Exchange of Experts on Green Vehicles
IFV, Arnhem
6- 8 May 2019

Short Report

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Content

Preface

Arnhem, 7 June 2019

Worldwide, and in particular in Europe[1], a great energy transition is currently going on in the field of transportation: from vehicles, including heavy goods vehicles, fuelled by fossil fuels to vehicles fuelled by alternative fuels such as hydrogen, electricity (battery packs) and liquefied natural gas (green vehicles). Green cars are also gaining market share at an unbelievable speed.
We expect that, at least in first instance, the number of accidents will also grow simultaneously. However, the way in which such accidents need to be dealt with is far from well-developed and optimised. We suspected that the individual countries had started developing tactics and techniques for the response to such new type of accidents, and that they had also started developing knowledge and doing experiments by themselves.

In the Netherlands, we had started to bring together all the available knowledge from the various industries, and internationally, to find ways of coping with these new kinds of incidents. But in doing this, there is always the question: maybe this is already known in other European countries?

It was for this reason that we decided to organise an Exchange of Experts to find out what knowledge is already available, and also to share the available knowledge. We are very satisfied by the results of this exchange. We learnt that, although both the pace and the direction of the energy transition differed in the participating countries, we were still able to exchange a lot of documentation and knowledge**.** Judging by the positive reactions from all participants, the meeting was a big success. In addition to the exchange of knowledge, we have also created a network of people working on this subject that will continue to exist and which will make the easy sharing of knowledge possible in the future.

We want to thank you, the participants, for your active interaction, your presence and input. It was a pleasure to meet you and your enthusiasm made this exchange a great success!

Ricardo Weewer
Nils Rosmuller

[1] In the summer of 2017, France and the UK announced that, starting from 2040, it will be forbidden to sell fossil fuelled cars, including hybrids. The Netherlands intends to ban them from the year 2035. In addition, the Netherlands intends to have one million electric cars in the year 2020 (out of a total amount of 8.2 million). The German government is aiming at 2030. Meanwhile, many cities themselves have already forbidden diesel cars in their city centres today. Liquified natural gas (LNG) is increasing its market share of heavy goods transportation for road and inland navigation. However, not every European country is that far in their transportation policy and Europe is an open market. There is nothing to stop green cars and lorries driving anywhere in Europe and becoming involved in an accident.

1 Objectives

Exchanges of Experts, funded by the EU, are an important means for answering experts' need of sharing practical and scientific knowledge at an international (European) level and on actual topics. This specific exchange had three objectives:

1. Sharing the expertise of experts in European member states regarding the incident management of 'green vehicles' (hydrogen, electric and Liquefied Natural Gas), based on a risk assessment.
2. Attempting to harmonise incident management guidelines among countries.
3. Identifying knowledge gaps and formulating research questions for future research in order to improve incident management.

We anticipated the following results:

1. Participants would share and exchange experiences in incident management regarding green vehicles.
2. Participants would gain insights into the knowledge gaps in their incident management procedures for 'green cars'.
3. Participants would gain insights into each other's research programmes.
4. Participants could find ways of collaborating in developing incident management tactics, procedures, and training.
5. Member states could make proposals for collaboration in developing research programmes.

A total of 17 experts participated in this Exchange, representing 9 Member states. A list of participants is presented in Chapter 4.

2 Results

During the programme, some of the participants who had specific knowledge gave an overview of the state of the art of a certain subject in their organisation. There was also a presentation by Peter Hendriks from Rolande, a company that is very involved with LNG and has a lot of knowledge about this subject.

In advance, the specific fields of knowledge were inventoried, as well as the specific needs, so that we could specifically make an effort to go into these subjects in order to gain optimum results.

It turned out that the participants were especially interested in the following three questions:

a) is there legislation in participating member states about the safety of specific new fuels or vehicles?
b) are there procedures to prevent incidents (risk mitigation) with the specific fuel?
c) are there procedures for the response to incidents with the specific fuel?

In addition to the network we created, and the exchange of knowledge and the situations in the different countries, we achieved the following results:

1. During the exchange, we composed **a table for H2, CNG, LNG and electric vehicles** based on all the knowledge we could collect on the three questions above. The tables we composed are presented in Chapter 8.
2. We made a first step in the development of a **decision scheme** which can be used for incidents involving electric vehicles (lithium-ion batteries). This is presented in Chapter 8.4.
3. Furthermore, we exchanged a lot of **literature**. This literature list is presented in Chapter 6.
4. We also composed a list of **knowledge gaps** where we think more research is needed. This list is presented in Chapter 7.

