing layer, surface topography, plume buoyancy and deposition etc. - modelling can predict the environmental concentrations of a given chemical release (Including deposition)
- national Hazmat teams to support exposure assessment organised within national fire and rescue service - the output of national Hazmat teams' activity: Determining response based up on nature of material / On site screening for harmful substances / Carry out assessment at incidents with support form local and national scientific services / Fire Detection Identification and Monitoring teams respond daily across UK to a range of Hazmat related calls / respond to incidents and provide data for emergency responders and the wider responding community / National HART Teams / Local Detection and Identification which is then passed to local responding agencies / Detection Identification & Monitoring vehicles to deal with CBRN & other hazmat issues - the receiver of their output: operators of hazardous activities: Cat 1 responders, Police, Water Companies etc, / Dependent on incident but normally fire commanders for information of multi agency partners / Other Government Agencies and Public / emergency services and government agencies, NHS / Emergency Service and Health representatives / Home office / Scottish Government
- back office service for onsite Hazmat advisors to support exposure assessment
- Hazmat sampling teams within national Hazmat teams (8) and as separate units (2)
resources and equipment available for sampling: - Procedures for drinking water, surface water, ground water, soil, air, food, vegetation, debris and particulate matter, powder - Commercial off the shelf sampling kit for drinking water, surface water, ground water, soil, air, food, vegetation, debris and particulate matter, powder

- Self made sampling kit for drinking water, surface water, ground water, vegetation
- Specific technical equipment for drinking water, surface water, ground water, soil, air, food, vegetation, debris and particulate matter, powder

- resource/equipment available for detection and identification:
    - within local resources: Raman spectroscopy, IMS, PID, Detection tubes, IR spectroscopy, UV-Vis spectroscopy, ICP – techniques (ICP-AES, ICP-MS), GC – techniques (GC, GC-MS, GC-MS-MS), LC-techniques (LC-MS, LC-MS-MS), HPLC and other
    - regional resources: Raman spectroscopy, IMS, PID, Detection tubes, IR spectroscopy, GC – techniques (GC, GC-MS, GC-MS-MS)
    - within national resources: Raman spectroscopy IMS, PID, Detection tubes, IR spectroscopy, XRF, ICP – techniques (ICP-AES, ICP-MS), GC – techniques (GC, GC-MS, GC-MS-MS), LC-techniques (LC-MS, LC-MS-MS), HPLC
    - equipment deployed at/near scene of incident: Raman spectroscopy, IMS, PID, Detection tubes, IR spectroscopy, UV-Vis spectroscopy, ICP – techniques (ICP-AES, ICP-MS), GC – techniques (GC, GC-MS, GC-MS-MS), HPLC
    - equipment deployed at nearby locations: IMS, PID, Detection tubes, IR spectroscopy, UV-Vis spectroscopy, GC – techniques (GC, GC-MS, GC-MS-MS), LC-techniques (LC-MS, LC-MS-MS), HPLC

Other

- Some basic analysis would also be done (such as turbidity, pH, colour, etc). The responses above cover only water company specific testing. There are national facilities for more specialised testing but I do not know which methods would be employed. Note: all water company testing is done off site.
- Don't know comprehensive list - spread across different secure sites some of which is secure or in confidence.

- an interdisciplinary procedure for sampling, detection, identification and monitoring exist for air, water, soil, crops/food

- mobile detection and identification equipment NOT available for: water (1), soil (1), crops/food (1) / 12 answers don't know

- a national laboratory network exists for air, water, soil, crops/food

- When exposure assessment is performed, the analysis results are compared to Acute Exposure Guideline Levels, Other guidance values (TDI, TWI, BMDL, National and international standards, European Drinking Water Standards, Water quality standards as set out in the Water Supply Water Quality Regulations; the WHO guidelines for drinking water quality; Suggested No Adverse Response Levels (SNARL) as derived by United Kingdom Water Industry Research (UKWIR) and WRc in the Toxicity Datasheets - this is a database used by water companies to assess chemicals/toxins; EQS's, AEGLS, SNARLS etc.

- the data deriving from DIM (Detection, Identification, Monitoring) activities carried on incident site are forwarded to: (and health risk assessment is undertaken by:)
    - Fire and rescue service at local, regional, national level
    - Environmental protection officials at local, regional, national level
    - Public health officials at local, regional, national level
    - Food safety officials at local, regional, national level
    - Other (provide who, e.g. site operator) - level depending on how severe the incident is

- the lead organisation for provision of public health advice in case of chemical incident - Smaller incidents: Fire and Rescue Services &/or Police &/or Ambulance Service;

Then multiagency with: Public Health Agency ‘PHA’ Northern Ireland Environment Agency Department of Agriculture and Rural Development ‘DARD’ http://www.dardni.gov.uk/ Local Authorities
- additional information gathered during the acute phase of a chemical incident (needed for exposure assessment) by: - fire and rescue service, environmental protection service, health service and site operator - Short characterisation of the place of release (closed building, open air etc.) - Potentially exposed population (kind, size) - Potentially exposed grounds / crops / facilities etc.) - Type of the substance - Quantity released - Exposed population – health effects - Meteorological (weather) conditions - Observations / notifications (e.g. smell, deposition etc.) - Analytical data - Other
- using risk mapping (GIS mapping) systems available in UK it is possible to gather information about: Land use (agriculture, residential, industry area etc.), Population size, Population type (possible identification of susceptible populations near the incident location), The vulnerable zones (populations at risk/sensitive receptors)
- airborne dispersion models available provided by meteorological and non meteorological experts
- water borne dispersion models are available in UK
- available outputs of environmental modelling: - Chemical concentrations in the air and water - Deposition
- no standardised geographical registration of complaints of the effects of chemical incidents (e.g. complaints of odour nuisance, health complaints) - no databases of previous incidents with good practices of exposure assessment though interesting incidents are shared via HazMat / DIM network.
III. Cross-border cooperation in case of chemical incident
- arrangements on international collaboration in case of a major chemical incident YES (at first responder and national level) - Do share data with other Member states but cross border agreements between Scotland & England & N Ireland
- information flow: Fire service talks direct to Fire service across border. Has local arrangements in near border regions to cross cover / support. Each Fire and Rescue Service does not liaise otherwise outside border.
- practice monitoring data exchange in case of a cross-border incident: For FRS - direct to corresponding FRS. Presume same for others responding agencies.

- practice modelling data exchange in case of a cross-border incident: For FRS - direct to corresponding FRS. Presume same for others responding agencies. - practice data exchange in case of a cross-border incident for scientific public health interpretation to incident command: For FRS - direct to corresponding FRS. Presume same for others responding agencies. - practice data exchange in case of a cross-border incident for public messages: FRS share. Emergency Response Coordinators expected to share.
- misinterpretation of data shared with neighbouring countries not expected
- restrictions on data exchange across borders - For FRS no. Noted that DIM equipment south of the border is operated by military, who have a different remit and are unlikely to cross the border and less likely to share information.
mobile laboratories' functions (available in UK) support the international response to chemical incidents YES (2)/NO (2) / 13 answers don't know - FRS and specialist assess from MoD - Likely to be commercial labs - We have mobile lab for use in Scotland & potentially other parts of UK but would not envisage transporting beyond UK boundaries - Mobile monitoring units are able / willing to cross borders according to wind direction to make best use of resource.
- we have (3)/ have not (2) a risk mapping (GIS mapping) system which shows receptors (potentially affected persons) in neighbouring countries
- dispersion models available for UK and for neighbouring countries: the same models and compatible ones – i.e. the basis and outputs are similar
- the "source" country's dispersion modelling will / will not be used on both sides of the border ?
- water borne dispersion models available for UK and for neighbouring countries: compatible ones
- the "source" country's water borne dispersion modelling will be used on both sides of the border
- risk assessors are able to share plans, information with colleagues in neighbouring countries, are aware of response, particularly public health systems and resources in neighbouring countries, are able to understand the neighbouring countries risk assessment procedures and acute response trigger levels. - dispersion modelling is not equivalent and cross validated / the differences are not understood but the information would be interpreted in equivalent manner. - GIS systems are not integrated / do not maintain some cross border functionality - Risk characterisation is integrated on both sides of the border, with an agreed assessment and if possible common messages.

An example of successful exposure assessment in a cross-border chemical incident:
There have not been cross border incidents since the availability of monitoring equipment within FRS. Historically there have been incidents at lower tier Seveso sites on the border. Also there is much cooperation and exercising for high pressure gas lines.
Factors contributed to the success: Knowing and working with cross border partners regularly.

10 Appendix 4 Table-Top exercise participants

country	Title	Name Name of organisation Email address	professional background	skipped / don't know questions:
Austria			Environmental meteorologist - working for National government department/agency and Environmental services - involved in exposure assessment by: Modelling, Risk characterisation and Other (air) (We can calculating the toxic distances by accidental release of toxic substances(gases) for the purposes of elaboration of external/internal emergency plans for SEVESO establishments and emergency trainings. And we support the emergency responders with meteorological information by demand.) - focused on: Pathways	- 8 (monitoring resource), - 11, 12 (output of Hazmat teams) - 15, 16, 17, 18 (sampling, detection, identification) - 25 (water borne dispersion models availability) - 27-30, 32-34 (cross-border cooperation)
Belgium			Officer in the department of NBC and detection - working for Emergency services (Fire services) - involved in exposure assessment by: Monitoring, At scene sampling, Detection and identification and Risk characterisation for air - focused on: Source and Receptors	- 6 (authorities supervising) - 13 (back office service) - 17, 18, 19 (procedure for sampling, DIM, laboratory network) - 24-26 (dispersion models) - 29-34 (cross-border cooperation) better in air
Czech Republic			University professor - working for: Other - involved in exposure assessment by: Detection and identification, Modelling, Risk characterisation, Identification of affected groups (air, water) and Risk characterisation also for soil - focused on: Source, Pathway	- 29 (mobile laboratories cross-border) - 32 ('source' country's modelling usage)
Denmark			Job description: Fire officer - working for Emergency services (Fire services) - involved in exposure assessment by: At scene sampling, Detection and identification, Data assessing, Risk characterisation, Identification of affected groups, Coordination of exposure assessment - focused on: Source, Pathways, Receptors	- 11 (Hazmat teams activity output) - 16, 17, 18 (detection and identification) - 20(guidelines) - 22 (additional information) - 24-26 (modelling) - 28-34 (cross-border cooperation)
France			national epidemiologist : public health officer involved in preparedness to post-disaster response	- 11, 12 (output of Hazmat teams) - 16, 18, 19 (detection and identification)

			- working for: National government department/agency, Federal or provincial government department/agency - involved in exposure assessment by: Risk characterisation (air, water; soil, crops/food, other); other (health effects monitoring among exposed population or concerning the area where the event happened) - focused on: Pathways, Receptors	- 28-34 (cross-border cooperation)
			During crisis, in charge of expertise on response techniques suitable, risk assessment linked with the incident. - working for: Other - involved in exposure assessment by: Monitoring, At scene sampling, Data assessing, Risk characterisation (air, water, crops/food); Detection and identification, Analytical laboratory, Identification of affected groups, Coordination of exposure assessment (water, crops/food); Modelling (air, water); Other (To give the opinion of Cedre on the response deployed) - focused on: Source, Pathways	- 15 (resources/equipment for sampling) - 16, 17, 18 (detection and identification) - 22 (additional information) - 23 (GIS) - 28, 30-34 (cross-border cooperation)
Germany			Chief CBRN - working for: Emergency services (Fire services) - involved in exposure assessment by: Monitoring, At scene sampling, Detection and identification, Data assessing, Modelling (air, water); Analytical laboratory, Risk characterisation, Identification of affected groups, Coordination of exposure assessment (air) - focused on: Source	- 17, 18, 19 (detection and identification, laboratory network) - 25 (modelling) - 28, 29 (cross-border cooperation)
			advisor supporting the operations of headquarters in accidents with chemical/radiological materials. - working for: Emergency services (Fire services) - involved in exposure assessment by: At scene sampling (air, water; soil); Detection and identification, Data assessing, Risk characterisation (air) - focused on: Source	- 11, 12 (output of Hazmat teams) - 14 (Hazmat sampling teams) - 27-34 (cross-border cooperation)
Greece			studying, planning, organizing and coordinating actions for the prevention of major-accident hazards involving dangerous substances and the response to relevant major accident. - working for: National government department/agency - involved in exposure assessment by: Other (When an	- 7, 8 (monitoring) - 9 (modelling) - 10 (national Hazmat teams) - 12 (receiver of output of Hazmat teams) - 13 (back office service)

			accident with hazard releases happens, the Civil Protection Operation Centre is informed and coordinates the actions aiming at emergency response in order to ensure the population and environment protection. Also when a major-accident involving dangerous substances happens, the General Emergency Plan (Major Industrial Accidents Response Plan) (SATAME), which was drown up under the coordination of the General Secretariat for Civil Protection and approved by the General Secretary for Civil Protection, is activated. This plan, among others, refers to the necessary actions of each involved public agency during all steps of the accident.) - focused on: Source, Pathways, Receptors	- 14 (Hazmat sampling teams) - 15 (resources/equipment for sampling) - 16-19 (detection and identification, laboratory network) - 20 (guidelines) - 21 (receiver of data from DIM) - 22 (additional information) - 24-26 (modelling) - 27-34 (cross-border cooperation)
Hungary			Meteorological Service - working for: National government department/agency - involved in exposure assessment by: Monitoring, At scene sampling, Data assessing, Modelling, Analytical laboratory (air) - focused on: Source, Pathways	- 11, 12 (output of Hazmat teams) - 15(resources/equipment for sampling) - 18 (detection and identification) - 23 (GIS) - 25 (modelling) - 27-30, 32-34 (cross-border cooperation)
Ireland			Medical doctor (Public Health Medicine) - working for Health services - involved in exposure assessment by: Data assessing, Risk characterisation, Identification of affected groups, Coordination of exposure assessment (air, water, soil, crops/food) - focused on: Source, Pathways, Receptors	- 11, 12 (output of Hazmat teams) - 16 (detection and identification) - 25 (modelling) - 29, 33, 34 (cross-border cooperation)
			Meteorologist - working for: National government department/agency - involved in exposure assessment by: Data assessing, Modelling (air) - focused on: Pathways	- 10 (national Hazmat teams) - 11, 12-14 (Hazmat sampling teams) - 16, 17 (detection and identification) - 20 (guidelines) - 25, 26 (modelling) - 28, 32-34 (cross-border cooperation)
Italy			advisor (bio-emergency) - working for Health services and Other - involved in exposure assessment by: Monitoring, At scene sampling, Detection and identification, Modelling, Analytical	- 8 (monitoring) - 11, 12 (output of Hazmat teams) - 18 (detection and identification) - 25 (modelling)

			laboratory (water, crops/food, other) Data assessing, Risk characterisation, Identification of affected groups, Coordination of exposure assessment (other) - focused on: Source, Pathways, Receptors	- 28, 30, 32 (cross-border cooperation)
Latvia			civil defence - working for Emergency services (Fire services) - involved in exposure assessment by: Detection and identification, Data assessing, Modelling (air) - focused on: Source	- 30-34 (cross-border cooperation)
Lithuania			advisor on all aspects of public health protection in case of chemical emergency. - working for: National government department/agency and Health services - involved in exposure assessment by: Data assessing, Identification of affected groups, Coordination of exposure assessment, Risk characterisation (matrices: air, water, soil, crops food) - focused on: Source, Pathways and Receptors	- 8 (monitoring) - 9 (modelling) - 10 (national Hazmat teams) - 11-14 (Hazmat sampling teams) - 15 (resources/equipment for sampling) - 16, 18, 19 (detection and identification, laboratory network) - 20 (guidelines) - 24, 25 (modelling) - 27-34 (cross-border cooperation)
Portugal			Fire Officer - working for Emergency services (Fire services) - involved in exposure assessment by: At scene sampling, Risk characterisation (matrices: air, water, soil), Detection and identification and Coordination of exposure assessment (matrices: air, water, soil, crops/food), Identification of affected groups (matrices: air, water) - focused on: Source and Receptors	- 11, 12 (output of Hazmat teams) - 16, 18, 19 (detection and identification, laboratory network) - 25 (modelling) - 31-34 (cross-border cooperation)
			Volunteer Firefighter / IT Consultant for the Volunteer Fire Service - working for Emergency services (Fire services) and Emergency services (Ambulance services) - involved in exposure assessment by: Monitoring, Detection and identification (matrices: air), Modelling and Risk characterisation (matrices: air, water, soil) - focused on: Source, Pathways and Receptors	- 29 (cross-border cooperation)
			Safety Engineer; Emergency Manager - working for Military, Emergency services (Fire services) and Other	- 30-34 (cross-border cooperation)

			- involved in exposure assessment by: Detection and identification and Risk characterisation (matrices: air, water, soil), Modelling and Identification of affected groups (matrices: air) - focused on: Source, Pathways	
			Volunteer Firefighter - working for Emergency services (Fire services) - involved in exposure assessment by: Detection and identification (matrices: air), Risk characterisation (matrices: air, water, soil) - focused on: Source	
Slovakia			safety and risk specialist (Fire protection; Nuclear Power Plants) - working for Environmental services - involved in exposure assessment by: Data assessing (matrices: air, water and other), Modelling and Risk characterisation (matrices: air, water, soil and other) Other: Halon alternative gas monitoring (matrices: air) - focused on: Source and Pathways	- 11, 12 (output of Hazmat teams) - 18 (detection and identification) - 32, 34 (cross-border cooperation)
Slovenia			Public Health Physician - working for Health services - involved in exposure assessment by: : Monitoring, Detection and identification (matrices: water, crops/food), Data assessing (matrices: air, water, soil, crops/food), Analytical laboratory (matrices: water, crops/food and other), Risk characterisation and Identification of affected groups (matrices: air, water, soil, crops/food and other) - focused on: Source, Pathways and Receptors	- 16, 18 (detection and identification) - 20 (guidelines) - 25 (modelling) - 28-32 (cross-border cooperation)
			Medical toxicologist - working for Health services - involved in exposure assessment by: Risk characterisation (matrices: air, water, soil, crops/food and other) Other: assessment of exposure from contaminated consumer products - focused on: Source and Receptors	- 8 - 11, 12 (output of Hazmat teams) -15 (resources/equipment for sampling) -16-19 (detection and identification, laboratory network) - 23 (GIS), - 24, 26 (modelling) - 27-34 (cross-border cooperation)
Spain			Fire Officer - working for Emergency services (Fire services)	- 11, 12 (output of Hazmat teams) - 17, 19 (detection and identification,

			- involved in exposure assessment by: other - Work on the scene of incidents as fire chief. However, with operational purposes – making some modelling scenarios. - focused on: Source and Receptors	laboratory network) - 25 (modelling) - 27-34 (cross-border cooperation)
			Training Coordinator of the 112 Emergency Number - working for Federal or provincial government department/agency - involved in exposure assessment by: Training other emergency professionals about the chemical hazards and the risk that suppose for the populated areas to live very near to these dangerous industries. - focused on: Pathways and Receptors	- 8 (monitoring) - 9 (modelling) - 10 (national Hazmat teams) - 11-14 (Hazmat sampling teams) - 16, 18 (detection and identification) - 20 (guidelines) - 24 (modelling) - 28, 29, 32-34 (cross-border cooperation)
The Netherlands			environmental health physician - working for Local government department/agency, Health services - involved in exposure assessment by: Monitoring, At scene sampling and Modelling for air, Data assessing, Risk characterisation and Identification of affected groups for air, water, soil - focused on: Source, Pathways and Receptors	- 18 (detection and identification) - 25 (modelling) - 29, 31-34 (cross-border cooperation)
			Toxicologist /Health physicist at the Dutch Poisons Information Centre - working for National government department/agency, Health services - involved in exposure assessment by: Risk characterisation, Identification of affected groups, Coordination of exposure assessment and other - deriving exposure area and severity from symptoms in humans and animals, reported to the DPIC; advising on (medical) management of patients and measures to prevent (further) exposure and reduce harm (matrices: air, water, soil, crops food and other) - focused on: Pathways and Receptors	- 18 (detection and identification) - 30-34 (cross-border cooperation)
			Toxicologist, Health Advisor HazMat (risk assessment for the general public and pre-hospital medical care in case of chemical accidents) - working for Health services - involved in exposure assessment by: Risk characterisation, Identification of affected groups, Coordination of exposure	- 17, 18 (detection and identification) - 29-31, 33, 34 (cross-border cooperation)

			assessment (matrices: air, water, soil, crops food) and other - Biological monitoring of components in air if applicable - focused on: Source, Pathways and Receptors	
			public health advisor hazmat for 5 safety regions in South of The Netherlands; toxicologist at a university hospital; certified occupational hygienist - working for Health services - involved in exposure assessment by: Monitoring, Detection and identification for air, crops/food and other, At scene sampling, Modelling, Analytical laboratory and Risk characterisation for air and other, Detection and identification for air, water, crops/food and other, Data assessing for air and water, Identification of affected groups, Coordination of exposure assessment and other - Biological monitoring (matrices: air, water, soil, crops food and other) - focused on: Source, Pathways and Receptors	- 18 (detection and identification) - 25 (modelling) - 30, 31, 33, 34 (cross-border cooperation)
			Assessing and managing HAZMAT protocols and incidents - working for Local government department/agency, Health services - involved in exposure assessment by Modelling, Data assessing and Coordination of exposure assessment for air, Risk characterisation and Identification of affected groups for air, water, soil - focused on: Source, Pathways	- 15 (resources/equipment for sampling) - 16, 17 (detection and identification) - 29, 31-34 (cross-border cooperation)
			Emergency response backoffice team(Quantitative risk analysis for industrial plants, pipelines; Development of QRA methodology; Helpdesk support of competent authorities) - working for National government department/agency - involved in exposure assessment by: Modelling, Risk characterisation (matrices: air) - focused on: Source, Pathways	- 15 (resources/equipment for sampling) - 16-19 (detection and identification, laboratory network) - 21 (receiver of data from DIM) - 27-34 (cross-border cooperation)
			Person working in Environmental Protection Agency - working for National government department/agency, Federal or provincial government department/agency, Local government department/agency, Emergency services (Fire services), Environmental services - involved in exposure assessment by: Monitoring, Data	- 30-34 (cross-border cooperation)

			assessing and Identification of affected groups for air, At scene sampling, Detection and identification for air, water, soil, Modelling, Risk characterisation and Coordination of exposure assessment for air and water - focused on: Source, Pathways	
			Hazmat specialist - working for Emergency services (Fire services) - involved in exposure assessment by: At scene sampling, Identification of affected groups, Coordination of exposure assessment (matrices: air, water, soil), Modelling for air - focused on: Source, Pathways	- 14, 15 (Hazmat sampling teams) - 18 (detection and identification) - 20 (guidelines) - 27, 28, 33, 34 (cross-border cooperation)
United Kingdom			Scientific Advisor to fire service and Emergency Planner with the Environment Agency - working for National government department/agency, Environmental services - involved in exposure assessment by: Monitoring, At scene sampling, Detection and identification for air and water; Modelling for air - focused on: Source, Pathways, Receptors	- 19 (laboratory network) - 20 (guidelines) - 27-30, 32-34 (cross-border cooperation)
			Fire Hazmat Officer - working for Emergency services (Fire services) - involved in exposure assessment by: Detection and identification for air and water; At scene sampling, Data assessing and Risk characterisation for air, water and soil - focused on: Source, Pathways, Receptors	- 18 (detection and identification) - 25 (modelling) - 28, 30, 32-34 (cross-border cooperation)
			CBRN/Hazardous Area Response Team Manager - working for Emergency services (Ambulance services) - involved in exposure assessment by: Detection and identification for air and Other - patient assessment - focused on: Source	- 25 (modelling) - 27, 28, 32-34 (cross-border cooperation)
			aim to anticipate and prevent the adverse effects of acute and chronic exposure to non infectious environmental hazards and support health protection units and other agencies to protect public health - working for Other - involved in exposure assessment by: Data assessing, Risk characterisation, Identification of affected groups,	- 11-14 (Hazmat sampling teams) - 18 (detection and identification) - 29-34 (cross-border cooperation)

			Coordination of exposure assessment for air, water, soil and other (assessing impact of exposure on wider public health and identifying vulnerable or sensitive groups) - focused on: Pathways, Receptors	

APPENDIX 4

Cross-border Exposure Characterisation for Risk Assessment in Chemical Incidents CERACI

Workshops with table-top exercises - TASK D Report

Main contributors:

RIVM: Task manager

RIVM: co-ordination and review of workshop design, implementation, execution and reporting.

RIVM (with sub-contractors): develop scenarios for the workshops, produce report on best practices and potential benefits, finalise network.

RIVM: all practical arrangements for the organisation of the workshops.

HPA and NIOM: Aid development of scenarios and identify eligible border region for recruitment of workshop participants. Provide input for and review the analysis of the table-top exercises and the framework for the network of experts.

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Sole responsibility for this report lies with the authors: the National Institute for Public Health and the Environment (RIVM), the Health Protection Agency (HPA) and the Nofer Institute of Occupational Medicine (NIOM). Neither the European Commission, nor the authors, nor any person acting on their behalf is responsible for the use which might be made of this information.

This report is a collation of the information made available via literature reviews, expert feedback and project surveys and workshops, within the resources available to the project. It does not represent the position of the European Commission, the National Institute for Public Health and the Environment, the Health Protection Agency or the Nofer Institute of Occupational Medicine.

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www.rivm.nl/ceraci

Contents

Task D: Workshops with table-top exercises

1 Executive Summary

In this task of the CERACI project, European experts on exposure assessment were invited to workshops to share their experience and good practices on the exposure assessment of chemical incidents, in particular cross-border incidents. A framework for a network of experts was also discussed during this task.

A wide range of experts, covering many aspects of exposure assessment and representing various organisations, such as public health and fire and rescue services, participated in the workshops. During the workshops, exercises using scenarios of chemical incidents were used to elicit good practices, unmet needs and success factors for exposure assessment. The exercises focussed on the exposure assessment of a chemical incident within a country's borders as well as the exposure assessment of a cross-border incident.

The delegates verified or endorsed the good practices already identified in this project. Moreover, they contributed many additional examples of good practices pertaining to both the preparedness and the response phases of an incident. Many good practices related to general aspects of exposure assessment, such as information exchange and collaboration, with less of a focus on technical aspects, perhaps due to the diverse backgrounds of the delegates. When discussing unmet needs, it became clear that one country's unmet need is another country's good practice. This enabled delegates to learn from one another and highlighted the importance of sharing good practices in a multidisciplinary, international setting.

The delegates expressed their satisfaction with the workshops and felt they were an event worthy of repetition. Furthermore, the workshop discussions and outcomes provided interesting ideas for future development, such as a regional cross-border approach to exposure assessment, using a regional risk profile as a starting point.

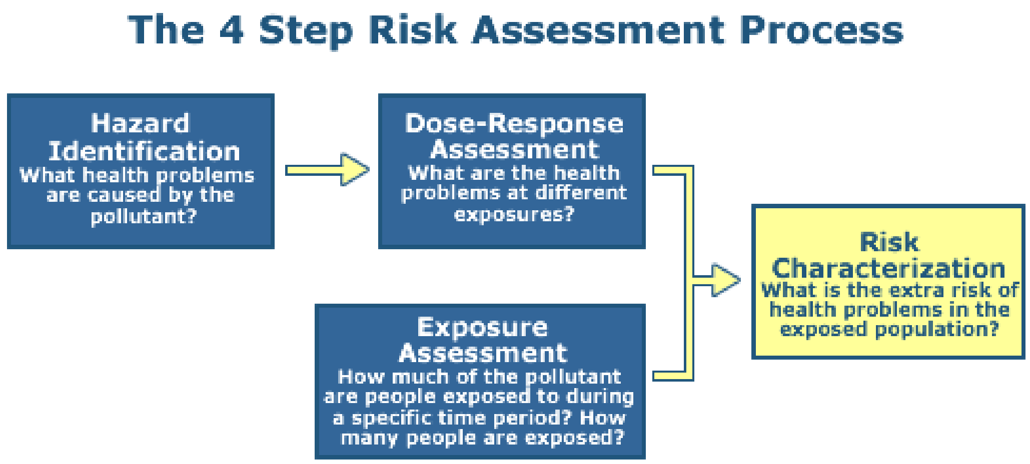
The need for a network of experts in the field of exposure assessment was clearly expressed by the delegates, with the focus of the network ranging from presenting support to a country during a chemical incident to helping prepare a country for an incident. How to organise, coordinate and resource the network is elaborated on in this report.

2 Introduction

The CERACI project aims to strengthen public health risk assessment for the acute phase of chemical incidents by improving exposure assessment. Furthermore, this project aims to facilitate cooperation in the public health management of chemical incidents across administrative boundaries by improving interoperability of exposure assessment guidelines, tools and practices.

Exposure assessment is considered to be part of the 4 step risk assessment process as described by the National Research Council, see Figure 1. Exposure assessment forms the basis for health risk assessment during acute chemical incidents, in order to reduce the burden of disease and to inform both the public and workers involved in the incident. Therefore, exposure assessment is also the basis for risk management and communication about risk. In the acute phase of an incident, the focus is on protecting anyone from (further) harm and proper treatment of those potentially exposed or at risk. In the case of cross-border incidents, it is important to be aware of the similarities and differences in approaches to exposure assessment between Member States.

Figure 1. The National Research Council Risk Assessment Model; NRC, 1996



The CERACI project aims to provide answers to the following questions:

- How have Member States organised exposure assessment for health risk assessment during acute chemical incidents?
- Which Member States have organised collaboration and interoperability on exposure assessment nationally and across borders?
- Which good practices - technical or organisational - can be (further) developed?
- Will harmonisation and collaboration improve Member States' capabilities and capacities to respond to acute chemical incidents?

2.1 Task D objectives and deliverables

In the two previous tasks of the project, a literature review (Task B) and a web-based survey (Task C) were conducted to identify exposure assessment capabilities and good practices in chemical incident response in Member States.

Building on these tasks, two workshops with table-top exercises were conducted, with the following objectives:

- Verify and test the general applicability of good practices for environmental monitoring across administrative boundaries within and between Member States as proposed by Task C.
- Assess the capabilities for exposure assessment in Member States with public health officials and civil protection personnel.
- Explore the potential to improve EU responsiveness to cross-border chemical incidents by harmonisation and collaboration in the field of exposure assessment.
- Further develop a network of experts from Member States involved in public health risk assessment.

The deliverables of Task D as formulated in the Project Strategy are:

- Workshops with table top exercises for chemical incidents.
- Report of the workshops with minimum standards, feasibility and good practices for environmental monitoring to support health risk assessments. This will include an exploration of the potential beneficial effects of further collaboration and joint development in the field of exposure assessment of chemical incidents on EU responsiveness.
- Framework for a network of experts and expert centres from EU Member States to support the sustainability of the network

3 Methodology

In case of a large chemical incident on one of our borders in Europe, it is necessary to know how our neighbours will deal with such an incident in terms of exposure assessment and exchange of information on all aspects relevant for health risk assessment, decision making and risk and crisis communication.

Relevant questions are: “What information is available?” “How will this be shared to inform health risk assessment?” and “How will advice to the public be shared?”

These issues were discussed during two regional workshops in Amsterdam, the Netherlands (19th and 20th March 2012) and Warsaw, Poland (4th and 5th April 2012). Each workshop comprised of table-top exercises using two scenarios based on real life incidents, see Appendix 1.

3.1 Selection of Delegates

A mixed audience of professionals that are active in exposure assessment during a chemical incident were invited, including experts from:

- Health protection services
- Environmental protection services
- Fire and rescue services
- Research institutes
- National and local government
- Military

The invitation (see Appendix 2), including an expression of interest form (see Appendix 3) and a flyer with project information, was sent via e-mail to a contact list of professionals in all 27 Member States which had been developed during the Task B literature review and the Task C survey. This list had been expanded with the networks of individual project members and sub-contractors. Approximately 400 potential delegates were invited directly. Additionally, the invitees were asked to disseminate the invitation mail among relevant contacts in their networks. The CERACI project advisory board was also asked to disseminate the invitation e-mail to relevant interested parties. Furthermore, at a presentation of the CERACI project to the EU working group on CBRN resilience in Civil Protection in March 2012, the audience was encouraged to express an interest in the workshops and to disseminate the invitation among interested parties.

The first invitations were sent on the 19th of January 2012. To increase the response rate a reminder was sent two weeks later. In total, 51 expressions of interest were received, of which in total 37 delegates from 17 countries (including 2 non-EU countries) accepted an invitation to attend the workshops.

As part of their preparation for the workshop, the delegates were sent the ‘CERACI workshop Task-Time Matrix’ (TTM) as homework (see Appendix 4). They were asked to hand in two completed tables during registration or to return them by email in advance of the workshop. Additionally, an overview of Task B and Task C findings was sent as background reading to be read before attending the workshop with the intention of stimulating discussion. Finally, information gathered during Task B and Task C specific to each delegate's country was sent. Delegates were asked to review this information and to provide the project team with feedback.

3.2 Workshop design

The main focus of the workshops was on exposure assessment as the basis for health risk assessment during acute chemical incidents in order to reduce the burden of disease and to inform both the public and workers involved in incident and disaster management.

The workshops were designed to elicit and discuss good practices in exposure assessment, building on the good practice findings of Tasks B and C which the delegates had received as homework. Delegates were also encouraged to discuss key success factors, unmet needs and minimum standards for exposure assessment. To make sure that the goals and deliverables for Task D could be met, all subcontractors and project partners were asked to comment on draft versions of the workshop programme and also on the expression of interest form and invitation e-mail. Additionally, the CERACI project advisory board commented on the first draft design of the workshops at the advisory board meeting in December 2011.

In order to reach the aforementioned objectives (see section 2.1), two scenarios of incidents with a chemical release were used to focus on distinct aspects of exposure assessment, such as modelling, monitoring, use of reference values, observations and analytical laboratory support. These scenarios were based on two real-life incidents. Both scenarios were exaggerated on some points compared to the real scenarios to better reach the goals. The focus on the first day of the workshop was on a chemical incident within a country and on the second day on a cross-border incident. The scenarios were used as a vehicle or means to elicit and share good practices and were not an exercise to test the delegates. At the end of each day, the real course of one of the incidents was presented and illustrated by a keynote speaker to further support the exchange of information and knowledge on exposure assessment. Detail regarding the actual course of events in these real-life incidents was not disclosed until the end of each session to prevent it from influencing the discussions during the exercises. The workshop programme is presented in Appendix 5.

The aims of the workshops per day are described below.

Day one

Elicit an overview based on approaches to exposure assessment *within* Member States of

- Good practices for monitoring, modelling, and interpretation of exposure data, and
- Requirements and good practices for successful information-sharing within a country.

This overview was broken down into:

- Current approaches of Member States
- Unmet needs
- Opinions on good practices, feasibility and minimum standards.

Based on a group discussion, a ranking by priority was generated as a group result.

Day two

Elicit an overview of *cross-border* approaches to exposure assessment along the lines of

1. “Need to do”,
2. “Need to have”, and
3. “Like to have”.

Based on a group discussion, a ranking by priority was generated as a group result.

At the end of Day 2, delegates were requested to complete an evaluation form (see Appendix 6). This enabled minor adjustments to be made before the second workshop, using feedback from the first workshop.

The outcomes of the first workshop in Amsterdam were used as input to elaborate on in the second workshop in Warsaw. The outcomes of the workshop in Amsterdam were presented on a flip chart at the Warsaw workshop, and these issues were further discussed and some new issues were added. This overview with the summed individual ranking of the delegates was used as a basis to present the outcomes of the group discussions during the plenary session.

3.3 Scenarios

The scenarios were based on two real-life incidents.

- *Chemica* scenario: Airborne release, with ‘standard’ chemical components in smoke. This scenario is an exaggeration of the incident at the Buncefield Oil Storage Depot in the UK.
- *Alumina* scenario: Chemical release in a river that may cross a border. The routes of exposure might be inhalation, dermal contact and ingestion through contaminated water, crops, food or soil. This scenario is based on the Ajka alumina sludge spill in Hungary.

The *Chemica* scenario was used for both the ‘within country’ session (day 1) and the cross-border session (day 2). The *Alumina* scenario was used for the cross-border session (day 2) only.

In both workshops, the delegates were divided according to their expertise (as divulged on the expression of interest form and the TTM matrix) into two groups during one of the sessions. The goal of group A was to elicit and share good practices for monitoring, modelling, and interpretation of exposure data. The goal of group B was to elicit and share requirements and good practices for successful information sharing within a country. During the second session the groups were mixed, bringing together delegates with different expertise.

Slight differences existed between both workshops. During the first day of the Amsterdam workshop, the delegates were divided into two groups as described above, and on the second day, the groups were mixed and then divided into four groups. During the Warsaw workshops, the delegates were divided into four groups on both days as, based on the Amsterdam workshop, it was felt that the discussions in smaller groups were more effective.

3.4 Time line and Tasks

An incident time line, from 'initial chaos' to 'under control', formed the line of approach in discussing the issues.

The following relevant points in time were used

- Golden hour when the first rough impression of the incident is available
- First incident report after the first session of the incident team in charge. This may include first monitoring data, interpretation and communication information to be shared with other parties. The first actions and decisions are described.
- Second incident report, including feedback of actions that have been carried out, new information being included (about the situation, monitoring, questions asked, decisions made on a higher level)
- Situation after approximately one day
- Situation after first 3 days

For the benefit of the exercise and due to the limited amount of time, three rounds of injects and questions were used to discuss the tasks on exposure assessment. Injects were defined according to relevant points in time.

Round 1 (Inject 1): the golden hour; Round 2 (Inject 2): there have been 1-2 reporting sessions, which have generated some details and monitoring data; Round 3 (Inject 3): roughly at the end of day 1 or next 1-2 day(s), or period that can still be considered as the acute phase in which some more detailed information and interpretation becomes available.

Delegates have specific tasks and roles in their countries in relation to exposure assessment. Besides, the tasks to be carried out might depend on the moment in time (incident time line or phase). As relevant steps in time are strongly related to other key processes in incident management, tasks will depend on time accordingly. The connection between task and time line is described in the Task-Time Matrix which delegates received as homework (see Appendix 4). In this matrix, the tasks, in the perspective of the course of the incident, are specified for each function/job description. Such a matrix visualises the role/function of the experts in a uniform way allowing comparison between countries.

3.5 International Network of Experts

In the CERACI project an expert network has been initiated. This network can act to exchange knowledge and procedures and to share experience (lessons learned) to enhance cross-border cooperation beyond the project's lifetime. A network which survives the project can serve as a starting point for an operational pool of experts and as a means to maintain expertise, discuss and plan for innovation, research and exercises: it is a starting point for an operational and knowledge exchange platform. In this Task, the possibility to permanently host the network of experts under a relevant organisation has been investigated. This was done through a literature review, workshop discussions and a short questionnaire, held during the Warsaw workshop. The outcomes of this are presented in Chapter 5.

3.6 Terminology and categorisation of results

In the CERACI project, we initially used the term 'best practice'. During the workshops, we decided to use the term 'good practice' instead of 'best practice'. This was in order to avoid discussions between what are 'good' practices and what are 'the best' practice whereby delegates might feel their countries' practices were being judged. This could lead to an uncomfortable atmosphere in which delegates would not be willing to share their practices and this would undermine the purpose of the workshops.

Furthermore, delegates were asked to name 'key success factors' and 'unmet needs' for exposure assessment. Delegates sometimes mentioned these explicitly. In other cases, we have interpreted their answers as pertaining to success factors or unmet needs, depending on the terminology used. For example, if delegates mentioned practices which they considered 'important' or 'essential' we refer to them as 'success factors'. We accept that there may be cases in which we have not categorised the issues raised by delegates in the same way as they would have categorised them. The fact that most delegates were not speaking their first language during the workshops might also have led to differences in interpretation.

4 Results: The Workshops

One of the objectives of Task D was to verify and test the general applicability of the good practices for exposure assessment across administrative boundaries that were found in Tasks B and C. These good practices were disseminated to the delegates before the workshops as background reading and the delegates were invited to give feedback on these findings. Although the delegates did not provide any written feedback on these findings, during the workshops they either reiterated, endorsed or added to the good practices.

In this chapter, an overview of the information provided by delegates is first given, based on the expression of interest forms and the Task-Time Matrix. Subsequently, the findings of Tasks B and C, which the delegates had received before the workshop, are presented, followed by the workshop findings. These findings are divided into practices pertaining to the preparedness phase and the response phase of a chemical incident. Per theme, the findings of Tasks B and C are presented first, followed by the workshop findings. The Task C survey was completed by respondents from 26 of the 27 Member States.

The findings are divided into:

- The main issues or unfavourable practices
- The common practices across the EU
- The good practices for individual Member State actions
- The good practices for sharing between Member States

Furthermore, the workshop findings include the following categories:

- Unmet needs
- Success factors

In the workshop discussions, the chairpersons also attempted to elicit minimum standards for exposure assessment. However, delegates were reticent in naming these, perhaps as it was felt more opportune to specify unmet needs and success factors than a standard by which their country's practices could be judged.

4.1 Delegates

The workshops were attended by 37 delegates in total: 34 delegates from 15 Member States (Austria, Belgium, Cyprus, France, Germany, Greece, Ireland, Latvia, Lithuania, Netherlands, Poland, Portugal, Slovenia, Spain and United Kingdom), 2 delegates from EU neighbouring states (Croatia and Moldova) and 1 delegate from the World Health Organisation (WHO). The majority of the delegates were representatives of health protection services, environmental services and fire services. In addition, some experts were present from ambulance services, meteorological institutes and research laboratories. With regard to their exposure assessment function, most delegates played a part in the process of risk assessment, either for public health or the environment. Other prevalent functions involved environmental monitoring, detection and identification of the substances involved, coordination of exposure assessment and risk management (i.e. decision making). A smaller number of the participants were responsible for modelling.

The delegates' roles in response to chemical incidents were almost equally divided between the strategic, tactical and operational levels. Some delegates, depending on their function, acted on more than one level. Their organisational level was mainly national, although local and regional organisations were also well represented. Several experts worked both on a national and regional/local level.

There was little experience of actual cross-border chemical incidents among the delegates. Whether this is because the frequency of cross-border incidents is low or whether the delegates are not involved when such an incident happens was not clear. A few delegates had experience of modelling or monitoring the impact of actual cross-border incidents (such as the Ajka alumina sludge spill in Hungary), or had taken part in cross-border exercises. However, most delegates had no such experience. Collaboration in preparedness and planning for cross-border incidents was more common: approximately half of the delegates engaged in cross-border collaboration. An overview of information from the delegates' expression of interest forms is given in Appendix 7.

As preparation for the workshop, the delegates were asked to fill in a Task-Time Matrix which provided an overview of the tasks of the delegates during the different phases of an incident. Twenty four of the 37 delegates filled in the matrix, the results of which are presented in Appendix 4a and 4b. From the results, it is clear that the tasks of the delegates were spread over all the tasks we wished to cover in the workshops. Furthermore, the delegates' tasks were spread over all the different phases of an incident covered by the workshop exercises.

The delegates were also asked to note best practices and unmet needs with regard to the different stages of an incident. In Appendix 4c an overview is given of the best practices for each task group per delegate and in Appendix 4d an overview is given of the unmet needs for each task group per delegate. Many of these best practices and unmet needs were reiterated during the workshops.

Prior to the workshops, the delegates had been asked to review information specific to their country gathered during Task B and Task C. This resulted in updates to the Task B country matrices for Finland, France, Greece and Lithuania and updates to the Task C survey results for Austria, France, Germany, Greece, Latvia, Lithuania, Poland and Portugal.

4.2 Preparedness

4.2.1 Task B and C findings on institutional and advisory bodies and emergency services organisation and general cross-border cooperation

In Tasks B and C, all Member States (MS) were identified as having institutions supervising environmental monitoring and public health exposure characterisation in case of a major chemical incident. According to the Task C survey results, in 50% of EU countries, environmental monitoring is supervised by the Ministry of Environment or an equivalent authority and public health exposure characterisation is by the Ministry of Health or an equivalent institution. Nevertheless, often (50% of Member States) these responsibilities are not clearly specified. Similarly, different services involved in fire and rescue actions carry out monitoring at the incident scene for various purposes (88% of Member States). Only three countries were identified where environmental services monitor the incident site solely for environmental protection purposes and health services and fire and rescue services solely for health protection purposes.

A clearly specified scope of each institution's responsibilities in exposure assessment (e.g. legal acts in force) is crucial. Furthermore, the scope of data gathered on site by each of the respondents and the forms of information exchange between the institutions involved in risk assessment in case of a major chemical incident should be precisely defined. In some countries the set of data gathered on the site of an incident by the fire and rescue service is specified in legal acts. Collection and submission of data to the EU on major incidents falling under the definition in the 'Seveso II' directive is common for all European countries.

Unfortunately, problems arise when it comes to sharing data between different institutions within a Member State. Difficulties in sharing data among various services and the lack of any official systematic procedure for sharing data among responders and public health officials carrying out risk assessment were mentioned by the survey respondents. As respondents declared that health risk assessment can be undertaken by different bodies on different levels (depending on incident severity), an effective and quick way of information exchange is important. Sharing data by all parties active in incident management via a dedicated website was identified as a good practice in one country.

Another good practice was when a single organisation was widely understood to lead on public health risk assessment, with scientists from different fields in exposure assessment working within that organisation, as this helped to provide timely coordinated scientific and technical advice during the response to a chemical incident.

HazMat teams seem to be common practice in the EU, according to the survey respondents, as analogous structures are organised in 19 countries (73%), 18 of which within the fire and rescue service. In 16 EU countries, a back office service for onsite HazMat advisors to support exposure assessment is organised. In 11 EU countries

(42%), HazMat sampling teams are included in national HazMat teams, which may positively influence the effectiveness of the whole team (time, standardisation).

Coming to the organisation of emergency services, the same regional boundaries for each emergency response service (Police, Fire, and Ambulance) may result in better communication between services.

As far as cross-border cooperation is concerned, all Member States have existing agreements on international collaboration with their neighbours, in case of a major chemical incident. According to those interviewed for Task C, agreements signed, not only at national level (such as the EU Civil Protection Mechanism), but also at regional level, specifying detailed procedures and protocols, are the best practice. Some survey respondents stated that cooperation during fire and rescue actions, including information and data exchange, is much easier and more effective with EU neighbouring countries (where agreements between the fire and rescue services were signed at regional/first responder level) rather than non-EU countries (where cross-border cooperation agreements were signed only at official national level).

Survey respondents regarded as a good practice agreements signed at first responder level which specified detailed rescue procedures used during an incident (described in both country's languages) to facilitate cooperation.

Interviewees mentioned the importance of personal contacts between the incident responders as a key success factor for effective cooperation during an emergency. Furthermore, on the operational level, people get to know each other and their capabilities better if they work together.

Regular international training (a good practice) of operational staff increases familiarity with neighbouring regions' capabilities, understanding of neighbouring response structures and the number of suitable contacts with peer organisations in neighbouring countries. Some countries hold regular cross-border response conferences.

Institutional and advisory bodies and emergency services organisation and general cross-border cooperation: Task B and C findings

The main issues / unfavourable practices:

- Different administrative and governmental organisation (e.g. a number of countries are split into regions or municipalities for which each has a local government or mayor, who is directly responsible for the organisation of the local services including fire, ambulance, police and environmental health)
- Responsibilities connected with risk assessment in case of a chemical incident not clearly divided between emergency response management bodies
- Poor information and data exchange between emergency responders and risk assessors
- The lack of an official systematic procedure for data sharing among respondents and public health officials carrying out risk assessment

- The lack of one advisory body leading in widely understood public health risk assessment in case of an incident

The common practices across the EU:

- Some countries rely upon the military to provide a response (exposure assessment and/or risk management)
- The majority of countries have Environmental and Civil cooperation arrangements in the event of major incidents
- Risk assessment in case of a chemical incident done by different emergency response management bodies
- The lack of an official systematic procedure for data sharing among respondents and public health officials carrying out risk assessment
- The lack of one advisory body leading in widely understood public health risk assessment in case of an incident
- International cooperation agreements at national level

The good practices for individual MS actions:

- Member States possessing an emergency management centre (this was found in all MS)
- Assistance available from voluntary organisations and civilians towards local incident and crisis management
- Clearly specified scope of each institution's responsibilities in exposure assessment (legal acts in force)
- Official protocols and procedures on the responsibilities and cooperation of different emergency services
- Incident command within the relevant services (Police, Fire Service and Medical Service) - efficient information flow and effective decision making
- Effective information exchange forms/channels – web based service available for experts and emergency services and procedures for managing it

The good practices for sharing between MS:

- International cooperation agreements at national and regional (first responder level)
- Regular trainings, conferences, meetings – raising awareness of neighbouring country emergency response capabilities and networking.