3 Programme

3.1 General

The two and a half-day Exchange of Experts took place in Arnhem, in the Netherlands, and was organised by the Institute for Safety (IFV) from May 6th until May 8th, 2019. In preparation for the Exchange, all experts were asked to provide specific input for the programme. These topics were discussed during the different sessions.

The exchange was divided into four major topics, and every topic had one session:

A. LNG
B. Tunnels
C. Electric vehicles
D. CNG and H2.

Every session started with a keynote address by a guest or one of the participants. The topic continued with the discussion and filling out the table for available knowledge and guidelines regarding that specific topic per member state as much as possible. In the table, we answered the question regarding what is known in the participating member states about:

a) legislation
b) risk mitigation
c) incident management

3.2 Detailed programme

Programme - Monday

12.00 Lunch
13.00 Welcome by Ricardo Weewer
13.20 Keynote developments in transportation by Nils Rosmuller
14.00 Introductions
16.00 Break and snack
16.30 Discussion about knowledge positions in the participating countries
17.15 Wrap-up
17.30 Transfer to hotel
18.00 Dinner and networking.

Programme - Tuesday

9.00 Opening
9.15 Opening keynote about LNG by Peter Hendriks (Rolande)
10.15 Break
10.45 Discussion about LNG
12.00 Lunch
13.00 Opening discussion about electric vehicles
14.00 Film
14.30 Discussion about electric vehicles
16.00 Opening keynote about tunnels by Lotta Vylund
16:15 Keynote by Ron Bey about tunnel safety
16.30 Wrap-up
17.30 Transfer to hotel
18.00 Dinner and networking.

Programme - Wednesday

9.00 Opening
9.15 Opening keynote about CNG and H2 by Lotta Vylund
9.45 Break
10.15 Presentation about international survey energy transition and safety by Nils Rosmuller
10.45 Break
11.00 Discussion about CNG and H2
11.30 Wrap-up / closing
12.00 Lunch
12.45 Excursion to Elaad
16.00 Transfer to Arnhem railway station.

4 Report

4.1 Monday 6 May 2019

After arrival at the Institute of Safety (IFV), participants were welcomed by Ricardo Weewer, professor of Fire Service Science, at the Netherlands Fire Service Academy.

4.1.1 Session 1 Keynote by Nils Rosmuller

After the welcome, Nils Rosmuller started the exchange with a keynote on the present situation in the Netherlands. He explained the main objective of organising this exchange (Chapters 1 and 2). The Netherlands is presently aware of the consequences of the energy transition for safety and has noticed that the energy transition is proceeding at a fast pace, but that safety is not on the agenda of policy makers yet. Therefore, the Institute for Safety (IFV) and its professors are collaborating to put safety on the political agenda. They are also collecting the existing knowledge on all elements of the energy transition, and also checking their existing knowledge internationally.

4.1.2 Session 2 Introductions and situation in participating countries

Göran Valentin (Norges Brannskole DSB)
Göran is an instructor at the Norwegian Fire Academy. He is an expert on electric vehicles. He stated that about 50% of the cars that are sold in Norway nowadays are electric, 10-20% are hybrid. Most of the time they are used as second cars for families. The vehicle are charged at home. There are many fires involving the electrical system in the home in Norway.

Tomas Serauskas (Firefighter training school, Lithuania)
Tomas stated that the energy transition is rather new for Lithuania, and that there are not many electric cars yet. For him it is interesting to anticipate the coming events.

Dale Mason (Suffolk FRS on behalf of the NFCC UK)
Dale is an instructor at the Suffolk FRS. He is specialised in transport incidents. He was sent as a representative of the NFCC (National Fire Chiefs Counsel) in the UK in order to exchange knowledge for the UK. In the UK, about 7% = 50,000 of the vehicle population is

“green”. The energy transition is just starting in the UK and so the translation of knowledge into practice is of the utmost importance.

Adrian Bralewski (Main Fire Service School, Poland)
Adrian is an officer at the national fire service school. He was doing research on public safety and working on his PhD (which he has gained in the meantime). In Poland, at the moment, about 4% of vehicles are electric, and LNG is now entering the country. He is therefore predominantly interested in LNG risk prevention and incident management. He is writing a plan for this now. The energy transition is rapidly entering Poland.

Ralph Simon (Berlin Fire and Rescue Academy)
Ralph is an instructor at the Fire Academy of Berlin. The most important questions puzzling him are “how do we know the situation is safe after an accident regarding electrical hazards, how can we measure the temperature of batteries, and how can we safely tow an electric vehicle that has been on fire or involved in a crash?” In Germany there are about 200,000 electric cars and this number is increasing rapidly.