4.2.1.1 Fire and Rescue Services

Common practices

- Some countries rely upon voluntary fire services
- FRS may be privatised in some countries
- The FRS may be managed by regions / municipalities in some Member States and therefore there may be differences in organisation and capabilities

Good Practice

- Specialist chemically trained fire services ("HazMat" equivalent)
- International coordination and cooperation agreements

4.2.1.2 Ambulance Services

Common practices

- Privatised and voluntary health services
- Operated locally/regionally and not nationally by a number of Member States

- Ambulance services may be provided by local hospitals or voluntary organisations (e.g. the Red Cross)

Good Practice

- Specialist chemically trained first responders (“HAZMED” equivalent)
- International coordination and cooperation agreements

4.2.1.3 Police Services

Common practices

- Different administrative organisation of national and local / regional police

Good Practice

- International police coordination and cooperation agreements

4.2.1.4 Environment and Health Institutions

The main issues / unfavourable practices

- No focussed public health agency

Good Practice

- Access to specialist teams who provide health risk assessment and characterisation
- National poisons advice centres, part of a networked European Association of poisons centres

4.2.2 Workshop findings on preparedness

4.2.2.1 Knowing one’s counterparts, collaboration and agreements

The workshop delegates considered that knowing one’s counterparts was a key element in achieving an optimal, shared exposure assessment and relevant exchange of information between Member States on all levels from operational to decision-making. This confirmed the earlier findings of Tasks B and C. In neighbouring countries, different organisations and experts are involved in managing chemical incidents and different dispersion models, monitoring equipment and reference values could be used. A clearly specified scope of each institution’s responsibilities is regarded as crucial. These responsibilities, the scope of data gathered at an incident site by each of the institutions, and the forms of information exchange between the institutions involved in risk assessment in case of a major chemical incident should be known by responders on both sides of a border.

Knowing one’s counterparts leads to being informed of and aware of each other’s expertise, activities, and organisational differences, which in turn will facilitate cross-border cooperation. Furthermore, different experts and organisations have different approaches. For example, first responders are responsible for ‘saving lives’ in the acute phase, whereas risk assessors need information for modelling in a later phase. In case of a chemical incident, first responders need to be aware of the importance of gathering and sharing information for risk assessors as soon as possible. This starts with preparedness, which includes knowing the people in a network of relevant experts, being aware of neighbouring countries’ approaches to exposure assessment and being willing to cooperate, understand and align activities with neighbours. On an operational level, people get to know each other and their capabilities better if they work together.

Delegates noted that there is often local familiarity and contact with neighbouring counterparts without formal structural agreements.

A good practice within a country is to have formal agreements with the first responders (fire fighters, ambulance and police) that public health services should be involved from the start of an incident. The common and less favourable practice is for there to be a considerable lag time between alerting of the first responders and the public health service officials.

Cross-border collaboration was discussed from different points of views covering practical implications as well as the formal aspects from individual Member States' perspectives. The EMRIC+ project (EUregion Meuse Rhine Intervention in case of a Crisis) was mentioned as an example of a good practice in cross-border collaboration between Belgium, Germany and the Netherlands. In this project, a cross-border HazMat team has been created for monitoring and modelling. Delegates also mentioned the cross-border cooperation along the river Odra (bordering Poland and Germany) as a good practice.

Delegate regarded as important an awareness of the differences in the responsibilities and involvement of Ministries when achieving cross-border agreement, reiterating the Task B and C findings. Several Ministries could be involved per country and the (shared) responsibilities may vary depending on the issue (e.g. Public Health vs. coordination tasks).

A good practice of knowledge beyond that of neighbouring countries' counterparts is the European Association of Poisons Centres and Clinical Toxicologists (EAPCCT)[1]. The EAPCCT unites individuals whose professional activities are concerned with clinical toxicology, facilitates the collection, exchange and dissemination of relevant information among individual members, Poisons Centres and organisations interested in clinical toxicology, promotes training in and sets standards for the practice of clinical toxicology and to encourage high professional standards in Poisons Centres and in the management of poisoned patients generally. The EAPCCT collaborates with international organisations such as the World Health Organisation (WHO).

Delegates expressed a need for a framework for mutual assistance, without too much prescriptive detail. There was a need for a (EU) legal basis for cooperation. Another unmet need is an appropriate format for (semi-formal) cooperation between Member States (e.g. through memorandums of understanding). Delegates mentioned several issues that needed solving including EU legislation that lacks clarity about hazards (industrial plants) near borders and delayed reaction time of at least two days concerning EU service callout. As a possible solution for cross-border assistance with neighbouring non-EU states, bilateral agreements were mentioned. Delegates expressed the need for a legislative requirement for responders to cooperate in preparedness and to share information.

[1] EAPCCT: http://www.eapcct.org/

Delegates recommended developing a common framework or an EU agency aimed at identifying, assessing and communicating current and emerging threats to human health posed by chemical incidents. Such a framework could work in partnership with national health protection bodies across Europe to strengthen and develop early warning systems, amongst others. By working with experts throughout Europe, this framework should pool Europe's health knowledge to develop authoritative scientific opinions about the risks, such as the European Centre for Disease Prevention and Control (ECDC)[2] does for infectious diseases.

The EU CBRN Action Plan[3] (on Strengthening Chemical, Biological, Radiological and Nuclear Security in the European Union) was mentioned by a delegate in this regard. This Action Plan aims to concentrate efforts and resources on minimising the likelihood of CBRN incidents occurring and limiting their consequences should they materialise. The core measures to achieve these goals which are of relevance to the CERACI project are:

- deploying a risk-based approach to CBRN security in the European Union. This entails the use of risk-assessments to drive the prioritisation of security measures;
- strengthening the exchange of information between Member States on CBRN security issues in order to react more swiftly to emerging threats;
- improving the development and use of detection systems across the EU.

Knowing one's counterparts, collaboration and agreements: the workshop findings

The main issues / unfavourable practices:

- Unfamiliarity with neighbouring countries' counterparts and response.

The common practices across the EU:

- Familiarity with neighbouring countries' counterparts and response is insufficient.

The good practices for individual MS actions:

– Formal agreements between first responders (fire fighters, ambulance and police) and public health services to involve public health services from the start of an incident.
– Central Crisis Coordination Centre.

The good practices for sharing between MS:

- Having bilateral agreements makes familiarity with counterparts more likely than having generic agreements only.
- In Poland agreements on provincial level have been set up with neighbouring non-EU countries as well as EU member States.
- The EMRIC+ project (EUregion Meuse Rhine Intervention in case of a Crisis) is a cross-border collaboration project between Belgium, Germany and the Netherlands.
- Cooperation agreements along the Odra river (Poland, Germany) including trainings and alerting procedures.
- EU CBRN Action Plan.

[2] ECDC: http://ecdc.europa.eu/en/Pages/home.aspx

[3] EU CBRN Action Plan: http://ec.europa.eu/home-affairs/summary/docs/com_2009_0273_en.pdf

- European Association of Poisons Centres and Clinical Toxicologists (EAPCCT).

Unmet needs for sharing between MS:

- Develop a common framework or an EU agency concerning threats to human health posed by chemical incidents.
- Legislative requirement for responders to cooperate in preparedness and to share information.
- Format for (semi-formal) cooperation between MS or equivalent political entities (e.g. memorandum of understanding).
- A Crisis or Emergency Cooperation Centre consisting of all relevant lead agencies from neighbouring countries.

Success factors:

- Know one's counterparts in order to be aware of differences in expertise, activities and approach and to align these where appropriate.
- Ensure a clearly specified scope of each institution's responsibilities and share this with neighbouring countries.
- Ensure that the requirement to share information proactively across borders - and which organisations to share it with - is clearly understood.

4.2.2.2 International training, exercises and education

Delegates considered that regular international training of operational staff with neighbouring countries and regions increases familiarity with the neighbours' capabilities and creates an understanding of neighbouring response structures. In addition, a good reason for organising joint training and exercises is that some countries lack 'real life' experience due to the low number of HazMat incidents.

Some countries do have experience organising cross-border response exercises. In Poland, for example, large international exercises have been organised (funded by the EU) in preparation for EURO 2012. A Polish delegate explained that training is generally on a local/regional level without national involvement, based on existing programmes. This was perceived as positive. In addition, delegates mentioned interagency training on coordination and response as a good practice.

Furthermore, delegates mentioned as a good practice the facilitation of international exercises by the EU, for example via INTERREG programmes. INTERREG is an initiative that aims to stimulate cooperation between regions in the European Union. It started in 1989, and is financed under the European Regional Development Fund (ERDF). The current programme is INTERREG IV[4], covering the period 2007–2013. The EU COST[5] actions were mentioned in terms of gathering expertise and knowledge. Through COST actions, reports on the state of the art in specialist areas and guidelines can be produced.

Coordination and support for applications for funding was considered necessary by some delegates, as knowledge on how to apply for funding is not always present with relevant

[4] INTERREG: http://www.interreg4c.eu/
[5] COST: http://www.cost.eu/

officials in an organisation. The EU-funded (DG ECHO) programme for the international exchange of experts was considered a good practice[6].

A good practice mentioned by a UK delegate is the NATO International CBRN training curriculum[7] developed within the project Minimum Standards and Non-binding Guidelines for First Responders Regarding Planning, Training, Procedures and Equipment for Chemical, Biological, Radiological and Nuclear (CBRN) Incidents. This encompasses a number of learning outcomes relevant to the CERACI project, such as:

- comprehend awareness requirements in relation to CBRN response
- comprehend detection requirements in relation to CBRN response
- comprehend command and control requirements in relation to CBRN incidents
- comprehend the implications of bilateral or multilateral assistance for local first responders

For each learning outcome, a number of learning objectives and teaching points are described. Member States could incorporate this curriculum into a training and exercise programme for chemical incidents, based on the learning outcomes they find most relevant.

Table-top exercises were felt to be a cost-effective way of getting to know each other as an alternative for expensive multi-agency real life or field exercises. The Public Health Response to Chemical Incident Emergencies (CIE) Toolkit[8] is useful as a source of exercises. CIE Toolkit is a collaborative project involving European partners which developed a toolkit and manual for the training of public health officials to facilitate rapid and effective responses to acute chemical incidents. The toolkit includes fact sheets, guidelines for conducting training exercises, generic case studies identifying likely scenarios in the form of table-top training cards and a manual.

Exercises, trainings and education within the cross-border context could be organised at local, regional and national levels as well as at operational, tactical and strategic levels. Furthermore, all relevant organisations should be involved in exercises. Although delegates indicated that in many Member States, public health officials are often involved in Seveso site exercises, a Polish delegate mentioned that there are financial barriers to their participation. For Seveso site exercises, national legislation may not allow cost-recovery for some responding organisations, which is a barrier to their involvement.

Delegates considered it to be a good practice to train chemical specialists within the emergency services for detection, identification and monitoring (DIM). In contrast, the good practice of having non-specialists using DIM equipment with access to expert 'reachback' advice was also mentioned. Topics for education and training might also include shared concepts, such as exposure assessment based on toxidromes to support early decision making (see also section 4.3.1).

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[6] http://www.exchangeofexperts.eu/download/public/EXE_quick-overview_eng.pdf

[7] NATO: www.nato.int/docu/cep/cep-cbrn-training-e.pdf

[8] CIE Toolkit: http://www.hpa.org.uk/CIEToolkit/

Delegates agreed that training, mutual education and exercises should be targeted at functions, with people working with and meeting their counterparts irrespective of their organisations. A few delegates suggested that the best sequence for good cooperation on training and exercise between bordering countries would be to first get to know each other before looking into areas of possible harmonisation. Harmonisation might be considered too utopian.

Another point which the delegates found worthy of attention is the interaction between technicians and scientists on the one hand and decision-makers and the public on the other. Although traditional scientific training does not typically prepare scientists to be effective communicators outside of academia, researchers should be trained both to influence decision makers and to communicate their results directly to the public.

A further topic to be trained and exercised is communication between partners with different mother tongues. English might be used as a *lingua franca*, but other languages might be considered depending on the familiarity with that language in the specific border region. Another option mentioned was to train ad hoc liaison officers with the task to facilitate translation during an incident. Exercises should include the testing of cross-border communication circuits in order to identify gaps and needs for improvement.

Delegates thought that the generation of an EU database of past, current and future exercises at Seveso plants within the EU should be considered and be made available to Member States. The focus should be on larger exercises with a significant impact and public health involvement. This would provide insight into exercises across the border (with the possibility of collaboration) and relevant exercises in other areas of Europe.

International training, exercises and education: the workshop findings

The main issues / unfavourable practices:

- Lack of training/experience in some countries.
- Language as a barrier to communication (i.e. in training material, common procedures etc – these should be in a country's own language).
- Public health officials do not always participate in Seveso site exercises / off site plan preparation.

The good practices for individual MS actions:

- Training material, common procedures etc. translated into a country's own language.
- Training of chemical specialists for DIM (detection, identification, monitoring).
- Training of first responders in the use of toxidromes to speed up early decision making whilst knowledge of exact identity and concentration of a substance is poor.

The good practices for sharing between MS:

- Regular cross-border exercises among fire fighters (e.g. Poland, Germany, Czech Republic).
- Invite cross-border colleagues to participate at major exercises.
- Requirement to collaborate (e.g. memorandum of understanding, convention or legal requirement).
- INTERREG[4] and COST[5] as potential sources of funding for cross-border collaboration.
- NATO CBRN training curriculum[7] (covers joint planning, training, detection, cross-border working).
- Interagency training in coordination & response.

- Exercises from the Chemical Incident Emergencies (CIE) Toolkit[8].

Unmet needs for sharing between MS:

- Improved interagency training and exercises involving public health officials even if there is no legal requirement.
- Coordination and support for funding applications, e.g. for INTERREG programme.
- Create databases of exercises at Seveso plants within EU.
- Exercise cross-border communication circuits.

Success factors:

- Mutual education.
- Joint training and exercising with neighbouring countries at different command and control levels and different geographical levels.
- Target joint training and exercising at functions with people working with/meeting counterparts irrespective of their organisations.
- Detection, alerting, and notification is prepared and exercised to take place in the 'golden hour'
- Train ad hoc liaison officers to facilitate translation.
- Train researchers in communication skills to influence decision makers and communicate directly with the public.
- Common and repeated trainings to mitigate language barriers and to be familiar with neighbours' capacities (e.g. different equipment).
- Ensure public health representation in interagency training and exercises even if there is no legal requirement.
- Turn existing exercises into cross-border exercises – this may be easier with table-top workshops rather than live exercises.

4.2.2.3 Preparedness plans

Making Preparedness plans for sites which might impact across borders, even if they are not classified as 'Seveso' sites, and sharing these with neighbours was considered a good practice by delegates. They felt that Preparedness plans should include worst-case rather than most likely failures to create the appropriate awareness of hazard and risk in a neighbouring country. The impact of cross-border incidents is considered especially high in terms of media attention and political response (at local, regional or even national level).

Another good practice is that risk assessors are readily able to communicate with colleagues across borders, if public health service involvement is described in Emergency Response plans and if these plans are written in the relevant languages, preferably both English and the languages of the people who might be affected. Emergency Response plans should be shared with the neighbouring country including pre-prepared standard messages in the languages of the specific cross-border region. These plans should meet the Seveso requirements for border regions in terms of information, content, and exercising.

Another requirement for Emergency Response plans is that they should be transparent, short and simple and people should be familiar with the plans through exercise, because these plans will be used under time pressure. Exposure assessment should be described in emergency plans for Seveso plants. Another improvement of the plans is to include the basic premises for response systems and decision-making mechanisms on both sides of the border. Also, there is a need for a joint procedure on controlled burns across borders.

Delegates suggested compiling a European risk profile map with a focus on regions with a high risk of chemical incidents with serious cross-border health effects and broad consequences for society. This should encourage a cost-effective focus on preparedness in relevant regions.

Preparedness plans: the workshop findings

The main issues / unfavourable practices:

- No emergency plans for some large non-Seveso facilities.
- No alerting system considering cross-border effects.

The common practices across the EU:

- Seveso sites obliged to prepare internal and external emergency plans.

The good practices for individual MS actions:

- Preparedness plans include topography and worst-case release and dispersion modelling.

The good practices for sharing between MS:

- Preparedness plans produced collaboratively for river systems include automatic alerts across borders for events within a certain distance of the border.
- Seveso plans written in 2 or more languages (e.g. national language and neighbouring countries' language or English).

Unmet needs for sharing between MS:

- Include (worst case) dispersion models for cross-border purposes in Seveso Emergency plans.
- Preparedness plans should specify a monitoring approach and the basis for decisions on monitoring in both countries.
- A joint procedure on controlled burns across borders.

Success factors:

- Develop and share Emergency Response plans /Preparedness plans with neighbouring countries for sites which might impact across borders.
- Ensure Emergency Response plans are transparent, short and simple and well exercised.
- Include a standard section in Seveso plans for public health potential impacts, response and coordination.
- Apply Seveso like requirements for plans and exercises to relevant non-Seveso sites in border regions.
- Pre-prepared multi-language FAQ and media statements for Seveso sites scenarios which can have cross-border impacts.
- Inter-agency agreements on cooperation and information sharing. These can be legally binding or written into plans.
- Compile a European risk profile map with a focus on regions with a high risk of chemical incidents with serious cross-border health effects.

- Describe exposure assessment in emergency plans for Seveso plants and include the basic premises for decision making on both sides of the border.

4.2.2.4 Information exchange

The importance of an effective exchange of information in both the preparedness and response phases of an incident (a finding of Tasks B & C) was endorsed by the delegates. For those practices pertaining to the response phase, please see section 4.3.1.

Preparedness does not end at the border. Delegates considered that preparedness messages should be in all relevant languages and that there should be a joint issuing of information in cross-border regions. Delegates regarded the availability of shared contact details across borders as a good practice for effective and efficient communication. Approaches to informing the public and communication in general might differ substantially between Member States due to countries' differing cultures and practices. However, as communication is of key importance, the harmonisation of the exchange of information is considered important. It was suggested that there should be a harmonised approach to communication on both sides of a border through, for example, defined formats, checklists and multi-agency messages. There should be agreement on which agencies and/or officials are involved and what the appropriate form and timing of communication should be.

Delegates considered that services during out of office hours and weekends should be in place including a 24/7 information exchange capability. Furthermore, delegates suggested that the EU should maintain a database of recommended resources (e.g. models and acute exposure reference values) as an aid to information exchange.

In some Member States, the military is involved in exposure assessment. This can depend on the geographical level of the affected area (e.g. regional monitoring might be performed by Fire Services, whereas the military takes the lead on a national level), on timely alerting of the military, or when civilian organisations are not involved in monitoring at all. Delegates mentioned that if the military is involved, information exchange is sometimes perceived as difficult.

As networks must be able to communicate during a crisis, the integrated chain of communication, including a mutual agreement on the understanding of underlying concepts (e.g. evacuation advice), the purpose and timeliness of communication and the technical aspects such as ICT (e.g. back-up systems) should be agreed upon. This communications resilience should be tested in advance at the saturation of a crisis and there should be both internal and cross-border capacity.

Debriefing together after incidents, including considering lessons learnt, is also seen as a good practice as it is an opportunity to highlight gaps or unmet needs. Another good practice mentioned by delegates is to publish incident reports (including evaluations) and initiatives on collaborative preparedness in an incident journal, preferably in English.

Information exchange for preparedness: the workshop findings

The main issues / unfavourable practices:

- No information exchange.
- Information exchange with the military can be difficult.

The good practices for individual MS actions:

- Agreed chain of communication from scene to hospital (so it can take early action/ be prepared).
- A checklist of information that is a minimum to exchange.
- A prioritised or emergency communication system (e.g. TETRA).
- A communication back-up system (e.g. fax machines).

The good practices for sharing between MS:

- Share contact details of incident response agencies with neighbouring countries.
- Debrief together after incidents including considering lessons learnt.
- Publish incident reports (including evaluations) and initiatives on collaborative preparedness in an accident journal.

Unmet needs for sharing between MS:

- An EU database of recommended resources (e.g. models) and knowledge exchange.
- Harmonised guidelines for information sharing.
- A glossary of common vocabulary with translations to assist cross-border working.

Success factors:

- Ensure preparedness messages are in all relevant languages and issue jointly in cross-border regions.
- Harmonised approach to communication on both sides of a border through multi-agency messages.
- Services during out of office hours and weekends, including a 24/7 information exchange capability.
- An integrated chain of communication agreed upon and tested in advance at the saturation of a crisis.
- Share lists / mapping for industrial sites/areas in border regions.

4.3 Response

Probably the most challenging phase for cross-border collaboration is the response phase of an incident. Below, we first describe the workshop findings on information exchange and guidelines for response. We then describe the Task B and C findings, followed by the workshop findings, on the subjects of Meteorological dispersion models, Monitoring, Analytical Laboratories and Geographical Information Systems.

4.3.1 Workshop findings on Information exchange

Delegates considered as a good practice the immediate and sustained exchange of information between fire services, environmental agencies and public health services during the acute phase of an incident. Delegates mentioned that in some cases, information exchange during the acute phase is expanded to other agencies which come together in face-to-face meetings. In these meetings, agency representatives all receive the same briefings, updates and information at the same time. This reduces the required communication time and prevents possible misunderstandings occurring.

The importance of coordinating communication on both sides of the border was emphasised and delegates felt that ideally there should be a regional (cross-border) network for sharing information. Delegates mentioned the use of checklists to prompt incident information exchange between countries and the necessity for 24/7 information exchange between countries during an incident. Furthermore, it is important that communication between all relevant partners involved is quick and efficient.

A Dutch delegate mentioned the good practice of an online 24/7 network of experts from different government institutes and services who advise the local health community, police and fire service during a chemical incident in the Netherlands. Other delegates expressed the need for a 24/7 Expert centre for advice. This could be a national centre which for small countries has a fallback to the EU or larger countries. Delegates agreed that early information exchange with experts was essential and that experts should certainly be available in the first hour of an incident, at least by phone for advice and support.

Delegates considered that a shared uniform approach to information exchange should be aimed at. This should include the use of a transparent shared language for first responders to facilitate information exchange, such as METHANE (Major Incident, Exact Location, Type of Incident, Hazards, Access, Number of Casualties, Emergency Services) for reporting an incident.

First responders could also use shared concepts, such as assessment based on toxidromes. A toxidrome is a syndrome caused by exposure to a dangerous level of a toxic compound. The use of toxidromes by first responders supports early decision making with respect to treatment, decontamination, incident assessment and response. This can be done while knowledge of the exact identity and concentration of a substance is (still) poor. However, using reported health effects to monitor toxidromes can be difficult, since attention from the media can generate false positive complaints. The use of toxidromes can also be helpful in the chain of communication from the site of the incident to the hospitals. It may help the hospitals in their preparation to take early actions.

Delegates mentioned the importance of information exchange on health complaints between organisations and countries which could include type of symptoms, severity of symptoms, number and mapping of the complaints and potential treatment. In areas of the Netherlands and elsewhere, a good practice is to map incoming health complaints. However, sharing complaint information across agencies is not without difficulties. Moreover, the usefulness of reported health effects may depend on the type and/or the phase of the incident. However, it is considered useful to get a general picture.

Automatic alarm cascades were noted as a good practice, for example, failure sensors sound klaxons and automatically alert responders, including across borders, depending on distance. Delegates considered it helpful to have one number to call in emergencies and to have an established protocol or alert cascade to follow. Alerts should be assessed (graded) and then cascaded to stop a megaphone effect where people do not readily discriminate between minor and major incidents. A good practice in the UK are local and regional alerting and notification arrangements for national public health bodies with supra-regional units linked to stakeholders and local chemical units with a national log and national out of office hours service with a single contact number. Alerting in this way may be quicker than a national-only structure. To ensure that hospital systems do not get overloaded, it is useful to have a number for the worried well to call.

One focal point, for example, the fire service on-scene for disseminating information may be a good practice initially. In the UK and Ireland it would escalate upwards to an off site multi-agency lead for a large incident and then if needed have national oversight. It was concluded that both a national point of contact is needed to formalise cooperation and a local contact for the local situation. An important consideration is to have an agreed approach to communication and decision making when findings on relevant aspects (e.g. measurement data, number of casualties, or health complaints) are contradictory.

WISER[9] (Wireless Information System for Emergency Responders) was considered a good tool for acquiring information rapidly. It is a system designed to assist first responders in hazardous material incidents. WISER provides a wide range of information on hazardous substances, including substance identification support, physical characteristics, human health information, and containment and suppression advice.

Information can also be gathered by observing social media, for example by tracking the trend of reports on incidents. Delegates felt that response organisations could consider posting official reactions on Twitter or Facebook in case of an incident. Early involvement of the media can be used to the advantage of the emergency services. Being pro-active, transparent and preferably using one channel and the same message(s) were felt to be

[9] WISER: http://wiser.nlm.nih.gov

important points. Responders should also be aware that the media tends to exaggerate an incident.

The International Chemical Environment (ICE)[10] was mentioned as a good practice for sharing information. It is network of national schemes (e.g. CHEMSAFE[11] in the UK and TUIS in Germany) set up by the European Chemical Industry to provide information, advice and resources to the emergency authorities in case of land based chemical transport accidents.

Delegates also mentioned the Common Emergency Communication and Information System (CECIS)[12] as a good practice for sharing between Member States. This system facilitates communication between the EU DG ECHO Monitoring and Information Centre (MIC)[13] with National Authorities, making response to disasters faster and more effective. Its main task is to host a database on potentially available assets for assistance, to handle requests for assistance on the basis of these data, to exchange information and to document all action and message traffic.

Delegates expressed the need for a common alerting and notification procedure for chemical incidents, such as is the case for infectious diseases (through ECDC). One of the delegates noted the ASHTII[14] (Alerting System for Chemical Health Threats phase II) project in this regard. Delegates also mentioned several good practices which provide frameworks for alerting and notification, such as the WHO International Health Regulations[15], the EU MIC (mentioned above), the European Community Urgent Radiological Information Exchange (ECurie)[16], the Rapid Alerting System for food and feed (RASFF)[17], Rapid Alerting System used for exchanging information on health threats due to deliberate release of chemical, biological and radio-nuclear agents (RAS BICHAT)[18], the Rapid Alerting System for Chemical Health Threats (RAS CHEM)[18] and the UNECE Industrial Accident Notification system[19].

For incidents involving water, an alarm system to monitor water composition of large European rivers was regarded as a good practice. One example mentioned was the accident emergency warning system of the International Commission for the Protection of the Danube River (ICPDR)[20]. This Commission comprises of 15 parties (14 EU and non-EU countries and the European Union) who have committed themselves to implementing the Danube River Protection Convention.

[10] ICE: http://helid.digicollection.org/en/d/Js13467e/11.2.html

[11] CHEMSAFE: http://the-ncec.com/chemsafe/

[12] CECIS: http://ec.europa.eu/echo/policies/disaster_response/cecis_en.html

[13] MIC: http://ec.europa.eu/echo/policies/disaster_response/mic_en.htm

[14] ASHTII: http://www.hpa.org.uk/ProductsServices/ChemicalsPoisons/InternationalActivities/ASHT/

[15] IHR: http://www.who.int/ihr/en/

[16] ECurie: http://rem.jrc.ec.europa.eu/RemWeb/activities/Ecurie.aspx

[17] RASFF: http://ec.europa.eu/food/food/rapidalert/index_en.htm

[18] RAS BICHAT and RAS CHEM:
http://ec.europa.eu/health/preparedness_response/generic_preparedness/planning/rapid_alert_en.htm

[19] UNECE IAN: http://www.unece.org/env/teia/pointsofcontact.html

[20] ICPDR: http://www.icpdr.org/

A network for information sharing in the River Schelde/Meuse area was also seen as a good practice. In addition, another good practice mentioned was the Trans Europe Shipping coding system, which is used so that common messages can be readily understood in any of 28 European languages. This is a more generic version of the Risk and Safety codes for chemicals.

4.3.2 Workshop findings on Guidelines for response

A good practice mentioned by a UK delegate are the NATO Guidelines for first response to a CBRN incident[21] developed within the project Minimum Standards and Non-binding Guidelines for First Responders Regarding Planning, Training, Procedures and Equipment for Chemical, Biological, Radiological and Nuclear (CBRN) Incidents. These guidelines provide generic advice and guidance on procedures, capabilities and equipment required to implement an effective response. They are designed to improve multi-agency interoperability in first response to a CBRN incident and provide guidance on when regional, national or international assistance may be required. They focus on developing a common understanding of the actions required during the initial response phase (20 mins). The response guidelines are divided into four sections: information gathering, scene management, saving and protecting lives and additional support. Each section lists procedures, capabilities and equipment required to implement an effective response.

Another good practice mentioned is to keep the number of organisations and people involved limited to be effective and efficient. For this it is important to reach agreement in advance on what is seen as appropriate.

Information exchange during incidents and guidelines for response: The workshop findings

The main issues / unfavourable practices:

- No information exchange.
- Information exchange with the military can be difficult.
- Chemical nomenclature not always easily understood by first responders.
- Lack of a national log (e.g. each region has a different log and does not have access to each other's log)

The common practices across the EU:

- Fire services are the central point of contact for source related information.

The good practices for individual MS actions:

- Information exchange during acute phase between: fire department, environmental agencies and public health services.
- Local and regional alerting and notification arrangements for public health bodies.
- A single point of contact at scene.
- Information exchange by secured website.
- Multi-agency face-to-face meetings in the acute phase.
- A dedicated media liaison unit.

[21] NATO: www.nato.int/docu/cep/cep-cbrn-response-e.pdf

The good practices for sharing between MS:

- Information exchange and telephone list of involved persons in neighbouring countries that is documented and exercised.
- Capability for 24/7 information exchange between countries.
- Using cross-border ‘guest’ colleagues during cross-border incidents.
- ICE (International Chemical Environment)[10] advice centres (CEFIC: European Chemical Industry Council) for chemical information to emergency services.
- CECIS[12] (Common Emergency Communication Information System), a secure EU Civil Protection system for alerting and communication between national MIC focal points.
- Network for information sharing (Schelde/Meuse area; water).
- Alarm system to monitor water composition of large European rivers.
- NATO CBRN guidelines for first response to a CBRN incident[21].
- Trans Europe Shipping coding system, whereby common messages can be understood in 28 European languages.
- Alerting system for chemical threats: ASHTII[14]

Unmet needs for sharing between MS:

- Information sharing between networks of experts.
- 24/7 specialist advice available with dedicated hotlines and databases for health effects and prepared text for common chemicals.
- The chemical information to emergency services such as ICE (see above) should be shared with or coordinated by public health services.
- A focal point consisting of officials from neighbouring countries (experts and politicians) generating agreed and consistent messages for the public.
- Awareness of differences in public guidance across borders and the underlying rationale (i.e. different advice in neighbouring countries on shelter/evacuation). Pay attention to uniformity/consistency of advice.
- Cross-border exchange of health complaints.

Success factors:

- Immediate and sustained information exchange during acute phase between fire department, environmental agencies and public health services.
- Availability of expert advice and support in the first hour.
- Common procedures for informing neighbours (in different languages) (what has happened; chemical; measurements taken etc.).
- Exchange information on health complaints.
- Regional cross-border network for sharing information.
- Information sharing with neighbouring non-EU countries.
- Both national focal point and local contact to generate agreed and consistent messages.
- An agreed approach to communication and decision making when findings on relevant aspects are contradictory.
- Be pro-active, transparent and preferably use one channel and the same message(s) when communicating with the media.
- Visualisation of information (e.g. Google Earth overlays as a means of using a mapping tool for which borders are not a barrier to ready usage / familiarisation).

4.3.3 Task B and C findings on Dispersion modelling

In 24 Member States (92%), local and/or dispersion modelling is available, according to the Task C survey respondents. Local models for air are used in 21 Member States, for water in 13 Member States; airborne dispersion modelling is available in 23 Member States (88%) (in 16 of which it is provided by meteorological experts and in 17 by non-meteorological experts). Water borne dispersion modelling is available in 14 Member States (54%). By using available models, chemical concentration in the air can be assessed in 23 Member States (88%), chemical concentration in water - in 18 Member States (69%) and deposition in 16 Member States (62%). In a few Member States, chemical concentration in soil can be assessed.

Some of the interviewees confirmed their familiarity with worldwide or European meteorological services, such as EUMETNET[22], that enable sharing of alerts, for example, for extreme events and alerting in a consistent fashion in most European countries. Moreover, others linked to a wider network of specialist centres outside of their Member State (a good practice).

Concerning the comparison of type and usage (in case of an incident) of dispersion models available in Member States and neighbouring countries, respondents from 11 (42%) Member States declared that air dispersion models for their own and neighbouring countries are compatible or the same, and respondents from 6 (23%) Member States stated the same was true for water borne dispersion models available across border. As many respondents skipped or didn’t know the answer for questions concerning compatibility of models used across the border and the usage of the ‘source’ country modelling in case of an incident, it is difficult to assess how widespread using compatible modelling is in neighbouring countries in the EU.

Dispersion modelling: Task B and Task C findings

The main issues / unfavourable practices:

- Modelling not used

The common practices across the EU:

- Local and/or dispersion modelling is available in 24 Member States
- Specialists and bodies familiar with worldwide or European meteorological services

The good practices for individual MS actions:

- Specialist environmental meteorology sections of met offices to provide information about meteorology during incidents and to examine the spread of pollutants both nationally and cross-boundary
- A number of countries have satellite software systems for automatic detection of forest fires
- Local and/or dispersion modelling is available in 24 Member States
- Modelling outcomes easily available for risk assessors from different institutions
- Specialists and bodies familiar with worldwide or European meteorological services

[22] EUMETNET: http://www.meteoalarm.eu/

The good practices for sharing between MS

- Compatible / the same models used by risk assessors on both sides of the border
- Modelling outcomes easily available and interpretable for risk assessors from neighbouring countries

4.3.4 Workshop findings on Dispersion modelling

Delegates considered a good practice to be 'quick and dirty' dispersion modelling during the first phase of an incident, followed by more accurate modelling in a later stage.

Examples of countries with the good practice of having models available at an early stage of an incident are the UK and Austria. The UK CHEMET[23] (Chemical Meteorology) circulation system proactively alerts relevant agencies to the production of dispersion model outputs. Telephone advice is available on demand which provides simple short-range prediction of the anticipated behaviour of the plume. Within 15 minutes, this is followed by meteorological and dispersion maps which provide a more detailed forecast. A map of areas at risk is sent to the emergency services. The situation is constantly monitored, and updates given until the emergency is over. In the event of an incident, local Fire and Police services contact the Meteorological Office Environment Monitoring and Response Centre (EMARC). For small-scale events, EMARC produces meteorological guidance and a plume prediction as a CHEMET report. For larger release events, such as the Buncefield Oil Depot fire, more-sophisticated plume modelling techniques are used.

In Austria, Lagrangian models are used for quick modelling. Models are refined after a 'quick' output and it is possible to back-calculate exposure concentrations/contours from inputting monitored levels. These models can be run very quickly. An Austrian delegate mentioned that a certain HazMat team can produce a (conservative) model within 1 minute and the Meteorological Office can run a model within 5-10 minutes of a call. Another example of a rapid yet sophisticated model which was mentioned is PUFF[24]. This dispersion model has been designed by the Royal Netherlands Meteorological Institute (KNMI) to calculate the dispersion of air pollution on European scales.

Monitoring results are necessary for the verification of dispersion modelling. Furthermore, delegates considered the use of complaint reports to adjust the source term for modelling outputs to be a good practice. If modellers know where complaints are they can look at where the model predicts highest impacts to be and see if it is the same. Using toxidromes as qualitative measures to indicate possible environmental concentration ranges can be tied in to this good practice of linking complaint mapping with modelling.

Collaboration between different institutions was suggested as a good practice by delegates. For example, in Poland, fire departments using modelling software, such as ALOHA, refine their outcomes by getting data from the Polish Meteorological Institute. This Meteorological institute provides dispersion model input parameters to stakeholders who carry out their own modelling, which this Meteorological Institute does not do routinely.

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[23] Met Office, CHEMNET: http://www.metoffice.gov.uk/publicsector/CHEMET

[24] KNMI, PUFF: http://www.knmi.nl/onderzk/applied/am/en/am_dispers.html

One delegate mentioned the problem of the use of different approaches and different models. Different models can use different threshold values (as the organisations using them are different). Differences in modelling capabilities can also exist between well-resourced urban areas and poorer resourced rural areas.

For cross-border purposes, delegates stressed the importance of *a priori* understanding of and agreements on modelling strategies, such as pre-agreements on the input values for models and the purpose, the use and the interpretation of models. Agreements should aim at interoperability of outputs, models and results to achieve a unified risk assessment and to satisfy unified and pre-determined information requirements. Where applicable units should be harmonised or conversion factors should be provided for neighbours. Furthermore, those using the outputs need to understand their limitations and the influence of the available information on the accuracy of the outputs.

Being able to add dispersion model outputs onto Google Earth or Google Maps was considered a potentially useful capability for sharing with neighbouring countries in the event of a cross-border incident. For this to be possible, an application would need to be developed.

The web-based platform ENSEMBLE[25] was mentioned as a good practice for sharing of dispersion modelling outputs between Member States. This system for the inter-comparison and evaluation of atmospheric chemistry transport and dispersion models was originally developed for support in case of nuclear emergencies and has evolved into a service for any kind of atmospheric model. ENSEMBLE can now be used for the inter-comparison and evaluation of models working at scales from local to global, and is capable of handling any number of variables and period of time. Furthermore, the ENSEMBLE system allows users to perform on line analysis.

A delegate mentioned a good practice in the Netherlands, relevant to countries with many water authorities, whereby a National Water Institute coordinates all the modelling and monitoring of the smaller water organisations in the country.

The Centre of Documentation, Research and Experimentation on Accidental Water Pollution (CEDRE[26]) in France performs a similar role to the UK Environment Agency[27]. There is a national cross-border agreement between UK and France regarding English Channel pollution with sea and river monitoring/modelling capability. More than 3 miles offshore, duties would be taken over by the coastguards.

Dispersion modelling: the workshop findings

The main issues / unfavourable practices:

- Different regions in a Member State use different approaches and different models.
- Urban areas are well resourced. Other areas have poorer resourcing and less capacity for modelling.
- Different models use different health thresholds (as the organisations doing them are different).

[25] ENSEMBLE: http://ensemble2.jrc.ec.europa.eu/public/

[26] CEDRE: http://www.cedre.fr/index-en.php

[27] UK Environment Agency: http://www.environment-agency.gov.uk/

The common practices across the EU:

- Local and/or dispersion modelling is available.
- Specialists and institutes are familiar with worldwide or European meteorological services.
- Meteorological Office/Agency which provides dispersion model input parameters to stakeholders or provides a modelling service.
- Dispersion models included in Seveso emergency plans.

The good practices for individual MS actions:

- Specialist environmental meteorology sections of Meteorological Offices (e.g. CHEMET in the UK) provide information about meteorology during incidents and examine the spread of pollutants both nationally and cross-boundary.
- The provision of interactive meteorological models for quick dispersion modelling by emergency responders / risk assessors.
- Specialists and bodies able to interact with European meteorological services.
- Alert cascades upon production of a dispersion model.
- Topography included in Preparedness plans for worst-case dispersion modelling.
- Link complaint mapping with modelling.

The good practices for sharing between MS:

- ENSEMBLE (a web-based platform) enables sharing of dispersion modelling outputs between Member States.
- The EMRIC+ project (EU region Meuse Rhine Intervention in case of a Crisis) is a cross-border collaboration project between Belgium, Germany and the Netherlands which created a HazMat team for monitoring and modelling.

Unmet needs for sharing between MS:

- A 24/7 EU resource for modelling.
- Provide outputs with contours for concentration or dose thresholds of reference values.
- Overlay models on GIS which shows some detail of neighbouring region (e.g. sensitive receptors) or provide modelling output as layer for neighbouring region's GIS.
- An application to add dispersion model outputs onto Google Earth or Google Maps.
- Include (worst case) dispersion models for cross-border purposes in Seveso Emergency plans.
- Testing and validation of models between countries.
- Harmonisation of dispersion models for air and water.

Success factors:

- Use monitoring results to verify dispersion models.
- Reach agreement with neighbouring countries on modelling strategies aiming at interoperability of models, results and output formats (where applicable units should be harmonised or conversion factors should be provided for neighbours).

4.3.5 Task B and C findings on Monitoring

In the initial literature review all Member States were identified as maintaining fixed air quality monitoring stations. The survey confirmed that in most of the Member States

(88%) monitoring is carried out within the emergency exclusionary zone, for emergency response and off site for assessing public exposure, mainly as dedicated 24/7 service and in all media (air, water, soil, crops/food) (a good practice).

In 23 (88%) Member States, environmental monitoring is carried out during and after a chemical incident (a good practice), only one respondent declared that monitoring is carried out only during the incident and not afterwards (two countries indicated that monitoring was only carried out after an incident).

Most Member States have a capability within their fire and rescue services to undertake analysis at the scene of an incident, using Detection, Identification and Monitoring (DIM) equipment. Within the survey, it was confirmed that at the scene monitoring is carried out by fire and rescue services (including national HazMat teams) (88% Member States) but also by environmental protection services (92% Member States), site operator (46% Member States) and health protection services (84% Member States). In some countries, monitoring activities are outsourced to commercial parties.

In seven countries, mobile field laboratories are available (a good practice). Some respondents indicated that mobile laboratories' functions (available in their country) can also support the international response to chemical incidents.

Suitable, coherent reference values for risk assessment are needed to achieve a clear and agreed interpretation of public health risks that can be communicated easily to incident commanders and ensure integrated public health actions and messages. In 18 (69%) Member States, the analysis results from exposure assessment are compared to Acute Exposure Guideline Levels. One respondent encountered the situation in which emergency responders and authorities prefer different threshold values. Standardisation of the assessment values used is highly desirable.

Monitoring: Task B and Task C findings

The main issues / unfavourable practices:

- Lack of repeated environmental monitoring
- Environmental monitoring not carried out both during and after the incident
- The reference values not standardised for risk assessment in case of a chemical incident purposes - emergency responders and authorities use different reference values or different values between MS
- Lack of mobile detection and identification equipment

The common practices across the EU:

- Most countries' fire services have an on-scene chemical analysis capability which at its most basic level can be qualitative / semi quantitative
- Monitoring is undertaken by a variety of organisations in addition to the FRS between MS
- Repeated environmental monitoring
- Environmental monitoring carried out during and after the incident
- The analysis results from exposure assessment are compared to Acute Exposure Guideline Levels

- Mobile labs available but only in a few countries do these support the international response to chemical incidents
- Access to data from fixed air quality monitoring stations

The good practices for individual MS actions:

- Environmental monitoring carried out during and after the incident, including the monitoring of shelter areas and other areas relevant to human exposure, especially sensitive populations
- Standardisation of the reference values
- Availability of mobile labs within first responders' resources

The good practices for sharing between MS:

- Outcomes of environmental monitoring carried out in case of an incident understandable for risk assessors on both sides of the border
- Standardisation of the reference values
- Mobile labs' functions support the international response to chemical incidents

4.3.6 Workshop findings on Monitoring

Delegates indicated that there are differences between the Member States regarding which organisation takes the decisions and the lead in monitoring. Mostly the fire departments take these decisions, but the military and Civil Protection organisations were also mentioned.

Some workshop delegates indicated that monitoring results are primarily used to protect the responders' health and safety, for example, present lower explosive limits of gases. The measurements are necessary for the verification of dispersion modelling. However, in other countries monitoring is performed for health protection of the public as well. It was noted that while monitoring was not always needed if a sufficient evidence base was available, it was useful to have real data for reassurance and for health enquiries which may come later.

In the Netherlands, the fire services have the capability to get semi-quantifiable samples from the scene using Draeger tubes early in the incident. Measuring fume gasses (5 to 6 parameters) should be possible within the first hour. Another good practice mentioned by a Dutch delegate is the application of novel technologies, such as the use of 'electronic noses' on the roofs of cars and a static monitoring network to detect gaseous substances / odours. In some industrialised parts of the Netherlands, these can be operable within 30 mins and are used for identification and quantification. The Dutch RIVM quick response service with analytical (field) laboratory capability (the Environmental Incident Service) can be on scene within 2 hours for more detailed monitoring.

Delegates considered it was important to account for differences in short-term and long-term impacts; at a minimum, sampling needs to look for common suites of chemicals, for example, products of combustion for fires, but early monitoring for persistent chemicals is needed too.

Access to expert advice was regarded as a good practice, for example, to answer the question “What should we monitor?” This should be available throughout the response phase. In the case of non-specialists using DIM equipment, delegates felt they should have access to expert ‘reachback’ advice.

Suitable reference values are needed to assess the risks to public health. The delegates agreed on the good practice of using Acute Exposure Guideline Levels (AEGLs)[28] or data which are easily compatible with AEGLs (duration, effects etc.). These exposure levels are applicable to the general population, including infants and children, and other individuals who may be susceptible. A good practice mentioned was using a GIS map with an overlay of dispersion modelling with relevant AEGL contours for various meteorological conditions (see also section 4.3.10).

Monitoring results should fit the validation requirements of the AEGLs to be able to use them. At this moment approximately 325 chemicals are described with AEGLs. Therefore, AEGLs do not cover all possible chemicals emitted during an incident. The German approach differs in that monitoring results may be presented in terms of dosage instead of concentration.

The delegates discussed whether legislative agreement was necessary on acute exposure reference values: Do we need EU standardised reference values, or should every country develop or adopt its own reference values (e.g. suited for its own political needs)? The group tended towards EU standardisation.

Delegates expressed the need for standardisation of monitoring methodology as well as health criteria values used i.e. the need for the same accuracy, precision, and levels of detection to an accredited methodology. This can be achieved by using the same methodology, which is the preferred option, or by providing interpretation/explanation if different methodologies are used, a good but second choice option. A problem mentioned is that accredited methodologies may take longer (e.g. MCERTS analysis).

It was noted that some chemicals are difficult to monitor safely (e.g. Sarin) and concentrations / exposure may be “mapped” by effects seen. Delegates also mentioned the lack of a common approach for chemical mixtures. A further issue mentioned was the timeliness of monitoring data.

The European Radiological Data Exchange Platform (EURDEP)[29] was mentioned as it could be adapted for usage for chemical incidents. This platform makes unvalidated radiological monitoring data from most European countries available in nearly real-time and is used for information sharing purposes.

A priori understanding of and agreements on exposure monitoring strategies were regarded as a good practice for cross-border incidents. This should cover quality assurance and certification of monitoring strategies and devices as well. Agreements should aim at interoperability of outputs by aiming at unified risk assessment and unified

[28] AEGLs: http://www.epa.gov/oppt/aegl/

[29] EURDEP: http://eurdep.jrc.ec.europa.eu/Basic/Pages/Public/Home/Default.aspx

and pre-determined information requirements. Where applicable, units should be harmonised or conversion factors should be provided for neighbours.

A further good practice mentioned was the use where appropriate of the WHO endorsed Tolerable Daily Intake (TDI) for water and food – adjusted for exposure timeframe if necessary – for example, Provisional Tolerable Weekly Intake (PTWI).

As mentioned in section 4.3.4, a good practice in the Netherlands, relevant to countries with many water authorities, is that the National Water Institute coordinates all the monitoring of the smaller water organisations in the country.

Monitoring: the workshop findings

The main issues / unfavourable practices:

- Lack of HazMat teams.
- Different organisations take the lead in monitoring. Sometimes information sharing between different organisations does not exist.
- Monitoring is primarily executed for the safety of the first responders and not for the public.
- The arrival of HazMat teams takes a long time.
- Lack of mobile detection and identification equipment.

The common practices across the EU:

- Most countries' fire services have an on-scene chemical analysis capability which at its most basic level can be qualitative / semi quantitative.
- Monitoring is undertaken by a range of organisations.
- Repeated environmental monitoring; environmental monitoring carried out during and after the incident.
- The analysis results from exposure assessment are compared to Acute Exposure Guideline Levels.

The good practices for individual MS actions:

- Environmental monitoring carried out during and after the incident, including the monitoring of shelter areas and other areas relevant to human exposure, especially sensitive populations.
- Standardisation of the reference values.
- Availability of mobile labs within first responders' resources.
- Use of novel technologies such as electronic noses.
- Access to expert 'reachback' advice.

The good practices for sharing between MS:

- Outcomes of environmental monitoring carried out in case of an incident understandable for risk assessors on both sides of the border.
- Use of TDI values for water and food.

Unmet needs for sharing between MS:

- A common approach to chemical mixtures.
- Awareness of neighbouring country's equipment detection limits and constraints.
- Early monitoring for persistent chemicals.

- Standardise reference values or agree in advance which to use.
- Harmonise acute reference values for particulate matter.
- Standardise monitoring methodology.

Success factors:

- Account for differences in short and long-term impacts of chemicals.
- Emergency plans should specify a monitoring approach and the basis for decisions on monitoring in both countries.
- Reach agreement with neighbouring countries on monitoring strategies aiming at interoperability of results and output formats (where applicable units should be harmonised or conversion factors should be provided for neighbours).

4.3.7 Task B and C findings on Analytical laboratories

According to the survey results, almost all Member States (22/85%) have a national laboratory network, and most of them, the capability to analyse all media (air, water, soil, food etc.).

According to the survey, most of the Member States (15/ 58%) have an interdisciplinary procedure for sampling, detection, identification and monitoring and for almost all of them this covers air and water as a minimum. This enables the situation in which interpretation of the results across border may be similar if scientific rationales are alike.