Jens Klink (Berlin Fire and Rescue Academy, and senior officer in Berlin FRS)
Jens is a member of the working group of the VDA (= a working group of FRS and car manufacturers together). This group has developed a procedure for dealing with electric vehicles. Jens is also a senior officer at the Berlin FRS and in charge of the acquisition of electric fire trucks. In Berlin there are about 100 fuel stations and 4 fuel stations in particular for hydrogen. LNG is a known problem and they have the knowledge to deal with that.

Valentin Göran (Swedish Civil Contingencies Agency, MSB)
Valentin works for MSB and is a firefighter, specialized in extrication. In Sweden there are about 400 CNG and LPG fuel stations and 23 hydrogen stations. There is a lot of knowledge about CNG and electric vehicles. He wants to learn more about firefighting regarding electric vehicles and LNG.

Lotta Vylund (RISE Sweden)
Lotta is a researcher at RISE. RISE carries out many research project regarding electric vehicles, CNG and tunnels. She wants to learn more about tunnels, parking garages and roll-on-roll-off ships. She can share what she knows about batteries and CNG.

Yvonna Nasman (MSB, Sweden)
Yvonne has held a variety of positions at the Swedish Rescue Services Agency and the Swedish Civil Contingencies Agency (MSB) since 2000. She was Head of Education and Development Section 2005-2014. Since 2015, Yvonne has been working to develop new methods at the Emergency Management Development Department at MSB. She is also the Swedish research and development committee representative at the International Forum for Advance First Responder Innovation (IFAFRI). Yvonne works as a project manager for multiple issues, one example is the “Trippel Helix” project “The rescue chain” (a project dealing with crashes and fires in electric vehicles).

Ando Vainjarv (Estonian Academy of Security Sciences)
Ando is an instructor at the Estonia Rescue school. In Estonia, the energy transition has just started and there is not much knowledge yet. He therefore wants to learn everything that is currently known about new energy sources, especially electric vehicles.

Marco van den Berg (Rotterdam-Riijnmond FRS, NL)
Marco developed the LNG procedure for the Dutch FRS.

Rob Terpstra (VRBZO, NL)
Rob works for the Fire Safety Region (FSR) Eindhoven, collaborating with the automotive Campus of Eindhoven University. His main concern is how to make knowledge practically available for the firefighters in the street.

Paul van Dooren (VRBZO, NL)
Paul also works for the FSR of Eindhoven and the surrounding area, mainly at a national level. He connects knowledge institutes and companies/manufacturers together to share knowledge and involve the FRS in the proactive phase.

4.2 Tuesday 7 May 2019

4.2.1 Session 3 LNG

This session started with a presentation by **Peter Hendrickx** of Rolande, LNG consultant, part of IVECO. The major Dutch supermarket chain Albert Heijn has started using LNG trucks for city centres in order to minimise emissions. Natural gas has no additives and retains the same quality throughout its lifetime. CNG gave too limited a range. By cooling methane to minus 165 degrees Celsius, it shrinks by a factor of 600. For that, all the trucks had to be converted, and the fuel stations and logistics also needed to be adjusted. You also need regulations and training for the fire brigade. This happened 10 years ago in the Netherlands.
Nowadays, Rolande operates 13 LNG fuel stations and a network with trucks to supply the fuel stations. Rolande is now expanding into Belgium and Germany. There are also 6 LNG fuel stations in Poland. Sweden goes for bio LNG and, according to Peter, that is also the ultimate goal for the Netherlands. BioLNG comes from the UK and has an even larger CO2 reduction than LNG.

LNG can only be kept for 4-5 days. As the temperature increases, so does the pressure and then the excess pressure is blown off via a pressure release valve. Drivers had to be trained by Rolande.
Advice: if there is a leak, it will blow off gas (boil-off gas (BOG) and then it is best to evacuate and keep sources of ignition out of the area. The tank will boil cold and the emission will stop. If a truck is parked somewhere and something is wrong, the procedure is to check the pressure gauge to see what the pressure is. If the pressure goes towards 16 bar, it might be already starting to leak. Always bring an explosion sensor.

The participants discussed the various issues regarding LNG together, exchanged literature, and filled in the table together. The table is presented in Chapter 8.

4.2.2 Session 4 Electric vehicles

The keynote lecture was presented by **Adrian Bralewski** from Poland. He presented the Polish procedures for dealing with electric cars (Li-on), but also posed a few questions. The knowledge gaps presented by Adrian were recognised by the other participants, and led to a discussion. The major questions were about the dangers of high voltage and electrocution. Can a firefighter be electrocuted when touching a car when the battery is damaged? How to extinguish an electric vehicle on fire?
After the keynote, the participants discussed the theme, exchanged experiences and knowledge, and filled in the table for electric cars. The literature that was exchanged is in Chapter 6, the knowledge gaps in Chapter 7, and the table in Chapter 8. A proposal was made for a decision scheme for electric vehicles. It is presented in Chapter 7.

4.2.3 Session 5 Keynote by Lotta Vylund about tunnels

Lotta Vylund started this session with a keynote about CNG buses and tunnels. RISE has a special research facility for tunnel fires, and also does a lot of research into this subject. The reports were exchanged. Sweden has also experienced a few accidents with CNG buses, and footage of these accidents is available via youtube. These accidents were evaluated during the presentation. RISE has already done a lot of research into tunnel safety, for example Ying Zhen Li, about explosion hazards. When hydrogen vehicles are involved, explosions are likely. At the moment, RISE is studying solutions for ferries, carrying electric and CNG and hydrogen vehicles.
According to the research, internal barriers in battery packs, ventilation systems in tunnels and parking garages, and sprinklers in parking garages are considered viable solutions that could be applied to improve safety.

Valentin Goran presented a few accidents with CNG buses. In the Netherlands, we have also had some of them. The most important issue to be solved seems to be the direction of the torch escaping from the overpressure relief device. There are no regulations for that at the moment.

4.3 Wednesday 8 May 2019

4.3.1 Session 6 CNG and H2

Ron Bey (guest speaker from Amsterdam FRS and also a member of the Tunnel platform in the Netherlands) started this session with a presentation about hydrogen and CNG buses. According to Ron, there is still a lack of knowledge regarding the risks of modern/green vehicles in tunnels. As an example, he mentioned the Temperature Pressure Release Valve of hydrogen tanks which opens at about 110 degrees Celsius. This temperature can easily be reached because of other vehicle fires in tunnels. What would the consequences be and is there a solution possible? Here there are still a lot of issues to be solved.

Lotta Vylund started this session with a keynote about hydrogen and CNG. She pointed out the research planned at RISE on this theme and presented a list of knowledge gaps. The participants recognised the themes on the list and supported the idea of more research. The list of knowledge gaps is presented in Chapter 7.

Participants filled in the table about hydrogen and CNG together, shared experiences, and knowledge.

4.3.2 Session 7 Knowledge gaps

The exchange of experts ended with a wrap-up by Ricardo Weewer. We concluded that there is a lot of knowledge available. Together we agreed that the tables, the literature, and the decision scheme were of great value and that it is important to share this knowledge. At the same time, we now know that there are also some knowledge gaps, and that it is important to collaborate to fill these gaps and urge for more research. At least we now know that these are real knowledge gaps. The network that was created during the exchange will continue and we will keep each other informed about any future developments.

4.3.3 Session 8 Excursion to Elaad

To close the session, participants took part in an excursion to Elaad. Elaad is a company that manages the charging spots all over the Netherlands for charging electric vehicles. Participants were informed about the safety measures and safety issues concerning this process.

5 List of Participants

Country	Participant	Email
Exchange of Experts		
Sweden RISE	Lotta Vylund	Lotta.vylund@ri.se
Sweden MSB	Goran Valentin	Goran.valentin@msb.se
Sweden MSB	Yvonne Nasman	Yvonne.nasman@msb.se
Finland	Vesa Kujanpää	Vesa.kujanpaa@pelastusopisto.fi
Germany	Jens Klink	Jens.klink@berliner-feurwehr.de
Germany	Ralf Gerd Simon	Ralf.simon@berliner-feuerwehr.de
Lithouania	Tomas Serauskas	Tomas.serauskas@vpgt.lt
Poland	Adrian Bralewski	abralewski@sgsp.eu.pl
United Kingdom	Dale Mason	Dale.mason@suffolk.gov.uk
Norway	Goran Valentin	goranl@live.no
Estonia	Ando Vainjarv	Ando.vainjarv@sisekaitse.ee
Participants from the Netherlands		
(Host)	Ricardo Weewer	ricardo.weewer@ifv.nl
(Host)	Nils Rosmuller	Nils.rosmuller@ifv.nl
	Sander Lepelaar	Sander.lepelaar@vrh.nl
	Marco van den Berg	Marco.vandenberg@vr-rr.nl
	Paul van Dooren	Paulvandooren@vrbzo.nl
	Rob Terpstra	robterpstra@vrbzo.nl

6 List of shared literature

During the exchange, a lot of literature was exchanged between the participants. This chapter provides the links to the various literature that was presented.