Analytical laboratories: Task B and Task C findings

The main issues / unfavourable practices:

- Lack of national reference laboratories

The common practices across the EU:

- All countries have national air quality reference laboratories, the majority of which are maintained by the relevant Environment Agency or governmental Department of Environment.
- A national laboratory network in almost all countries; interdisciplinary procedure for sampling, detection, identification and monitoring

The good practices for individual MS actions:

- A national laboratory network in almost all countries; interdisciplinary procedure for sampling, detection, identification and monitoring

The good practices for sharing between MS:

- A national laboratory network cooperating across border; procedure for sampling, detection, identification and monitoring standardised

4.3.8 Workshop findings on Analytical laboratories

Delegates mentioned that for cross-border cooperation it is essential to have analytical laboratories which are accredited as part of a proficiency testing of an internationally recognised quality system (e.g. ISO 17025). Trust between neighbouring countries can be created or enhanced by using comparable methods and by harmonising the units or giving conversion factors where appropriate. When using a different methodology, it is important to provide interpretation or explanation.

Although most Member States have mobile laboratories, there are differences in the organisations which have access to this equipment. These organisations are, amongst others, the fire services, the national government, environmental services, research institutes and the military. Another difference is the number of mobile laboratories and the time to perform the (monitoring and) analysis. As laboratories are often stationed in the centre of a country, it can often take a while to reach border areas and have them operational for on-scene analysis.

Analytical laboratories: the workshop findings

The main issues / unfavourable practices:

- Lack of mobile detection and identification equipment.
- Different organisations take the lead in analysing. Sometimes information sharing between different organisations does not exist.

The common practices across the EU:

- Most countries' fire services have an on-scene chemical analysis capability which at its most basic level can be qualitative / semi-quantitative.
- More sophisticated analysis is undertaken by a variety of organisations.
- Repeated environmental analysing.
- The analysis results from exposure assessment are compared to Acute Exposure Guideline Levels.

The good practices for individual MS actions:

- Availability of mobile labs within first responders' resources.

Unmet needs for sharing between MS:

- Laboratory accreditation as a measure for improving trust in neighbour's results (ISO 17025).
- Outcomes should be comparable and interpretable.
- Standardisation of the (acute exposure) reference values (AERV, for example AEGL).

4.3.9 Task B and C findings on Geographical information systems

Geographical information systems are used by different institutions in 21 Member States (81% of Member States), although a few respondents declared the lack of GIS usage. It is common that the systems used provide information on land use (agriculture, residential, industry area etc.) (21 Member States), population size (19 Member States), population type (possible identification of susceptible populations near the incident location) (16 Member States) and the vulnerable zones (populations at risk/sensitive receptors) (15 Member States).

A risk mapping system showing the neighbouring countries' receptors does not seem to be available in Member States as most of the respondents skipped this question or chose that it's not available. Only three Member States addressed this question.

Geographical information systems: Task B and Task C findings

The main issues / unfavourable practices:

- GIS not used at all

The common practices across the EU:

- GIS used by different organisations, for their own purposes. Organisations unfamiliar with each others outputs

The good practices for individual MS actions:

- GIS used for incident response to plot receptors and hazards etc
- Use of GIS that is compatible with modelling outputs and identifies receptors, in a format that is shared and understood between responders in that MS
- Mapping systems can work on cross-border grid reference systems
- Risk mapping system showing the neighbouring countries' receptors

The good practices for sharing between MS:

- Use of GIS compatible with modelling outputs and identifying receptors, in a format that is shared and understood between risk assessors and both can use, both countries share data layers on receptors

4.3.10 Workshop findings on Geographical Information Systems

Delegates from several Member States described the use of Geographical Information Systems (GIS). In Poland, GIS are used for water and soil, but not for land use functions. In Portugal, different GIS are used at local and regional levels. A good practice is to share GIS outputs for forest fires, which is done in Portugal and Spain. Delegates considered the sharing of GIS layers between responders and local mapping of health complaints as good practices. Being able to add dispersion model outputs onto Google Earth or Google Maps was considered a potentially useful capability for sharing with neighbouring countries in the event of a cross-border incident. For this to be possible, an application would need to be developed. It was noted that there may be political barriers to the sharing of technical data.

Geographical information systems: the workshop findings

The main issues / unfavourable practices:

- Different GIS systems used at local and regional levels.
- GIS not used at all.

The common practices across the EU:

- GIS used by different organisations, for their own purposes.

The good practices for individual MS actions:

- GIS used for incident response to plot receptors / health complaints.
- GIS map with sensitive receptors with an overlay of dispersion modelling (with relevant AEGL contours for various meteorological conditions).

The good practices for sharing between MS:

- Sharing GIS outputs for large incidents / forest fires.

Unmet needs for sharing between MS:

- An application to add dispersion model outputs onto Google Earth or Google Maps.
- Map critical sites (e.g. chemical plants) along the border.
- Exchange of GIS layers.

Success factors:

- Compile a European map of cross-border regions with facilities that have potential for cross-border impacts.

4.4 Ranking of good practices and unmet needs for exposure assessment

During the workshops, the delegates ranked the good practices and unmet needs which they had summarised on flip charts. At the Amsterdam workshop, this took place during a plenary session and in Warsaw, the ranking was done during the group sessions.

The ranking was on what were judged as most valued good practices and what were seen as the most important unmet needs for countries which do not have these good practices in place. One country's good practice could be regarded as another country's unmet need.

4.4.1 Ranking in Amsterdam of good practices and unmet needs

The most important good practices and unmet needs mentioned by the delegates in Amsterdam were:

- joint training and exercising with neighbouring countries
- exchange of and familiarisation with information and response systems
- understood arrangements for communication
- harmonisation of procedures

4.4.2 Ranking in Warsaw of good practices and unmet needs

In Warsaw, the good practices and unmet needs which were ranked included the outcomes of the Amsterdam workshop which had already been placed on the flip charts and which were added to and further discussed in groups in Warsaw. These overviews, with the summed individual ranking of the delegates, were used as the basis for presentations which the groups gave in the plenary sessions in Warsaw.

In terms of the good practices and unmet needs for exposure assessment of incidents *within a country* the ranking was as follows:

The availability of two levels of dispersion modelling was ranked most highly, both as a good practice and an unmet need; a quick and dirty approach followed by more precise modelling was deemed important. Other highly ranked topics were:

- the rapid availability and sharing of monitoring data (e.g. via an online network)
- inter-agency training in coordination and response

- availability of emergency plans
- information sharing between networks of experts
- multi-agency face-to-face meetings in the acute phase

In terms of the good practices and unmet needs for exposure assessment of *cross-border incidents* the ranking was as follows:

The topics ranked most highly primarily encompassed general issues and not technical or specific issues. The group of good practices and unmet needs that got by far the greatest number of votes fell under information exchange. Within this category, the topics ranked most highly were:

- sharing information during the acute phase of an incident between the fire services, the environmental agencies and the public health services
- having quick contact details such as telephone lists
- sharing information with relevant colleagues in neighbouring countries
- information exchange on health complaints between countries

The second most highly ranked topics were:

- having common notification procedures
- having a network for information sharing on chemical incidents involving water
- a legal (EU) basis for cooperation between both EU and non-EU states

The third most highly ranked topics were:

- information sharing between countries should be possible within 24 hours
- guidelines for information sharing should be developed or improved
- a Crisis or Emergency Cooperation Centre consisting of all relevant lead agencies from neighbouring countries

Other good practices and unmet needs receiving some votes were:

- reporting of joint working and exercising
- support for funding
- having specific exposure assessment procedures as part of emergency plans
- having the same basic equipment

4.5 Evaluation of workshops by delegates

The delegates received an evaluation form in their workshop information pack (Appendix 6). They were informed of the contents of this information pack at the beginning of Day 1 and at the end of Day 2 they were reminded to fill in the form. Eleven of the 15 delegates at the Amsterdam workshop completed the form; at the Warsaw workshop the form was completed by 16 of the 22 delegates.

In answer to the question 'Were your expectations of the workshop met?', the majority of delegates (63%) said they were well met, with 9 delegates (33%) indicating that they were completely met and one delegate that they were partly met. Concerning the programme, the majority of delegates (70%) thought the subjects covered were very relevant with the remaining delegates indicated that the subjects covered were relevant. All the delegates but one indicated that the amount of content covered was about right, with one delegate indicating that it was too much. All delegates indicated that the level of content was about right. The majority of delegates (85%) indicated that the length of the workshop was about right with the remaining delegates indicating that it was too short.

On a scale of 0 = poor to 3 = very good, the average score for the preparation of the workshop and the visual aids was 2.8. For the venue and the handouts and documentation, the average score was 2.7. The majority of delegates therefore rated these aspects as very good. The delegates were asked to rate the workshops on this same scale (0 = poor to 3 = very good). With an average of 2.7, the majority of delegates rated the workshops as very good.

Below are some examples of comments that the delegates noted on the evaluation form:

> "A good balance of exercises and talks. Very well managed and facilitated."

> "It was very good and excellent organised program."

> "Scenarios will be very useful to use …. to help me review and reprioritise what I need to do in relation to chemical incident preparedness and response with multi-agency colleagues."

> "Group was more diverse than I expected which was great because it gives better understanding of integrated organisation of different disciplines in different countries."

> "Would recommend similar spread of expertise (interagency, interdisciplinary, international) be brought together around other topics – perhaps single topics to work up/agree/harmonise/learn limitations/possibilities with EU."

There were also recommendations for improvement which predominantly referred to time constraints, such as:

> "More time to be spent on scenarios to allow delegates to share experience in more detail."

> "More time for working groups work."

5 Results: International Network of experts

To facilitate cross-border cooperation in chemical incident management, CERACI has identified good practices that contribute to the interoperability of exposure assessment guidelines, tools and practices. In this chapter, this is to be complemented by identifying the need and conditions for setting-up an effective network of European experts in the fields of exposure assessment and public health risk assessment.

The EU Member State Survey in the CERACI project revealed a wide range of professionals (and organisations) involved in exposure assessments. From public health advisors and their involvement in modelling, to fire fighters (including HazMat specialists) which are involved mostly in at scene sampling, detection and identification and toxicologists in identification of affected groups and data assessing. This patchwork of professionals (and organisations) was also verified by looking at the background of the delegates of the workshops (see also paragraph “Delegates”). By logging all the names, professions and organisations of the respondents and delegates, this project has started to initiate an expert network and organise the patchwork. A network emanating from this project can be a starting point for an operational and knowledge exchange platform. The possibilities of permanently hosting the network of experts under a relevant organisation are discussed below, supported by the results of a literature review, workshop discussions and a small questionnaire.

5.1 Need for a network

The delegates of the workshops first discussed the need and purpose of a network. The results of these discussions were verified by the results from a short questionnaire obtained during the Warsaw workshop. The majority of the delegates expressed the need for a network of experts in the field of exposure assessment. The following statements were made:

– *“The current practice shows that there is “too” much diversity in approaches, methods, systems and procedures. Harmonisation and standardisation are needed; a network can contribute to that.”*

– *“There is a need for a multidisciplinary network to spread good practices.”*

– *“A multidisciplinary network raises the possibility to get in very short time information from many disciplines.”*

A few delegates also expressed their doubts. The idea in itself is appealing, but realisation is considered to be difficult. And the costs versus benefits could turn out to be poor.

The purpose of such a network was stated as to improve EU response capabilities and capacities to respond to acute chemical health threats during cross-border incidents. But elaboration on this revealed different needs, namely:

- Learning from each other by e.g. presenting case studies with good/bad practices, approaches for preparation and presenting outcomes of exercises.
- Raising issues/dilemma to drive research & development and policy.
- Getting expert assistance in the hour of need (virtually or physically present).

The first two needs can be combined in the overall topic of preparedness. The third is an operational need.

Conclusions:

- There is a need for a network of experts for exposure assessment.
- The expression of interest in this network lies within two functions. Presenting support to a country during and helping to prepare a country for a chemical incident.

5.2 Existing Network

The delegates from the workshops stated that they preferred to make use of already existing networks. However, the delegates could not identify any existing network linked to the aforementioned first two needs and therefore, they came to the conclusion that the development of a network is necessary. This verifies our results of a literature search that most of the identified networks are not directly linked/relevant to exposure assessment. Moreover, the relevant networks identified do not focus on exposure assessment. They only reflect on the exposure assessment for a particular function (such as harmonisation of reference laboratories) or are networks of contacts that have been financed on a project basis and subsequently shut down. For these, the current statuses and relevance to CERACI are discussed in more detail in Appendix 8.

When looking at a similar network of experts for radiological emergencies, the NERIS platform[30] presents a good example. The objectives are to improve the effectiveness of preparedness, promoting more coherent approaches, identifying gaps and needs and addressing the new and emerging challenges concerning the nuclear or radiological emergency response and recovery. All objectives are similar to what has been stated by the delegates from the workshops in Amsterdam and Warsaw. The scope of this network is however broader, as it covers the whole response and recovery of nuclear and radiological emergencies.

For operational assistance some delegates made reference to the EU MIC and the WHO/UNEP structures. Both have a register of experts, which can be consulted during emergencies (see for more detail Appendix 8). However, several delegates at the workshops were unaware of these registers and their use during acute chemical incidents. Nevertheless, the need for international assistance was emphasised several times by the delegates.

[30] NERIS: http://www.eu-neris.net/

Conclusions:

- There is not one active network for exposure assessment in relation to the effectiveness or coherence of approaches, new developments and emergent challenges.
- There are networks present which deal with one specific topic relevant to exposure assessment.
- There are registers of experts at EU and UN level which can provide aid during acute chemical incidents. However, the function of these registers with regard to exposure assessment is not clear.

Points for consideration:

– Develop a new network and define the scope.

– Establish how the resources of international organisations (such as specialist staff) can be brought to the attention of Member States to assist their exposure assessment during acute chemical incidents and align these resources with the needs of Member States.

5.3 Members of the network

As stated above, a wide range of professionals are involved in exposure assessments. The delegates in the workshop also expressed their opinion on which specialists should be involved. The following were mentioned:

– Scientists with a background in environmental monitoring, emergency modelling, emergency toxicology, risk assessment

– Operators/specialists from fire service, health care, public health

– Emergency planners and trainers

Some of these professionals are organised in professional networks, such as the International Association of Fire and Rescue Services (CTIF) and The European Association of Poisons Centres and Clinical Toxicologists (EAPCCT) (see also Appendix 8). How can all these professionals be reached? Network members and stakeholders must be aware of the existence of the network, make use of it, and find benefit from its use. This could be rephrased by the following text:

- An active network has a mandate to act within a geographical and political scope
- An active network delivers a defined function (or functions)
- An active network interacts with its members and stakeholders
- An active network links to and interacts with other networks and organisations
- An active network evolves by developing existing and new work areas (e.g. both by fulfilling and developing its original purpose and by contributing to new research projects)

This means that when organising a network, the structure must facilitate the aforementioned functions.

In the discussion, some delegates expressed clearly that it is not the experts that need to be addressed but the relevant organisations, institutions, laboratories and bodies.

– *"Experts may vary, but the coordination of all operations necessary for exposure assessment should be formally established"*

Furthermore, WHO[31] have stated that "efficiency, as well as economy, makes it necessary to limit the number of experts participating in discussions on any given subject; on the other hand, it is difficult, in a small group of experts, to obtain adequate representation of the various branches of knowledge which bear upon its subject, and of the diversified forms of local experience and trends of thought prevailing in the various parts of the world. These apparently conflicting requirements may be reconciled by giving expert committees, whenever desirable, flexible membership. This may be done by setting up advisory panels of experts conversant with all the required branches of knowledge and forms of experience needed to cover adequately a particular subject and providing adequate geographical representation. From these panels will be drawn the members of the expert committees, selection being made according to the agenda of each meeting."

Conclusions:

- Organise a network in such a way that organisations (or experts) involved in exposure assessment during chemical incidents find benefit from its use.
- Exposure assessment itself encompasses several distinct functions with their own experts from distinct professional networks.

Points for consideration:

– Seek out adequate representation of knowledge tied to functional roles within the process of exposure assessment.

– Identify which existing professional international networks cover functional roles within exposure assessment.

– Value the already existing professional networks on the particular functions by making use of these structures and by preventing duplication when organising a new network i.e. see a CERACI network as one that joins existing networks together and provides a focus on exposure assessment during incidents.

5.4 Organising the network

The literature study and the EU Member State Survey in the CERACI project describe an understanding of how exposure assessment in itself is organised within the Member States. In 50% of EU countries, environmental monitoring as part of exposure assessment for public health purposes is supervised by the Ministry of Environment or an equivalent authority and public health exposure characterisation by the Ministry of Health or an equivalent institution. Nevertheless, depending on the incident severity the respondents from 24 European countries declared that health risk assessment is undertaken by different bodies at different levels. Additionally, very often (up to 50% of countries) the division of the responsibilities is not clearly specified since different institutions are chosen by different survey respondents as appropriate supervisors. These results suggest diversity of responsible organisations within the different Member States

[31] WHO: http://www.who.int/kms/Factsheet_EAP2010.pdf

both at national and regional level. The workshop delegates raised the possibility of making use of national focal points at national government level. Such a focal point could drive cooperation regionally, nationally and internationally. Focal points are the linking pin between policymakers and the experts and ensure that agreements / conventions / memorandum of understanding and need for cooperation are understood. However, one focal point might not be able to guide the national network(s) in all its functions since there are at least three focal points for chemical response and recovery: for the Seveso directive (and UNECE Helsinki convention), the International Health Regulations and the Civil Protection Mechanism.

Sharing information and improving response by benchmarking with other experts requires international contacts. However, such contacts might not consider regional cross-border interoperability / cooperation issues. Moreover, as already stated above, cross-border incidents will be handled primarily by regional experts with some specific functions at national level. This means that cooperation between neighbouring countries, getting to know each other plays a vital role. The dilemma will be how to link regional experts, national experts and international experts together on the topic of exposure assessment.

Conclusions:

- A blueprint on how to organise exposure assessment regionally, nationally and internationally is not easily drawn up due to the different organisational constructions in the Member States. Exposure assessment itself encompasses several distinct functions with their own experts from distinct professional networks.

Points for consideration:

– Regional cross-border cooperation is the driver for the CERACI network, but can only be viable by making use of functions which require international expert networks for e.g. modelling, new technologies, laboratory networks etc.

– When organising a cross-European network consider Member State focal points to drive cooperation regionally, nationally and internationally.

– Summarise the obligations and stated desire of countries to prepare and cooperate – such as IHR, Seveso and other conventions and regional and bilateral agreements.

– It is preferable to establish one overarching network that ties the functions required for exposure assessment together.

5.5 Resourcing the network

Resourcing is required to administrate a network of experts and deliver the defined function. A network must be kept up to date and a custodian is required to manage it and liaise with stakeholders

- A network requires new members and updating of its existing members' details.
- A network is facilitated through information provision and exchange (e.g. a network website, a network forum).

- A network is facilitated by holding events (e.g. courses, workshops, conferences, trainings, exercises) and sharing outputs.

It is important that new funding does not compromise the independent foundations of the network.

Financing of the activities of the NERIS Platform is ensured by the direct support of the members participating in the activities (i.e. working time, mission costs etc.). However, they are also financed by annual fees paid by each member organisation of the Platform to cover the operating cost of the Platform and, of course, by resources coming from national, regional or European projects.

Conclusions:

- To keep the network up and running the activities of the network needs to be financed.

Points for consideration:

– Create a business plan for a network.

5.6 Coordinating the network

Involving a range of diverse actors and organisations with different objectives and organisational structures in a network to discuss issues about the quality of work requires effective coordination. This is necessary to ensure that outcomes are created that will be embraced by the majority. The question is what form of coordination will be successful?

The answers of the delegates were not conclusive. Some stated that the professional organisations or the Member States themselves should take the lead in coordination. Management by professional organisations is exemplified by the NERIS platform.

> *"The NERIS Platform is managed by a Board of 10 members (organisations). Each member is nominated by the General Assembly for a period of 3 years. Only one person per organisation can be nominated to the Management Board at the same time. The Management Board meets twice a year (including one at the occasion of the General Assembly meeting) under the chairmanship of one of its Members.*
>
> *The Management Board defines the work program of the Platform in coherence with its objectives and the means for achieving them. It also performs a follow up of their implementation."* [30]

The big advantage of having the network coordinated by professional organisations is that its agenda will not be determined by the political issues of the day. On the other hand, delegates stated that coordination should not be dependent on specific organisations, because the multidisciplinary view might get lost.

Other delegates clearly preferred a coordination role at EU level.

– *"This has potential to attract greater support including funding. This also gives a status that professional organisations/Member States may not give".*

The UN organisation was also mentioned, but only in cooperation with the EU. The EU organises, for example, an expert system to aid the Member States in a training programme. This programme is tailored to the needs of civil protection interventions within the framework of the Community Mechanism for civil protection[32].

5.7 Framework for a network

European countries hold the knowledge within their professional organisations and experts to react in the most effective way to chemical emergencies. However, this knowledge is not distributed evenly when looking at the specific field of exposure assessment. In addition, although networks do exist in specific fields of exposure assessment there is no one body that ties these specific fields together with the focus on chemical incidents. Managing this knowledge on EU-level needs an overarching network that can generate win-win outcomes that benefit regional emergency services and national experts/organisations and their respective countries. The attainment of this aim requires strengthening organisational capacities and further enhancing cooperation between countries. The need for a national steer then becomes evident. A steer with knowledge of regional cross-border cooperation, national experts/organisations, international professional networks and links to policymakers on both national and EU-level is required for strategic directions. Joining these national steers together at European level will create the infrastructure for sharing knowledge and learning lessons from each other.

This requires organisational facilitation for the steers and the working groups of experts. When looking at directives/agreements/conventions/memorandum of understanding organising this network on EU level would be most effective.

This framework in itself can facilitate more functions. Since exposure assessment is part of the 4-step risk assessment process, one can consider incorporating the whole process in the overarching network. We noticed that during the workshops, the delegates shifted from topics belonging to these four steps, not knowing the distinct boundaries that mark these steps.

[32] http://www.exchangeofexperts.eu/

6 Discussion

In the previous chapters, we have described the views of the workshop delegates and these largely verified our earlier findings from the literature review and the web-based survey. Furthermore, the workshop outcomes highlighted differences in the approaches to exposure assessment, both within and between countries, due to differences in existing and currently applied methodologies, tools and guidelines. It also became apparent that not only sharing good practices but also discussing what is lacking and how to improve exposure assessment (such as through harmonisation) was deemed a very useful exercise by the delegates. This provided us with ideas for future work which we will discuss further after first reflecting on the design and outcomes of the workshops.

6.1 The Workshops

The outcome of the first workshop in Amsterdam was used as a starting point to elaborate on during the second workshop in Warsaw. Holding two workshops gave us the opportunity to verify the findings of the first workshop during the second one and when presented with these findings, the delegates of the second workshop endorsed them. It also gave us the opportunity to fine tune our approach in the second workshop based on the evaluation of the first workshop by the delegates and ourselves.

6.1.1 The outcomes

On reviewing the outcomes as described in Chapter 4, it appears that the delegates have shared a lot of information as 'good practices' and 'unmet needs'. However, it was sometimes difficult to ascertain if the good practices mentioned were practices already in place in a delegate's country or if they were opinions on what should be a good practice, without already being incorporated into practice (and therefore being an unmet need). This could have been due to language barriers. It was also clear that one country's good practice could be another country's unmet need.

6.1.1.1 The necessities

Based on the outcomes described in Chapter 4 and the discussions with the delegates, the minimum requirements for exposure assessment can be described as common sense necessities, such as:

1. There should be a capability and capacity.
2. Actions and communication should be taken in a timely manner.
3. Communication should be sufficient.
4. The output should be fit for purpose (i.e. help risk assessment).

6.1.1.2 The success factors

The WHO Human Health Risk Assessment Toolkit[33] proposes the type of information and structures needed for a successful exposure assessment. In the Task B report, key success factors for exposure assessment were formulated which encompassed the type of information required by public health risk assessors in a timely manner (see Task B report, Chapter 3.8).

We have compared the success factors from Task B with the success factors identified during the workshops, for each of the specific exposure assessment topics covered in the results in Chapter 4 (see Appendix 9 for an overview). Overall, the success factors identified during the workshops are in accordance with or covered by the success factors described in the Task B literature review. Due to the broad range of experts attending the workshops, technical issues were not covered in great detail and the focus was more on general issues, such as information exchange. This explains the differences in the range of success factors identified for the general issues compared to those for technical issues, such as modelling, monitoring and geographical information systems.

As stated by the delegates, cross-border preparedness starts with successful cooperation between Member States. Since the responsibilities of institutional and advisory bodies and emergency services differ between Member States, the first priority is to know how these responsibilities are organised and how to connect the experts within these bodies between neighbouring countries. Furthermore, awareness is needed of when and on what aspects to exchange knowledge.

6.1.1.3 The good practices

All the success factors mentioned need good practices to help to achieve the most effective way to carry out exposure assessment both nationally and cross-border. It was very encouraging that all the delegates could provide these. However, since we only had delegates from 15 Member States present, we will no doubt have missed out on some good practices. Furthermore, the good practices identified were determined not only by the mix of delegates present but also by the exercises used to elicit them. A different group of delegates and different exercises will probably produce different good practices as well as ones we have already encountered.

From the discussions with the delegates it appeared that some good practices are easily implemented since most of the countries had these in place, whereas others were more difficult to put into practice. How can these good practices be extracted in a more standardised way and maybe even be quantified as to how achievable they are?

Based on the above and the proposal in the WHO Human Health Risk Assessment Toolkit, a solution could be a self-assessment tool so that each Member State can assess what they need in terms of capacities and capabilities to achieve an adequate exposure assessment. The tool could also be used to share those good practices a Member State

[33] WHO: http://www.who.int/ipcs/publications/methods/harmonization/toolkit.pdf

already has in place with others. A framework for such a tool will be developed in Task E. Such a self-assessment will also help Member States to connect to the relevant Network of experts and work out the feasibility of success factors by sharing good practices in a standardised way.

6.2 The Experts

Task D brought together expertise from 15 Member States and two non Member States (Croatia and Moldavia) through a mixed audience of professionals who are active in exposure assessment during a chemical incident. The delegates were enthusiastic in sharing information with each other, since opportunities to meet experts from different fields but with the same focus are scarce. The drawback however was that specific specialist topics could not be discussed in depth because of a lack of dedicated subgroups for kindred spirits. However, the overall impression is that the main issues and topics that are relevant were identified and will form a solid basis for recommendations for future focus.

A Task-Time Matrix (TTM) was used as a means to identify which tasks are relevant in the course of exposure characterisation. As these tasks might not always be covered by the same roles or job titles in each Member State, this matrix was used to initially describe the jobs of the delegates in a uniform way prior to the workshop and also to help the delegates preparing for the workshop. This matrix was of great help in structuring the discussions. By using a time line as defined in the TTM, the focus was on each relevant step in the response to an incident, in relation to tasks connected to the delegates' expertise and roles. As discussions on response during the workshops were closely related to preparedness, many of the issues which arose related to requirements for cross-border preparedness.

Although the TTM was very useful in structuring the discussions, when it came to discussing specialist tasks in more depth, this could be done better in parallel sessions of professionals with the same tasks and levels of expertise. As we had aimed for participation by a broad range of experts involved in exposure assessment, we did not have sufficient numbers of experts per specific task for this approach. We recommend a follow-up workshop with expert groups with the aim of exploring these specialist tasks, such as modelling and environmental monitoring, in more depth and detail and with a focus on sharing inter and intra regional outputs.

The workshops in Task D elicited an extensive amount of knowledge, information, insight and opinions on how cross-border exposure assessment should be organised. However, real life experience with cross-border exposure assessment is limited. The challenge is to:

1) connect the right experts on the relevant issues and on the appropriate level of collaboration (operational, tactical, decision/policy making);
2) maintain a network to exchange knowledge to achieve tailor-made approaches between relevant neighbouring regions;

3) stimulate consensus on shared knowledge on generic issues related to state-of-the art exposure assessment (at EU level).

Below are some ideas as to how this can be approached.

6.3 Future work

Collaboration, getting to know one another and cooperation are all mentioned as key aspects in the workshops, but how can these be organised in a sustainable way? The delegates already mentioned training and exercises as success factors, but also the development of a network of experts as suggested in Chapter 5 or organising conferences would help. Delegates also recommended developing a common framework or an EU agency aimed at identifying, assessing and communicating current and emerging threats to human health posed by chemical incidents. A recent proposal by the European Commission for a decision of the European Parliament and of the Council on Serious cross-border threats to health[34] could go some way towards answering these needs. The aim of the proposed Decision is to streamline and strengthen European Union capacities and structures for effectively responding to serious cross-border health threats of *inter alia* chemical, environmental, or unknown origin. The objectives of the proposal are:

- coordination of the efforts of the Member States in terms of improved preparedness and capacity building;
- setting up an ad hoc network in situations where a Member State has raised an alert on a serious threat other than a communicable disease, in order to provide the relevant information and data for risk assessment and monitoring of emerging threats;
- expanding the use of the existing Early Warning and Response System to cover all serious threats to health, and not only communicable diseases as is the case today;
- coordinating development of national or European public health risk assessments for threats of biological, chemical, environmental or unknown origin in a crisis situation;
- setting up a coherent framework for the EU response to a public health crisis.

To elaborate on this we propose the following:

6.3.1 A regional approach

A regional cross-border approach to the preparation and response to chemical incident would enable resources to be channelled efficiently and effectively. As some border areas are more important than others when considering chemical exposure risk, we would recommend developing a regional risk profile as a starting point. For example, a border area with chemical plants in the vicinity of a downwind urban area in a neighbouring country will put pressure on the cross-border regions to exchange knowledge and cooperate on preparedness in order to be able to effectively respond in case of an

[34] EC: http://ec.europa.eu/health/preparedness_response/docs/hsi_proposal_en.pdf

incident. Recommendations on good practices and unmet needs to be prioritised have implications for all aspects of exposure assessment (e.g. operational, tactical and strategic). Therefore, a specific, regional cross-border approach would give direction to a feasible agenda of priorities between neighbouring countries for achieving an optimal cross-border exposure characterisation.

Before achieving official agreements at regional level between Member States, it is recommended that authorities are familiar with and make use of existing mechanisms, agreements and legal frameworks, such as the International Health Regulations (IHR) or the Seveso directive. The Task B report lists a number of overarching European cross-border initiatives and arrangements being administrated at national level between Member States (see Task B report, Figure 3.1). Mapping Seveso sites near borders would be an appropriate start to the aforementioned approach, as legislation is already in place for these sites.

6.3.2 From regional to international

Regional cooperation in cross-border areas will only be effective when similar evidence-based approaches are used, internationally recognised methodologies are exchanged and specialist capabilities based on similar theoretical models are called upon. National experts from responding agencies should be in place that can deliver specific knowledge, incorporate the outcomes, such as evidence-based practices, and exchange this information with their counterparts in other countries to reach common ground. Therefore, for regional cross-border cooperation to be effective, linkages with experts who work both at a national and an international level are important. These experts will ensure the availability of knowledge and good practices on specialist topics not only for sharing with their neighbouring countries' experts but also with other Member States.

However, as experts will change jobs/roles over time, it is important that networks are organised in such a way that knowledge, expertise and cooperation is sustainable and guaranteed over time. In Chapter 5 we already described a framework for an expert network. The structure of the Centres of Excellence for CBRN[35] is an example of how this could be organised. This is a regional flexible network in which all stakeholders have a sense of ownership and it can rapidly adapt to new situations. Nevertheless, there is also an overarching structure which ensures that the specialist knowledge is organised and presented to those networks that are lagging behind.

6.3.3 One country's good practice is another country's unmet need

As a follow-up, we would recommend a form of 'speed dating' for sharing good practices on exposure assessment. Delegates from countries wishing to promote their good practices and those from countries wishing to learn from other countries' good practices would be invited to participate. Delegates would be asked to list good practices on registration to generate a useful overview of good practices in the EU. The self assessment tool would help to elicit good practices and unmet needs and the Task-Time Matrix would be a helpful tool in categorising these. This approach originates from our

[35] EU: http://www.cbrn-coe.eu/

finding that one country’s good practice is another country’s unmet need, as we mentioned above. Having multilingual partners present for translation and clarification would be an asset.

We would recommend having a mix of countries within a specific European region to lessen the cultural differences and to help establish personal contacts that will also strengthen cross-border response structures in real life incidents.

6.3.4 Harmonisation

The topic of harmonisation was often addressed by the delegates. However, some differences between countries are justified by national requirements or organisational setups which require different approaches to exposure assessment. Nevertheless, some issues could be addressed, such as the harmonisation of reference values.

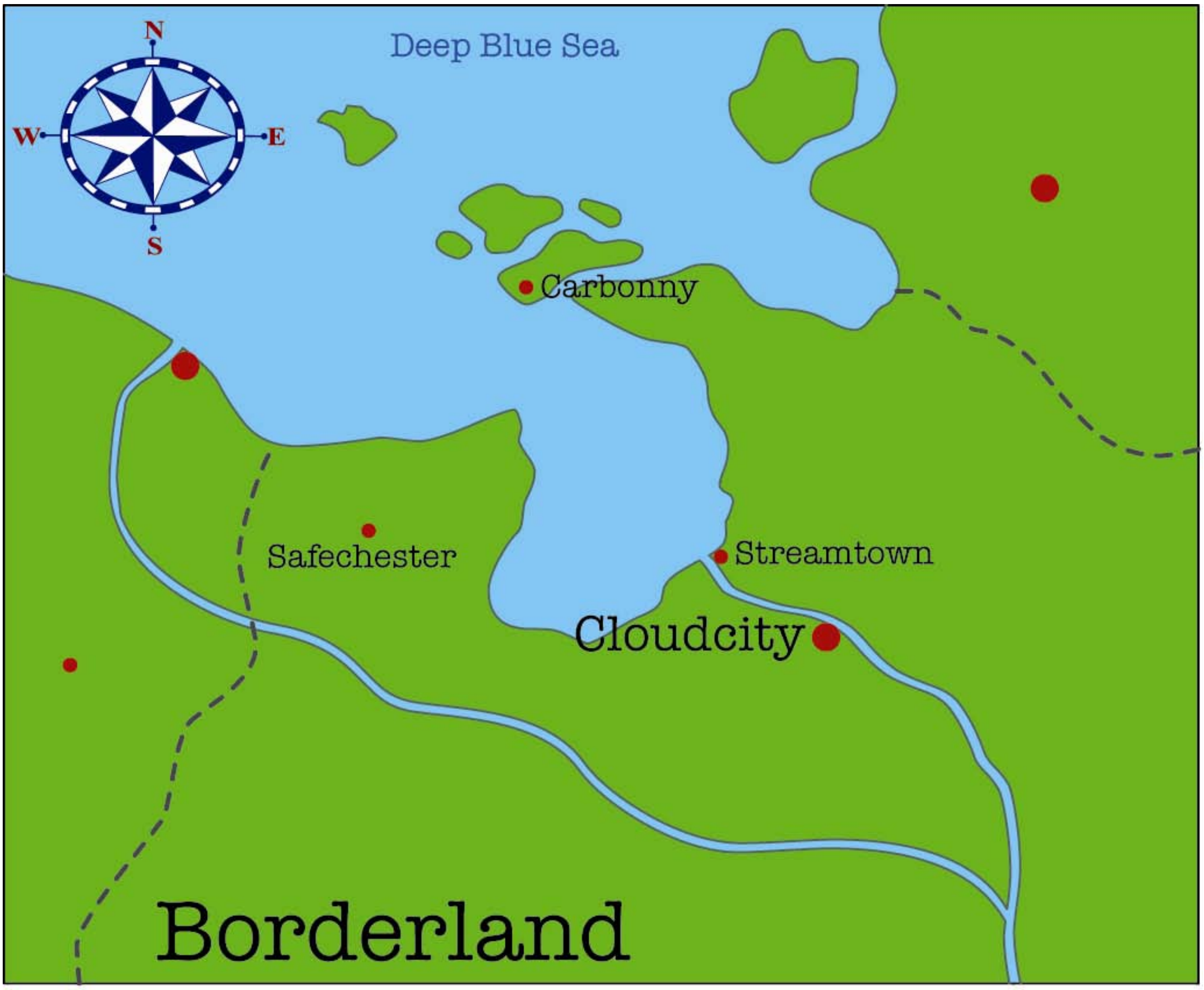
A good starting point to approaching harmonisation of the topics mentioned would be to identify which constraints there are due to, for example, national requirements. Those topics for which no constraints apply and where the need for harmonisation is deemed high could be prioritised.

7 Appendix 1: The workshop scenarios

Scenario 1: Disaster at chemical plant – Chemica

Playing time: 1h30 min

Chemica is a large chemical depot that stores, among others, petroleum distillates and related materials (aviation fuel, petrol, diesel, kerosene). The depot is situated in "Borderland". The depot employs 500 workers from different nationalities. Chemica is located on the eastern outskirts, near the harbour of the main capital "Cloudcity".



Wednesday 29 October 2011

09.00hrs – (Time 0)

It is 29 October 2011 and the prevailing high pressure means that the weather is clear with light winds (Beaufort 2) from the east blowing towards the capital with 700,000 inhabitants.

An employee at Chemica depot notices a leakage of a kerosene storage tank (the tank contains 3 million litres kerosene). He notifies his manager. The manager raises the alarm and mobilises the in-house fire service. They arrive within 15 minutes to assess explosion risk level.

Key questions

a. *Is an exposure assessment important in this phase? If so, why?*
b. *Are you able to characterise exposure with the given information? Please explain.*
c. *Which function will decide that exposure assessment needs to be done? For example, first responders (which ones?), local public health services (how will these be alerted?), regional or national public health services.*

Inject 1 (phase 1)

9.35hrs – (Time 0 + 35 minutes)

A small waste disposal truck drives by. This causes the kerosene vapours in the air to ignite. This results in a huge explosion and fire in the kerosene tank and a petrol storage tank nearby. Instantly, at least seven people are killed.

GROUP A

1) Which dispersion models would you use to chart the plume, if any?

a) In more general terms: Could you name good practices on how to assess the magnitude of exposure during the first hour?

2) Which measurement monitoring strategy would you use, if any?

a) In more general terms: Could you name good practices on how to take the potentially affected population and the exposure pathways into consideration.

3) What monitoring equipment (e.g. GCMS, Draeger tubes) would you use, if any?

a) In more general terms: Could you name good practices on how to assess the likelihood of exposure (procedures & techniques) during the first hour. Facilitators: focus on air measurements.

4) Which acute exposure reference values would you use, if any?

Elicit and share good practices of, for example, monitoring, detection, modelling, and interpretation of exposure data at the golden hour

GROUP B

1) Do you have a methodological approach (e.g. the usage of GIS) for getting an overview of the 'golden hour' and to be able to start exposure assessment?

2) Would you start up communication with other organisations for information sharing in the first hour? If yes, with whom?

a) Would you consider sharing information with other experts, interpreting the information and ensuring the relevant output/information is generated? (e.g. about health effects, protective measures)

3) Would there be information exchange between emergency response organisations about protective measures?

*a) In more general terms: Could you name good practices on how to provide information during the first hour about exposure assessment to characterise risks of emergency responders and the public? **Focus** on air measurements for public and emergency responders.*

4) Which acute exposure reference values would you use, if any?

Elicit and share good practices for example for ICT technologies for sharing information, templates, organisation structures, guidelines for reference values.

Please formulate the key success factors for an accurate exposure assessment in this phase (what needs to be done!)

Inject 2 (introduction of inject 2 by the facilitators)
15h00 (Time 0 + 6 hours)

The depot emergency plan has been activated and an incident cordon established around the site. The emergency services in the whole country are alerted and have dispatched fire, ambulance and police vehicles to the scene. Besides fire fighting and first aid, estimates of combustion source term and initial detection and dispersal modelling outputs are being received.

During the past few hours several more explosions were heard. The nearby area has been evacuated. Inhabitants of the capital are instructed to 'go in, stay in, tune in'.

Several more oil tanks are thought to be burning at temperatures exceeding 1,000 ºC. Such a hot fire is expected to cause complete combustion of the hydrocarbon fuel, and toxic products within the plume are likely to be limited to black carbon, carbon monoxide and carbon dioxide. The fire brigade is discussing whether the fire should be allowed to burn itself out or if it should be extinguished.

It is reported that 2,000 citizens have called local authorities with respiratory complaints and eye irritation. The main general hospital received about 30 patients with severe respiratory problems.

At this stage Chemica admits that the overflow reservoir is not large enough. Therefore, it seems likely that kerosene has been leaking into the harbour, prior to the explosions.

GROUP A

1) *Which models would you use to chart the plume? Are they different from the ones you would use in the golden hour?*
    a) *In more general terms: Could you name good practices on how to assess the magnitude of exposure after the first hour?*
2) *Would your measurement strategy change due to this new information?*
    a) *In more general terms: Could you name good practices on how to take the potentially affected population and the exposure pathways into consideration. Focus on water, crop, soil and grass measurements.*
3) *Which monitoring equipment would you use? (e.g. GCMS, Draeger tubes).*
    a) *In more general terms: Could you name good practices on how to assess the likelihood of exposure (procedures & techniques) after the first hour.* ***Focus*** *on water, crop, soil and grass measurements.*
4) *Which organisations would be involved in measuring/monitoring?* ***Focus*** *on local vs. national.*
    a) *Which reference values would you use, if any?*

Elicit and share good practices of, for example, monitoring, detection, modelling, and interpretation of exposure data after the golden hour.

Formulate the key success factors for an accurate exposure assessment in this phase (what is needed!)

GROUP B

1. *Would there be communication between the local authorities/ health agencies that receive the calls about the health complaints and the authorities that perform the dispersion modelling and monitoring? If so, does it flow smoothly?*
2. *Would there be information exchange between the fire brigade and emergency health services about the consequences of extinguishing fire (compared to allowing it to burn itself out?*
    a. *Would you consider sharing information with other experts, interpreting the information and ensuring the relevant output/information is generated (e.g. about health effects, protective measures)*
3. *Would you start up procedures to inform the general public and which authority is responsible for this?* ***Focus*** *on expected health effects due to air, crop and soil contamination.*
4. *Which organisations would be involved in communicating to the public?* ***Focus*** *on local vs. national.*
5. *Which acute/cumulative exposure reference values would you use, if any?*

Elicit and share good practices for example for ICT technologies for sharing information, templates, organisational structures, guidelines for reference values.

Please formulate the key success factors for an accurate exposure assessment in this phase (what is needed!).

Inject 3 (introduction of inject 3 by the facilitators)

Day 2, 12.00 hrs – (Time 0 + 27 hours)

The weather conditions have changed slightly. There is an inversion layer. The wind is not expected to pick up over the following 24 hours. The fire department has started to extinguish the fire, using foam cannons, which have resulted in a large production of smoke at ground level and a steep increase in both number and severity of health complaints.

Benzene and PAHs, such as naphthalene, were measured in water. Soil samples were taken in an area 30 kilometres down wind from the fire and show high levels of PAHs, benzene, ethylbenzene and soot. Measurement results in crop samples are expected within the next few hours.

GROUP A

1) *Which models would you would use to chart the plume? Are these different from the ones you use in the first day?*
   a) *In more general terms: Could you name good practices on how to assess the magnitude of exposure after the first hour?*
2) *Would your measurement strategy change due to this new information?* ***Focus*** *on all exposure pathways except crops*

a) In more general terms: Could you name good practices on how to take the potentially affected population and the exposure pathways into consideration? Focus on water, crop, soil and grass measurements.

*3) Which organisations would be involved in interpreting the exposure data? **Focus** on local.*

*4) Which reference values would you use, if any? **Focus** on all exposure pathways except crops*

5) In more general terms: What additional good practices can you name for exposure assessment in this phase when looking at e.g. supporting mechanisms?

6) What would you consider to be key success factors for an accurate exposure assessment in this phase?

GROUP B

1. *Would there be communication between the local authorities that receive the calls about the health complaints and the authorities that perform the dispersal modelling and monitoring?*
2. *Would you start up procedures to inform the general public and which authority would be responsible for this? **Focus** on expected health effects due to exposure via air and soil contamination.*
3. *Would you start up procedures to inform hospitals and GPs about expected health complaints and the prognosis of incident developments? If so, when would you inform them?*
4. *Who would be responsible for communicating to the public about possible long-term health effects? **Focus** on local vs. national.*
5. *In more general terms: What additional good practices could you name for exposure assessment in this phase when looking at e.g. information management?*
6. *What would you consider to be key success factors for an accurate exposure assessment in this phase?*

- *Let the group prepare a presentation that will be presented by the delegate chair or a group member in the plenary session (10').*

- *Let the group use the filled in table to summarise the answers (red, green, blue).*

- *Use the following questions for the interpretation of the results.*

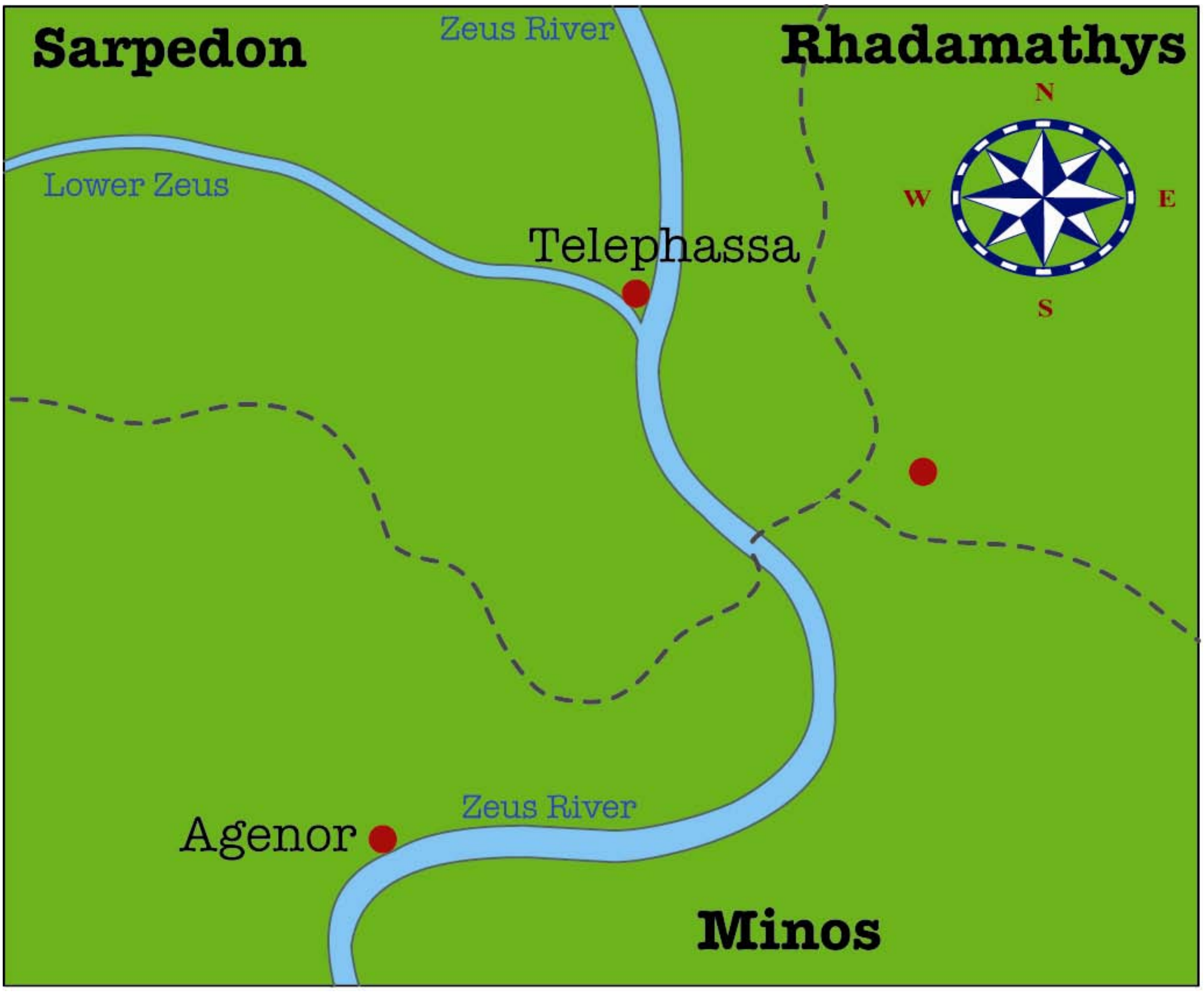
1) What unmet needs for exposure assessment can you identify in this phase when looking at the good practices and the key success factors?

2) Would sharing of expertise/good practices between countries be useful? Why?

3) Are there good practices, key success factors and unmet needs for exposure assessment when looking at preparedness?

Scenario 2: Disaster at Alumina
Playing time: 90 min

Alumina is a large plant producing aluminium oxide. The plant is situated in the Country of Minos nearby the city of Agenor and the river Zeus. Alumina is located on the southern outskirts of the city of Agenor.



Note: the used names are from mythology, where the countries are names of 'the children of Europe and the cities are names of 'the parents of Europe'.

Wednesday 4 September 2011

It is 4 September 2011 and the prevailing high pressure means that the weather is clear with light winds from the south blowing towards the Country of Sarpedon (City of Telephassa). The ambient temperature is low at 8°C. It has been a particularly hot and wet summer.

Inject 1 (phase 1)

06.30hrs

The dam of a reservoir within the Alumina plant collapses, freeing about a million cubic meters (35 million cubic feet) of liquid waste from red mud lakes. The mud is released as a 1–2 m (3–7 ft) wave, flooding several nearby localities, including the city of Agenor. About 40 square kilometres (15 sq mi) of land are affected initially. The wave of mud flooding the streets causes seven people to die due to crushing injuries from cars and vans swept along in the torrent. The pH of the mud is considered hazardous and causes an alkaline reaction on contact causing caustic irritation/ burns if not washed off with clean water. Within an hour, 30 people have been taken to hospital with chemical burns.

07.30hrs

The emergency detection team of the Country of Minos has started to carry out continuous monitoring. The spill reaches the river Zeus and starts travelling toward the Country of Sarpedon. Emergency workers of The Country of Minos are pouring tonnes of plaster into the waterway to try to bind / neutralise the sludge and prevent it from continuing downstream, but this has little effect.

Inject 2 (phase 2)
13:15 hrs – (Time + 6 hours)

The contamination in the river Zeus has now spread over 17 km into the Country of Sarpedon, affecting the City of Telephassa. This is leading to large public concern and calls to local, regional and national public health agencies. For example:

1. The bitter smell is pervasive and the public are contacting the local public health service of the Country of Sarpedon for advice.
2. People in the Country of Sarpedon are enquiring about the safety of the drinking water.

Water monitoring is performed by drinking water companies within the Country of Sarpedon (no drinking water inlets are affected in the Country of Minos).

Key questions:

Bearing in mind exposure assessment with regard to public health, please write down

1. *From your perspective, what are the pressing “cross-border issues” illustrated by this scenario in relation to exposure assessment?*
    a. *Also make use of the themes discussed on day 1 and add or delete themes*
2. *Do you know of existing good practices and could you relate these to the above mentioned issues?*
3. *What key success factors can you think of to make the cross border cooperation work based on the abovementioned themes? Think of both the preparedness and response*
4. *When looking at good practices and key success factors, what in your opinion are the unmet needs for cross-border preparedness and response illustrated by this scenario with relation to exposure assessment?*
5. *Is EU-harmonisation for the unmet needs required or can the EU facilitate in meeting these needs? If so, for which and why?*

8 Appendix 2: Letter of invitation to the delegates

Cross-border Exposure characterisation for Risk Assessment in Chemical Incidents (CERACI)

Invitation to workshops

19-20 March in Amsterdam, the Netherlands / 2-3 April in Warsaw, Poland

Dear Sir/Madam,

We are inviting experts in exposure characterisation and public health risk assessment of chemical incidents to take part in workshops in March and April 2012. The aim of the workshops is to verify and test best practices for exposure characterisation in (cross-border) chemical incidents. These best practices have been identified in the course of the EU-funded CERACI project.

We would like to have a mixed audience of professionals that are active in exposure assessment during a chemical incident, including experts from:

- Health protection services
- Environmental protection services
- Fire and rescue services
- Research institutes
- National and local government
- Military

The CERACI project will be able to cover the expenses (travel, accommodation and subsistence) of a limited number of participants. Selection will be based on professional experience in the fields of exposure characterisation and public health risk assessment of chemical incidents. We are particularly keen to have participants who are actively involved in cross-border emergency planning and emergency response and those who are involved in environmental monitoring and modelling during (inter)national incidents. The workshops will be conducted entirely in English and a good proficiency in English is therefore required.

If you are interested in participating in the workshops, please could you fill in the attached expression of interest form and return it to this e-mail address using 'reply to all', preferably by 31st January and no later than 3rd February 2012?

You may already have expressed your interest in these workshops if you contributed to the CERACI survey, held in the summer of 2011. We would appreciate it if you could complete the expression of interest form due to the additional background information we require.

We will reply to those expressing an interest in February, when we will provide further information to those selected.

Please find attached some information on the CERACI project. You can also find information on the project website www.rivm.nl/ceraci. If you require any additional information, please don't hesitate to contact me. On behalf of the CERACI project team, thank you very much for your interest.

9 Appendix 3: Expression of interest form

EXPRESSION OF INTEREST IN CERACI WORKSHOP

Please indicate your 1st and 2nd choice of workshop:

Amsterdam 19/20 March 2012* O 1st O 2nd

Warsaw 2/3 April 2012* O 1st O 2nd

*Both workshops will start at approximately 12:30 on the first day and will end at approximately 14:00 on the second day.

Title: ………………………………………………………………………………

Name: ………………………………………………………………………………

Surname: ………………………………………………………………………………

Occupation: ………………………………………………………………………………

Organisation: ………………………………………………………………………………

Address: ………………………………………………………………………………

Telephone: ………………………………………………………………………………

Email: ………………………………………………………………………………

1) What best describes your functions/responsibilities in exposure assessment for emergency preparedness or response to chemical incidents?

a) Expert from (please highlight one of more options)
   - o Health protection services
   - o Environmental protection services
   - o Emergency services
     - o Fire services
     - o Ambulance services
     - o Police
   - o Government
     - o Local
     - o Regional/provincial
     - o National
   - o Research institutes
   - o Military
   - o Other: ……………………………………………………………………………………..…………………

b) Function related to exposure assessment (please highlight one or more options)
   - o Environmental monitoring
   - o Modelling
   - o Detection and identification
   - o Coordination of exposure assessment
   - o Risk assessment (assessing risks for public health and/or environment and advising with regard to measures)
   - o Risk management (decision making)
   - o Other: ……………………………………………………………………………………..…………………

c) Response to chemical incidents (please highlight one option):
   - o Strategic
   - o Tactical
   - o Operational

d) Organisational level (please highlight one or more options)
   - o Local
   - o Regional
   - o National

2) In the event of an emergency in your country involving chemicals (e.g. a fire, or release to land or water), please briefly describe what your role would be and how it involves exposure assessment?

____
____
____
____
____
____
____

3) Do you have personal experience in responding to **cross-border** chemical incidents?
   a) Yes
   b) No

   If yes, please add further detail below:

____
____
____
____
____
____
____

4) Do you collaborate in preparedness and planning for **cross-border** (chemical) incidents?
   a) Yes
   b) No

   If yes, please add further detail below:

____
____
____
____
____
____
____

5) Please briefly describe your professional background and years of experience.

____
____
____
____
____

____

6) Please briefly describe your educational background

____

7) Is the organisation you work for able to cover your expenses (i.e. travel and accommodation costs)?

a) Yes

b) No

National Institute for Public Health and the Environment
Ministry of Health, Welfare and Sport

Health Protection Agency

Nofer Institute of Occupational Medicine

Project co-funded by the EU,
Civil Protection Financial Instrument
Grant Agreement No.
070401/2010/579055/SUB/C4

10 Appendix 4: Homework CERACI workshop Task-Time Matrix

Homework for CERACI Workshop 19th – 20th March, Amsterdam, the Netherlands

Task-Time Matrix (TTM)

Dear Delegate,

In order to discuss the issues relevant for cross-border exposure characterisation, it is important to know each delegate's involvement in the relevant tasks during the handling of the acute phase of a chemical incident. As job descriptions differ between member states we defined a Task-Time Matrix (TTM) that lists the relevant tasks in relation to the timeline of an incident.

This matrix will be used throughout the workshop as a means to facilitate the discussions and to help you to discuss or exchange knowledge with each other throughout the sessions.

We would like you to fill in the matrix (Table 1) on page 3 by ticking the relevant cells to specify your tasks. This is an initial warming up exercise for the workshop. During the workshop it will provide you and your colleagues with an easy insight into your involvement in this area of expertise. It can be seen as a uniform, Member State independent, job description.

Instructions

In Table 1, please fill in your name, the name of your job description related to exposure characterisation and tick the level of your involvement. You may tick more than one option (e.g. local and regional). Then please tick (with X) all cells that correspond to the tasks which you perform during different stages of an incident (task versus steps in time line). Please add remarks, where relevant. At the bottom of the table you can add additional tasks that you consider relevant.

Best practices

Per task which you have ticked we would like you to consider two questions:

1. Which best practices are available in your country?
2. Which unmet needs can you identify?

Please list these in Table 2 on page 4. In the first column please give the task number according to Table 1.

Please could you hand in the completed Tables 1 and 2 at the workshop during registration? Alternatively, you can email them to ceraci@rivm.nl before 16th March.

Explanation of Task-time matrix

Delegates will have specific tasks and roles in their countries in relation to exposure assessment. Moreover, the tasks to be carried out might depend on the moment in time (incident time line). As relevant steps in time are strongly related to other key processes in incident management, tasks will depend on it accordingly. The connection between task and time line are described below.

1. Tasks

- Data collection and data generation (for characterisation of exposure and interpretation)
- Data interpretation (for advising on risk and on related decision making)
- Decision making (by decision makers)

2. Roles/function

The experts and/or specific authorities responsible for the relevant tasks in exposure assessment operate on one or more of the following levels

- local,
- regional,
- national,
- cross-border, international

3. Time line

The Tasks (1) and therewith the role and/or function (2) in relation to the time line form a so-called Task-Time Matrix (TTM), in which the tasks, in the perspective of the course of the incident, are specified for each function/job description. Such a matrix will visualise the role/function of the experts in a uniform way allowing comparison between countries.

The following relevant points in time are used in the time line, from ‘initial chaos’ to ‘under control’:

1. Golden hour: the first rough impression is available
2. First incident report after the first session of the incident team in charge. This may include first monitoring data, interpretation and communication information to be shared with other parties. The first actions and decisions are described.
3. Second incident report, including feedback of actions that have been carried out, new information being included (about the situation, monitoring, questions asked, decisions made on a higher level)
4. Situation after approximately one day
5. Situation after first 3 days

Table 1. Task-Time Matrix (TTM)

Your name: Name of Job: ....

Level of operation:
[ ] local [ ] regional [ ] national [ ] international

			Day one				Follow-up
	Time line		'Golden' (first) hour	First reporting	Second reporting	End of day one	2-3 days
	Task	Remarks					
1	Initial and general impression of the incident (qualitative data on incident) e.g. reports from the scene and from health responders						
2	Determining strategy for monitoring and dispersion modelling						
3	Environmental monitoring of e.g. area of incident and area of population at risk						
4	Dispersion modelling						
5	Geographical Information System (GIS) mapping e.g. to locate sensitive receptors						
6	Analytical laboratory support						
7	Gathering and interpreting observational data e.g. casualties, health complaints, (sub) populations at risk						
8	Comparing measurements to reference values e.g. AEGLs						
9	Data interpretation and exposure assessment using regional team or reach back expert network e.g. for populations at risk						
10	Giving advice based on exposure assessment						
11	Decision making based on exposure assessment						
12	Cross-border exchange of information related to exposure assessment						
13							

Table 2. Best practices and unmet needs

Task Number	Best practices	Unmet Needs

10.1 Appendix 4a: Overview of Table 1 - Task-Time Matrix

The numbers in the table below represent the number of delegates that indicated being involved in this task

Tasks	Phase during incident				
	'Golden' (first) hour	First reporting	Second reporting	End of day one	2-3 days
Initial and general impression of the incident (qualitative data on incident) e.g. reports from the scene and from health responders	17	13	8	10	8
Determining strategy for monitoring and dispersion modelling	9	10	6	7	8
Environmental monitoring of e.g. area of incident and area of population at risk	4	7	8	7	9
Dispersion modelling	3	7	6	4	6
Geographical Information System (GIS) mapping e.g. to locate sensitive receptors	2	6	7	5	6
Analytical laboratory support	4	5	7	7	9
Gathering and interpreting observational data e.g. casualties, health complaints, (sub) populations at risk	8	12	11	10	8
Comparing measurements to reference values e.g. AEGLs	5	6	9	7	9
Data interpretation and exposure assessment using regional team or reach back expert network e.g. for populations at risk	9	11	12	10	11
Giving advice based on exposure assessment	9	11	11	11	11
Decision making based on exposure assessment	7	7	8	7	7
Cross-border exchange of information related to exposure assessment	5	4	6	6	7
Other	1	1	1	1	

10.2 Appendix 4b: Results of Table 2 - Best Practices described by delegates

In the tables below, the best practices per task are listed in the columns.

Task 1: Initial and general impression of the incident (qualitative data) e.g. reports from scene and from health responders	**Task 2: Determining strategy for monitoring and dispersion modelling**	**Task 3: Environmental monitoring of e.g. area of incident and area of population at risk**
First information coming from Alarm Centre. More detailed information through direct contact with health and fire department from the field	Web-portal for federal crisis centres and relief units	Joint working with HPA and EA
Fire Corps is involved from first moment of incident and as far as is necessary	Workshops on state-of-the-art air dispersion modelling tools	Interagency air quality health information group is developing proposal for interagency mandated unit to provide national modelling expertise
Collaboration between relevant bodies is at a good level. Civil protection organise and coordinate the operation	Common trainings for coordinators (all action forces: military, police & relief units) on pre-defined emergency scenarios – esp. to improve communication	Internal procedures and expert judgment
Detection, Identification and Monitoring capability in ERS	Influence on monitoring strategy and method through direct contact with specialists from fire department; getting information on measurements from firefighter specialist	Warnings to the public, isolation of the area and if needed evacuation.
Participation in emergency networks on local, regional and national level	Civil protection determines the strategy	Mobile lab with GCMS, IR spectroscopy etc. and good analytical specialist - fire fighters with chemistry study work 24/7
Immediate report to authorities concerning incident according to the interministerial agreement (all authorities involved in incident management are informed)	Assessment of potential impact of incident	All analytical equipment is ready to go by helicopter
Gathering information concerning incident, e.g. type of incident, hazardous substance, place of incident	Internal procedures and expert judgment	Establishing range of laboratory monitoring, taking samples, impact assessment
The Consultant in Public Health Medicine Environment and Health Group work collaboratively to develop guidance, share resources, provide peer support and training	Product identification, limitation of affected area	A Joint Dynamic Risk Assessment Process put in place by police which involves all 3 emergency services and Public Health. Proved to be invaluable in recent incidents
Obligatory announcement for treatment problems and accidental spills at company level to environmental inspection	Investigation of the application of UAVs (unmanned aerial vehicle or drone) for emergency applications: first guess of the danger area from dispersion model for the flight planning, overview with the UAVs of the danger zone, detection of injured persons, measurements of toxic gas concentrations and coupling with dispersion model for Advanced Back Calculations (better estimation of the source term).	
Recon, identification of products and decision making	Determine strategy in advance (agreements, actions of responsible institution, standard operating procedures)	
Education of potential leaders of rescue workers about the most important information necessary about chemical substance.	A Joint Dynamic Risk Assessment Process put in place by police which involves all 3 emergency services and Public Health. Proved to be invaluable in recent incidents	
A Joint Dynamic Risk Assessment Process put in place by police which involves all 3 emergency services and Public Health. Proved to be invaluable in recent incidents		
The Framework for Major Emergency Management with regional and national structures, training, exercises, guidelines, coordination works well		

Task 4: Dispersion modelling	Task 5: Geographical Information System (GIS) mapping e.g. to locate sensitive receptors	Task 6: Analytical laboratory support
Web-portal for federal crisis centres and relief units	Wide range planning by LRF emergency planning	Taking samples during onsite visit (with collaboration and participation of laboratory staff); accreditation
Workshops on state-of-the-art air dispersion modelling tools	Dispersion model output visualisation e.g. in Google Earth	Internal procedures and expert judgment
Common trainings for coordinators (all action forces: military, police & relief units) on pre-defined emergency scenarios – esp. to improve communication	GIS mapping; groundwater, surface water, nature, soil, topography	Dispatch of experts from the Regional and/or National Civil Protection Command Centres
Direction of dispersion. Dispersion for relatively simple LoC scenarios and short distances	The HSE, Health Information Units "Health Atlas" has great potential for GIS data to inform risk assessment	Laboratory network available
Comparison of several dispersion models and their utility for the fire brigade, cooperation among meteorologist and emergency responders, contribution to emergency response training and preparation, research in the area of the elaboration of emergency plans for SEVESO Establishments.	Internal procedures and expert judgment	Information is prepared for laboratory on which components should be analysed.
A Joint Dynamic Risk Assessment Process put in place by police which involves all 3 emergency services and Public Health. Proved to be invaluable in recent incidents	Local, Regional and National Emergency Plans, with the GIS technology associated.	We have analytical support from HQ industry laboratory – we compare our results
Manually made, based on Meteorological conditions, ground water, and water supplies.	Visualisation ("plume on the map") for relatively simple LoC scenarios	CBRN strategic planning includes non-terrorist HazMat incidents and all processes available to both including police lab analysis

Task 7: Gathering and interpreting observational data e.g. casualties, health complaints, (sub) populations at risk	Task 8: Comparing measurements to reference values e.g. AEGLs	Task 9: Data interpretation and exposure assessment using regional team or reach back expert network e.g. for populations at risk
Contact with health commanding officer in the field gives good overview of health complaints	National book of AEGL related guidelines for over 100 hazmats	In complex cases national team representing several national institutes and ministries present for back up
Contact with modelling specialist from fire departments gives estimates of populations at risk	Reference values used in clinical interpretation are derived from individual patient cases; acute dose-effect relations (mild, moderate, severe poisoning)	Reference values used in clinical interpretation are derived from individual patient cases; acute dose-effect relations (mild, moderate, severe poisoning)
Field incident commander on arrival immediately provides info to Coordination and Operation Centre by using analog radio or TETRA or mobile call	Package of information present on-site (laptop with substances database, internet connection), Coordination Centre basic support, contact with familiar experts, SPOT	Many sources of reach back
Up to date poison info service and clinical toxicological knowledge	Reference values regarding air, soil, water	Internal procedures and expert judgment
According to order of Ministry of Health data are interpreted and sent to authorities at once after confirmation by medical service	Made by the Public Health Department experts.	Network/organisation is in place
Impact on health is considered regarding law regulation concerning major accidents, that needs to be reported to Chief Inspectorate for Environmental Protection	Expert network available	Chemical experts in fire service - practical knowledge and experience - ready to take part in rescue operation

Integrated Medical Emergency System, trained teams.	Early access to expert scientific advice to quality assure advice	Participation in work of staff gathered at the scene of incident (together with Fire Department etc)
Network of emergency planners; well tried and tested emergency plans including information flows on casualties etc. built on pandemic planning	Internal procedures and expert judgment	Contract with HPA works well; National Poisons Information Centre
		Expert Network access through Regional Civil Protection Command Centre.
		Involvement of individual experts in the early phase leads to an interdisciplinary working group (e.g. members of agencies, scientists from academia, officials from ministries)
		Early access to expert scientific advice to quality assure advice

Task 10: Giving advice based on exposure assessment	**Task 11: Decision making based on exposure assessment**	**Task 12: Cross-border exchange of information related to exposure assessment**	**Other**
Official advice given to decision making officer of health chain. Best practice is slowly getting better appointments with health workers in the field and emergency rooms in hospitals	State detection services are called to be activated and take sample from the field	Warning and Alarming system (WAS) for Schelde/Meuse catchment area	Web platform with weather information and nowcasting specially for the dispersion models in use by the emergency responders, support via telephone - special training for the meteorologist on duty
Broad experience because of daily over 100 individual patients for which these medical treatment decisions are made. In this sense a disaster is "more of the same".	Broad experience because of daily over 100 individual patients for which these medical treatment decisions are made. In this sense a disaster is "more of the same".	Emergency Planning Arrangements across border areas in place for number of years and have focussed on mass casualties. Training and exercising on occasions	
Use of a differential diagnostic computerised system with impact of symptoms, in order to draw up a list of the most likely causative agents	Use of a differential diagnostic computerised system with impact of symptoms, in order to draw up a list of the most likely causative agents	Exchange information: only collecting, gathering data and reporting to Chief Inspectorate for Environmental Protection	
Participation in work of staff gathered at the scene of incident (together with Fire Department etc)	Good structure of operation commanding - good information flow from the local to the national level. Fire brigade in every district is prepared to deal with basic casualties decontamination	Through National Civil Protection Command Centre	
Contract with HPA works well; National Poisons Information Centre	HAZMAT team based on professional firefighters (operating 24/7) - quick response in the first minutes		
Early access to expert scientific advice to quality assure advice	Contract with HPA works well; National Poisons Information Centre		
Early involvement of academia (facilitates crisis / risk communication to the public in the incident and in the aftermath)	Joint Dynamic Risk Assessment allows early communication and joint decision making. Recognition of each others roles and responsibilities		
Based on the Guidelines, and field observations	Based on the Guidelines, and field observations		-

10.3 Appendix 4c: Results of Table 2 - Unmet Needs described by delegates

In the tables below, the unmet needs per task are listed in the columns.

Task 1: Initial and general impression of the incident (qualitative data) e.g. reports from scene and from health responders	**Task 2: Determining strategy for monitoring and dispersion modelling**	**Task 3: Environmental monitoring of e.g. area of incident and area of population at risk**	**Task 4: Dispersion modelling**	**Task 5: Geographical Information System (GIS) mapping e.g. to locate sensitive receptors**
Qualitative/quantitative data on incident. Sufficient flow of information among first responders and Coordination and Cooperation Centre (COC) and to decision makers	Visual exchange of information	No clear predefined coordination of the different units and institutions for monitoring of toxic hazards – well organised for radiological emergencies only	More advanced dispersion modelling of (large) fires is limited (source term, long-distance dispersion, deposition)	Identification of vulnerable population
Local community involvement for immediate information in case an incident is at a distance to living area (e.g. forest fire)	Communication protocols and task spreading among local/regional actors	Lack of trained personal and lack of equipment (personal and collective).	Lack of trained personal, lack of equipment (personal and collective), lack of means.	Visualisation of dispersion for large fires
Need for recognisable National unit for public health response to chemical/radionuclear incidents and IHR PHEIC response	Lack of trained personal and lack of equipment (personal and collective).	Equipment to perform environmental monitoring	Lack of real data (measurements) for model validation; Need of harmonisation on local-scale airborne hazards modelling and emergency response at European level: COST Action ES1006	Communication protocols and task spreading among local/regional actors
Communication protocols to connect civil/local observation or announcements with monitoring agencies	Different dispersion models and application practice (national); different threshold values preferred from emergency responders and decision makers; No clear regulations concerning the elaboration of the emergency plans and the dispersion modelling.	Need for CHEMNET type service	Easy access to dispersion modelling program (e.g. web said)	There is a need to implement more GIS
Lack of trained personal and lack of equipment (personal and collective).	No clear predefined coordination of the different units and institutions for monitoring of toxic hazards – well organised for radiological emergencies only	Communication protocols and task spreading among local/regional actors	No clear predefined coordination of the different units and institutions for monitoring of toxic hazards – well organised for radiological emergencies only	GIS could be useful
Reliable data				Combined visualisation tool for all data relevant for crisis coordinator
				Out-of-date data, non-standard exchangeable data.
				Link "Health Atlas" to monitoring /dispersion modelling and assessment of area of incident/population at risk

Task 6: Analytical laboratory support	Task 7: Gathering and interpreting observational data e.g. casualties, health complaints, (sub) populations at risk	Task 8: Comparing measurements to reference values e.g. AEGLs	Task 9: Data interpretation and exposure assessment using regional team or reach back expert network e.g. for populations at risk	Task 10: Giving advice based on exposure assessment
Communication protocols and task spreading among local/regional actors	Sufficient flow of information among first responders and COC and to decision makers; to be based on valid on-site measurement of hazardous agents	Need more expertise in area of environmental monitoring	Exposure often not well defined	Need more expertise in area of environmental monitoring
There is a need to improve our labs capacity and to increase the collaboration between MS labs and to create EU reference lab	Sufficient communications not based only on voice transmission through analog radio and mostly mobile phones and less on TETRA system	Quality of measurement? AEGL of relevant substances available? Which AEGL? (Current practice AEGL-2 (4h) for disaster relief forces)	Often no adequate biomonitoring	Faster communication lines for giving fast advice about safety of health workers and victims
Early involvement of "back up" laboratories especially with respect to sampling	Knowledge is largely based on experience. Evidence-based medicine is scarcely available with regard to clinical toxicology	Update national book of AEGL related guidelines (present one is from 2007)	Not quick access to expert networks (there are agreements with experts but in reality it takes a lot of precious time to get in touch	Better dose-effect relations needed, however difficult to achieve in clinical toxicology
Accreditation for laboratories to analyse more components	There is some delay because of diagnostic difficulties	Difficult to compare the reference values used in clinical interpretation (derived from individual patient cases) with AEGLs which are generally lower, aimed at the sensitive population.	Need more expertise in area of environmental monitoring	
Lack of availability of the experts.	Lack of trained personal and lack of equipment (personal and collective).	Wider support from emergency centre, easier getting in touch with experts (chemists, medical specialists of exposure)	Better case practising	
	No surveillance of chemical incidents; no monitoring of public health status in light of exposure to non-infectious environmental hazards	Exposure often not well defined	Communication protocols and task spreading among local/regional actors	
		Communication protocols and task spreading among local/regional actors		

Task 11: Decision making based on exposure assessment	Task 12: Cross-border exchange of information related to exposure assessment	Other
Mobile scene laboratories for first responders in order to be independent 24/7 from the General State Chemical laboratory and to have quicker identification and decision making.	Need more focus on HazMat incidents	Concerning weather Information and forecast, web platform: Not sufficient spatial cover for capture of wind distribution or wind fluctuations e.g. due to topography effects.
Not clear procedures with massive decontamination. Not best communication (different frequency, devices) between services on-scene (fire services, ambulance, police)	There is a need to develop cross-border plans between neighbour countries and also to use the alert systems more systematically (e.g. RASCHEM)	Develop communication plans in order to face major incidents effectively
More training in peripheral areas outside main cities	In-time communication with the authorities in the other country.	
Better dose-effect relations needed, however difficult to achieve in clinical toxicology	Need National unit and support of national experts - recognise and use to best effect	

11 Appendix 5: Workshop programmes

11.1 Workshop Amsterdam 19th-20th March 2012

Day 1

19th March		
12:00 - 12:30	Registration	
12:30 - 13:20	Lunch	
13:30 - 13:35	Opening and welcome by the Chairperson, Mr. Chris Dijkens, Director of International Enforcement Cooperation, Ministry of Infrastructure and the Environment, the Netherlands	
13:35 - 13:45	Presentation of the CERACI project: Objectives, progress so far and goals of the workshop. Ms. Lisbeth Hall, Project manager, RIVM	
13:45 - 14:00	Introduction to Session 1 and Scenario 1 by session leader, Dr. Sally Hoffer, RIVM. The goals and methodology of the plenary and group sessions will be explained.	
14:00 - 15:45 3 rounds: 5 min. break between rounds	**Session 1**	
	Group A Goal: Elicit and share best practices for monitoring, modelling, and interpretation of exposure data	**Group B** Goal: Elicit and share requirements and best practices for successful information sharing within a country
15:45 - 16:05	Tea/Coffee break	
16:05 - 16:45	Presentation of results of Session 1 by participants	
16:45 - 17:00	Presentation of real course of events of Scenario 1 Keynote speaker: Mr. James Stewart-Evans, HPA	
17:00 - 18:00	Presentation of best practices found in CERACI project by Dr. Sally Hoffer, followed by group discussion led by Mr. Chris Dijkens	
18:00	Closing of workshop	
19.30	Dinner	

Day 2

20th March	
9:00 - 9:05	Welcome and introduction to Day 2 by Mr. Chris Dijkens
9:05 - 9:20	HazMat incidents in EU-region Meuse-Rhine: Intervention and Cooperation. Presentation by Dr. Sven Evertz, GGD Zuid-Limburg, the Netherlands
9:20 - 9:35	Introduction to Session 2 and Scenario 2 by session leader, Dr. Fred Woudenberg, GGD Amsterdam, the Netherlands
9:35 – 11:05	**Session 2** Goal: To identify unmet cross-border preparedness and response needs for exposure assessment during chemical incidents and develop strategies for addressing these needs
11:05 - 11:20	Tea/Coffee break
11:20 - 12:00	Presentation of results of the session by participants
12:00 - 12:15	Presentation of real course of events of Scenario 2 Keynote speaker: Dr. Kevin Manley, HPA
12:15 - 12:45	Do we need an expert network on exposure assessment? Discussion led by Mr. Chris Dijkens
12:45 - 13:00	Final conclusions: Mr. Chris Dijkens
13:00 - 14:00	Lunch

11.2 Workshop Warsaw 2nd-3rd April 2012

Day 1

2nd April		
12:00 - 12:30	Registration	
12:30 - 13:20	Lunch	
13:30 - 13:35	Opening and welcome by the Chairperson, Mr. Chris Dijkens, Director of International Enforcement Cooperation, Ministry of Infrastructure and the Environment, the Netherlands	
13:35 - 13:50	Presentation of the CERACI project: Objectives, progress so far and goals of the workshop. Ms. Lisbeth Hall, Project manager, RIVM	
13:50 - 14:05	Introduction to Session 1 by session leader, Dr. Sally Hoffer, RIVM. The goals and methodology of the plenary and group sessions will be explained.	
14:05 - 15:45 3 rounds: 5 min. break between rounds	**Session 1**	
	Group A Goal: Elicit and share good practices for monitoring, modelling, and interpretation of exposure data	**Group B** Goal: Elicit and share requirements and good practices for successful information sharing within a country
15:45 - 16:15	Tea/Coffee break	
16:15 - 17:30	Presentation of results of Session 1 by delegates followed by a group discussion led by Mr. Chris Dijkens	
17:30 - 17:45	Presentation of real course of events of Scenario 1 Keynote speaker: Dr. Kevin Manley, HPA	
17:45 - 18:30	Do we need an expert network on exposure assessment? Introduction by Dr. Sally Hoffer and discussion led by Mr. Chris Dijkens	
18:30	Closing of workshop	
19:30	Dinner	

Day 2

3rd April	
8:45 - 8:50	Welcome and introduction to Day 2 by Mr. Chris Dijkens
8:50 - 9:05	EU CARPATHEX 2011: a cross-border cooperation project on CBRN incidents. Presentation by Captain Michal Langner, National Headquarters of the State Fire Service, Poland.
9:05 – 9:20	Introduction to Session 2 by session leader, Professor David Russell, HPA.
9:20 – 11:15	**Session 2** Goal: To identify unmet cross-border preparedness and response needs for exposure assessment during chemical incidents and develop strategies for addressing these needs
11:15 - 11:45	Tea/Coffee break
11:45 - 12:15	Presentation of results of the session by delegates, followed by a discussions on unmet needs and how to meet them led by Mr. Chris Dijkens
12:15 - 12:30	Presentation of real course of events of Scenario 2 Keynote speaker: Professor David Russell, HPA
12:30 - 13:00	Final conclusions by Mr. Chris Dijkens
13:00 - 14:00	Lunch

12 Appendix 6: Evaluation form

EVALUATION FORM

CERACI Workshop

19th - 20th March 2012, Amsterdam

Please complete this form at the end of this workshop, so that:

- You can provide feedback on the workshop.
- We can develop and improve this workshop and future events.

Please indicate your views by answering the questions below and ticking the appropriate response to each question or statement

1) What were your expectations for the workshop?

2) Were your expectations met?

Completely □ Well □ Partly □ Not very well □ Not at all □

Comments (Optional)

3) Programme			
Subjects	Very relevant □	Relevant □	Of little relevance □
Content covered	Too much □	About right □	Too little □
Level of content	Too advanced □	About right □	Too elementary □
Length of workshop	Too long □	About right □	Too short □
Comments (Optional)			

Please continue on the other side

Please give your opinion on the following areas by circling the appropriate score, using the rating scale below:
(0 = Poor, 3= Very Good)

6) Quality of preparation, infrastructure, material and equipment

Preparation (e.g. invitation & workshop information)	0	1	2	3
Venue	0	1	2	3
Visual Aids	0	1	2	3
Handouts and documentation	0	1	2	3

Comments (Optional)

7) Overall rating for the event 0 1 2 3

8) Would you recommend this workshop to be repeated? Yes □ No □

9) Recommendations for improvement

10) Other comments on any other aspect of this event

Thank you for taking the time to complete this sheet.

Name ………………………………………………(optional)

13 Appendix 7: Delegate information from expression of interest form

Question		# a)
Expert from	Health protection services	10
	Environmental protection services	12
	Emergency services: fire brigade	11
	Emergency services: ambulance	3
	Emergency services: police	0
	Government: local	1
	Government: regional/provincial	7
	Government: national	10
	Research institutes	10
	Military	0
	Other	0
Function related to exposure assessment	Environmental monitoring	10
	Modelling	5
	Detection and identification	11
	Coordination of exposure assessment	11
	Risk assessment	29
	Risk management	14
	Other	0
Response to chemical	Strategic	11
	Tactical	12
	Operational	19
Organisational level	Local	13
	Regional	20
	National	26
Experience with cross-border	Yes (including exercises)	12
	No	25
Collaboration in preparedness and planning for cross-border incidents	Yes	19
	No	18

a) As an answer was not always given sometimes more than one answer was possible, the total of answers can differ from the number of participating delegates (37).

14 Appendix 8: Network of experts - already existing networks

In Chapter 4 we have described in total 3 purposes for an expert network. We will cover these purposes by considering two topics:

- preparedness
- response

For these two topics we will identify relevant networks and the link with exposure assessment.

14.1 Preparedness: improving the quality of work

The primary purpose of this international expert network is to improve the quality of work through improved access to information in order to create, capture, store, retrieve, use and share knowledge for the purpose of learning or to drive research and development or policy. These are prerequisites for an effective response to chemical incidents. Possible objectives of the network which would lead to improving the quality of work are:

- To harmonise procedures, doctrines, emergency management plans to improve response capabilities and capacities to respond to chemical health threats.
- To promote good practices to improve response capabilities and capacities to respond to chemical health threats.
- To promote discussion to improve response capabilities and capacities to respond to chemical health threats.
- To offer information, guidance, and other forms of resources to improve response capabilities and capacities to respond to chemical health threats.
- To map experts and organisations from Europe and other regions active in the field of exposure assessment.
- To disseminate information on the activities of the network and other data of interest in the field of exposure assessment (publications, events, news).
- To provide clear, concrete and constructive guidance and advice to policymakers on topics relevant to the development of policies regarding exposure assessment during chemical incidents, by responding to ad-hoc questions formulated by the policy makers.
- To enhance the policy makers' knowledge-base on specific subjects and support the preparation of important initiatives and policy cooperation activities, by preparing short analytical reports or longer studies on the basis of demands presented.
- To maintain permanent communication between scientific experts in exposure assessment with policy makers.

14.2 Mapping existing networks

14.2.1 Professional organisations

By this we mean organisations which represent the interest of the professional practitioners. It is in this context a non-profit organisation seeking to further a particular profession, the interests of individuals engaged in that profession, and the public interest.

European Network of the Heads of Environment Protection Agencies - EPA Network[36]

The EPA Network is an informal grouping bringing together the heads and directors of environment protection agencies and similar bodies across Europe. It is supported by the European Environment Agency. The network exchanges views and experiences on issues of common interest to organisations involved in the practical day-to-day implementation of environmental policy.

Acute chemical incident response and exposure assessment is not an explicit focus of this network but member organisations are likely to have roles in incident response and exposure assessment.

The International Association of National Public Health Institutes - IANPHI[37]

IANPHI is a global initiative that aims to develop stronger and more coordinated public health systems through the development and support of national public health institutes – or NPHIs.

Acute chemical incident response and exposure assessment is not an explicit focus of this association but its EU member organisations are likely to have roles in incident response and exposure assessment.

International Technical Committee for the Prevention and Extinction of Fire - CTIF[38]

CTIF was founded for encouraging and promoting co-operation among fire fighters and other experts in fire and rescue throughout the world. CTIF is the international fire and rescue competency and information network. Its European branch has the task to develop a better understanding of fire matters across Europe, improve professional fire networks, establish a relationship with the European Commission and represent the views of CTIF, raise issues of strategy and policy related to Europe, gather better data on fires.

The commission's member countries are Austria, Belgium, Bulgaria, Denmark, France, Finland, Germany, Hungary, Italy, Spain, Sweden, United Kingdom, Ireland, and Luxembourg. These countries participate in meetings on a voluntary basis and can get support from their CTIF National Committee to cover travel and accommodation expenses.

CTIF also has a HazMat commission and acute chemical incident response has an explicit focus. Its function is hazard identification.

[36] The EPA Network: http://epanet.ew.eea.europa.eu/

[37] http://www.ianphi.org/

[38] http://www.ctif.org/

The European Association of Poisons Centres and Clinical Toxicologists - EAPCCT[39]

The European Association of Poisons Centres and Clinical Toxicologists (EAPCCT) was founded with the specific goal of advancing knowledge and understanding of the diagnosis and treatment of all forms of poisoning. The EAPCCT has 272 members from 56 countries in all continents. This association organises annual international congresses.

Many poisons centres participate in chemical incident preparedness and response activities at local and national level. Moreover, the European Commission (DG SANCO) is working with poisons centres to establish a surveillance system on chemical intoxications[40].

The Network of European Meteorological Services, Economic Interest Group - EUMETNET EIG[41]

This network comprises 26 European national meteorological services with the aim to become more efficient in delivering meteorological services in Europe by sharing costs and knowledge and by pooling resources. EUMETNET EIG derives the vast majority of its funding from the contributions and the subscription fees of its Members. The EUMETNET EIG network itself provides expertise in the field of meteorology (informing dispersion modelling).

EUMETNET EIG project stakeholders include contacts from organisations that contribute to modelling during acute incidents, but this is not its primary focus.

The Civil Military Emergency Preparedness Council – CMEPC SEE

The objective of the Council is to act as a consulting and coordinating body for regional cooperation in disaster management. The Council advocates for the development of common standards and procedures to be used by all the nations of the SEE region for planning and response to regional disasters and emergencies (Albania, Bosnia and Herzegovina, Bulgaria, Croatia, Macedonia, Slovenia, Romania and Turkey). Focusing on transboundary cooperation, the Council has drafted an agreement for facilitating border crossing procedures during emergency. The Council envisages developing and maintaining emergency, response and GIS databases for the region. The Council aims to open emergency operating centres in all the member countries, and to develop an emergency information network.

Advisory Group on Environmental Emergencies - AGEE[42]

The UN has established the AGEE. The AGEE is an international forum that brings together environmental experts from around the world to share information, expertise

[39] http://www.eapcct.org/

[40] Schaper A., *et al* (2012) Countering health threats by chemicals with a potential terrorist background — creating a rapid alert system for Europe. European Journal of Internal Medicine *European Journal of Internal Medicine* (23):63-66

[41] http://www.eumetnet.eu/

[42] http://ochaonline.un.org/ToolsServices/EmergencyRelief/EnvironmentalEmergenciesandtheJEU/AGEE/AGEE/tabid/1474/language/en-US/Default.aspx

and lessons learned for improved response to environmental emergencies worldwide, and in particular in developing countries. The environmental emergencies also include chemical incidents. The Joint UNEP/OCHA Environment Unit serves as the secretariat to this group.

The Advisory Group meets once every two years to share experiences and new approaches in the field of response to environmental disasters, as well as to review the work of the Joint Unit, and to provide advice and guidance on areas for development and future activities.

14.2.2 Projects with project based networks

The Public Health Response to Chemical Incident Emergencies Toolkit - CIE TOOLKIT[43]

The project ran from March 2008 – March 2011 but continues its administration up to today. The project developed guidance and training material for public health officials to facilitate rapid and effective responses to acute chemical incidents or emergencies. The project has developed a network of experts, consisting of a variety of public health experts with specialist knowledge of chemical incident emergency planning, preparedness, response and recovery.

Chemicals and Radiation Risk Assessment Network - CARRA-NET

The project ran from Oct 2010 - Oct 2011. The purpose of the CARRA-NET service contract is to facilitate effective mutual sharing of information among EU Member States notably risk assessors and risk managers, in respect of the impact on public health caused by acute events (incidents) caused by chemical or radio nuclear agents. The main objective is to consolidate risk assessment networks for toxic industrial chemicals and radioactive threats and risks.

Health and Environment Networking Portal - HENVINET[44]

The HENVINET is a networking portal designed for the global Environment and Health community. It is a product of the EU funded HENVINET project. It provides a networking forum and access to experts. There is no specific exposure assessment group within HENVINET itself, however, by registering for the forum CERACI would be able to create an 'exposure assessment' group on the portal in order to raise awareness of project aims, add to its network of experts, and canvass for opinions as to the future of the network. However, past entries are from 2009-10 and the portal appears not to be widely used.

14.2.3 Projects with links to exposure assessment and specific networks

A lot of these networks are listed in the results of Task B. The following project was brought to our attention during Task D.

Standardisation of laboratory analytical methods - SLAM[45]

[43] http://cietoolkit.fs-server.com/

[44] http://www.henvinet.eu/

The objectives of the SLAM project are to review the needs for standardisation of CBRN sample analysis and to suggest a road map for its implementation by national reference laboratories. The partners to the SLAM consortium are significant players in on-going dialogues on CBRN analytical requirements and procedures on the European scene and link to the relevant existing laboratory networks. This project will run from April 2012 until April 2014 and has just started.

14.3 Response, assistance in the hour of need

United Nations Disaster Assessment and Coordination - UNDAC[46]

OCHA plays a role in identifying, monitoring and providing technical and policy support both before and after a crisis. A main component of OCHA's work involves effectively responding to environmental emergencies. The Joint UNEP/OCHA Environment Unit is a partnership between the United Nations Environment Programme (UNEP) and serves as the integrated United Nations emergency response mechanism to activate and provide international assistance to countries facing environmental emergencies. The role of the Joint Unit is to rapidly mobilise and coordinate emergency assistance and response resources to countries facing environmental emergencies and natural disasters with significant environmental impacts.

Working with the United Nations Environment Programme, the Advisory Group on Environmental Emergencies, National Focal Points, other United Nations agencies and programmes, OCHA develops policies, guidelines and tools for environmental emergency response. Through its extensive network of contacts, OCHA also maintains a roster of environmental experts which it trains to work as an integral part of United Nations Disaster Assessment Coordination and other international response and preparedness missions. It currently has a roadmap for a regional approach to improving cooperation and a more robust and sustainable network. This proposes worldwide coordination by the UN and formal regional networks of nations. A 2011 paper proposes a study to identify areas to improve linkages between environmental emergency response and contingency planning and preparedness and the OCHA's current work plan includes an action to expand its resource network. OCHA is developing an Environmental Emergency Centre, implementing this over the next three years.

The OCHA network itself provides expertise in the field of public health risk assessment and includes experts in sampling and analysis[47]

EU DG ECHO MIC - The Monitoring and Information Centre (MIC)[48]

The MIC's work at EU level is similar to that of the Joint UNEP/OCHA Environment Unit, to which MIC has pre-existing links. During emergencies the MIC acts as a focal point for

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45 http://cordis.europa.eu/search/index.cfm?fuseaction=proj.document&PJ_LANG=EN&PJ_RCN=12809929&pid=33&q=FD8A9BBC079BD5FCECD584ADBD3CE6A7&type=adv

46 http://www.unocha.org/what-we-do/coordination-tools/undac/overview

47 http://ochanet.unocha.org/p/Documents/Emergency%20Response%20Services%20Info%20Sheet.pdf

48 http://ec.europa.eu/echo/policies/disaster_response/mic_en.htm

the exchange of requests and offers of assistance. As soon as the MIC receives a request for assistance, the Centre immediately forwards it to its 24-hour network of national contact points.

The MIC network itself provides expertise in the field of public health risk assessment and includes experts in sampling and analysis.

WHO environmental health and emergency team[49]

Through the International Programme on Chemical Safety (IPCS), WHO maintains functions to rapidly detect, verify/assess, alert and respond to chemical events of international public health concern as part of the revised International Health Regulations.

WHO draws upon a network of agencies and experts to support its efforts in assisting countries to prepare for and respond to the environmental health aspects of emergencies.

[49] http://www.who.int/environmental_health_emergencies/about_us/en/index.html

15 Appendix 9: Success factors for exposure assessment.

The table below gives an overview of the main success factors for exposure assessment gathered during the Task B literature review and the Task D workshops

Success factors for exposure assessment:

Preparedness: Arrangements, emergency plans, exercises and information exchange

Task B Literature review	***Task D Workshops***
- Seveso and site specific plans are available which have been developed with consideration of public health needs and response - Strategy which defines which is or are the lead organisation(s) for provision of health advice and should receive relevant data for e.g. risk assessment - Arrangements are in place with neighbour MS for cross-boundary interoperability - Aware of response systems in neighbouring countries - Understanding of neighbouring countries risk assessment procedures	- Know one's counterparts in order to be aware of differences in expertise, activities and approach and to align these where appropriate. - Ensure a clearly specified scope of each institution's responsibilities and share this with neighbouring countries. - Mutual education. - Joint training and exercising with neighbouring countries at different command and control levels and different geographical levels. - Target joint training and exercising at functions with people working with/meeting counterparts irrespective of their organisations. - Detection, alerting, and notification is prepared and exercised to take place in the 'golden hour'. - Train ad hoc liaison officers to facilitate translation. - Train researchers in communication skills to influence decision makers and communicate directly with the public. - Common and repeated trainings to mitigate language barriers and to be familiar with neighbours' capacities (e.g. different equipment). - Ensure public health representation in interagency training and exercises even if there is no legal requirement. - Turn existing exercises into cross-border exercises – this may be easier with table-top workshops rather than live exercises. - Develop and share Emergency Response plans /Preparedness plans with neighbouring countries for sites which might impact across borders.

	- Ensure Emergency Response plans are transparent, short and simple and well exercised. - Include a standard section in Seveso plans for public health potential impacts, response and coordination. - Apply Seveso requirements for plans and exercises to relevant non-Seveso sites in border regions. - Compile multi-language FAQ and media statements for Seveso sites scenarios which can have cross-border impacts. - Inter-agency agreements on cooperation and information sharing. These can be legally binding or written into plans. - Compile a European risk profile map with a focus on regions with a high risk of chemical incidents with serious cross-border health effects. - Describe exposure assessment in emergency plans for Seveso plants and include the basic premises for decision making on both sides of the border. - Ensure preparedness messages are in all relevant languages and issue jointly in cross-border regions. - Harmonised approach to communication on both sides of a border through multi-agency messages. - Services during out of office hours and weekends, including a 24/7 information exchange capability. - An integrated chain of communication agreed upon and tested in advance at the saturation of a crisis. - Pre-prepared multi-language FAQ and media statements for Seveso sites scenarios which can have cross-border impacts. - Share lists of industrial sites/areas in border regions.

Response: Information Exchange

Task B Literature review	***Task D Workshop***
- Reports from the scene (situation, hazard identification) - Health effects reports (situation)	- Immediate and sustained information exchange during acute phase between fire department, environmental agencies and public health services.

- Public health effects are communicated clearly to incident commanders and integrated in public health actions - Risk assessors are readily able to communicate with colleagues across borders - Restrictions of information sharing is understood - Ability to access translation services during cross border incidents	- Availability of expert advice and support in the first hour. - Common procedures for informing neighbours (in different languages) (what has happened; chemical; measurements taken etc.). - Exchange information on health complaints. - Regional cross-border network for sharing information. - Information sharing with neighbouring non-EU countries. - Both national focal point and local contact to generate agreed and consistent messages. - An agreed approach to communication and decision making when findings on relevant aspects are contradictory. - Be pro-active, transparent and preferably use one channel and the same message(s) when communicating with the media. - Visualisation of information (e.g. Google Earth overlays as a means of using a mapping tool for which borders are not a barrier to ready usage / familiarisation).

Dispersion Modelling

Task B Literature review	***Task D Workshop***
- Strategy which defines who undertakes modelling, what resources are available, how long it will take before data is provided, what are the local restrictions - For air it is understood where the plume is going, how much dilution is taking place, models/source term can be scaled using monitoring data and health effect reports, time course of the plume transport, plume density and topographical features, model output with contours for exposure reference levels - Dispersion models cross-border have equivalent capability and assumptions	- Use monitoring results to verify dispersion models. - Reach agreement with neighbouring countries on modelling strategies aiming at interoperability of outputs, models and results.

Monitoring

Task B Literature review	***Task D Workshop***
- Strategy which defines who undertakes monitoring, what resources are available, how long it will take before data is provided, what are the local restrictions - Monitoring strategy to define where various monitoring activities will take place and for what primary reasons is monitoring undertaken - Mobile resources are readily available and able to cross borders - Monitoring data to be obtained at the scene in the acute phase - Monitoring data obtained by fixed air or water quality sites - Monitoring data available from sensitive receptor sites - Continuous monitoring data is available - Field laboratory are available and able to cross borders - Time between each consecutive analysis is as short as possible	- Account for differences in short and long-term impacts. - Emergency plans should specify a monitoring approach and the basis for decisions on monitoring in both countries. - Reach agreement with neighbouring countries on monitoring strategies aiming at interoperability of outputs and results.

Geographical Information Systems

Task B Literature review	***Task D Workshop***
- Dispersion modelling outputs can be readily overlaid - Sensitive receptors and populations are mapped - GIS capability / outputs are similar cross border - GIS has the capability to show receptors in neighbouring countries	- Compile a European map of cross-border regions with risky plants that have potential cross-border impacts.