Germany, Ralf and Jens

https://publikationen.dguv.de/dguv/pdf/10002/i-8664.pdf

Batteries

https://www.vda.de/en/topics/safety-and-standards/rescue/rescue-recovery-vehicles-with-high-voltage-systems

Hydrogen

https://www.bmvi.de/SharedDocs/DE/Anlage/VerkehrUndMobilitaet/Gefahrgut/wasserstoff-und-dessen-gefahren-ein-leitfaden-fuer-feuerwehren.pdf?__blob=publicationFile

RISE

Electric vehicles

https://www.msb.se/sv/Insats--beredskap/Brand--raddning/Trafikolycka/Raddning-e-fordon/Kunskapsoversikt-/

LNG

https://www.transportstyrelsen.se/globalassets/global/publikationer/sjofart/nationella-riktlinjer-for-bunkring-av-flytande-metan.pdf

https://www.msb.se/externdata/rs/7331cf43-3b39-4fef-b235-b6c355a6a84a.pdf

https://www.msb.se/sv/Om-MSB/Lag-och-ratt/Gallande-regler/Brandfarliga-och-explosiva-varor/SRVFS-20047/

https://www.msb.se/sv/Om-MSB/Lag-och-ratt/Gallande-regler/Brandfarliga-och-explosiva-varor/MSBFS-20133/

Hydrogen in parking lots

https://risefr.no/media/publikasjoner/upload/2018/a18-p20319-01-hydrogenkjoretoy-i-parkeringskjellere.pdf

UK – Dale Mason

http://appsportal.suffire.suffolk-fire.gov.uk/_layouts/15/WopiFrame.aspx?sourcedoc=/Published%20SOPS/Miscellaneous/OPSP-4-800.docx&action=default&DefaultItemOpen=1

http://appsportal.suffire.suffolk-fire.gov.uk/department/OpsPolicyandEquipment/_layouts/15/WopiFrame.aspx?sourcedoc=/department/OpsPolicyandEquipment/OGG/Monthly%20OGG%20Folder/14%20FEBRUARY%202016/Hybrid%20Vehicles/MAHIS19%20Hybrid%20or%20Electric%20Vehicles%20-%201%20AHIS%20(word).doc&action=default

http://appsportal.suffire.suffolk-fire.gov.uk/department/OpsPolicyandEquipment/_layouts/15/WopiFrame.aspx?sourcedoc=/department/OpsPolicyandEquipment/OGG/Monthly%20OGG%20Folder/14%20FEBRUARY%202016/Hybrid%20Vehicles/MAHIS19%20Hybrid%20or%20Electric%20Vehicles%20-%202%20Risk%20Assessment.pdf&action=default

https://www.ukfrs.com/guidance/search?keyword=hybrid%20vehicles

MSB

https://www.msb.se/sv/Insats--beredskap/Brand--raddning/Trafikolycka/Raddning-e-fordon/Kunskapsoversikt-/

7 Identified knowledge gaps

Batteries and battery systems, energy storage systems:

> Batteries need to be studied from a holistic perspective in terms of risks (heat, fire, toxic gases, gas explosion), including types of faults, battery size and type, application and surrounding environment. In order to do this, there must be methods to assess the in-depth risks for different types of batteries.
> Knowledge about how to safely and effectively extinguish the different types of batteries and how the installation can facilitate extinguishing fires?
> Knowledge of the risks and guidelines for how battery storage in homes should be installed and designed. This may include special requirements for installers.
> Knowledge about how safety and risks change as batteries age.
> Methods for determining State of Health (SOH) and then the correlation between SOH and risks.
> Emissions of various toxic gases remain interesting to study, e.g. hydrogen fluoride (HF)
> Can we use water mist to “clean” toxic gases? Can water mist increase the production of HF?
> More testing on how well firefighters’ clothing can resist toxic gases.
> Concentration of HF in different locations than the fire itself.
> Can we use a fognail?
> After a crash – is there a risk of being electrocuted?

Gas:

> Characterisation of jet flames, both in terms of the extent and heat load in the form of temperature and radiation.
> Analysis of which safety valves are optimal (heat sensitive or pressure sensitive).
> Create a basis for standardising the security system, e.g. regarding the exhaust from the safety valve system.
> Analysis of existing standards and test methods to evaluate how representative they are for real cases and different risks.
> The behaviour of hydrogen gas needs to be characterized in connection with various fire sources, both in the form of gas tanks and in the form of free gas.

General:

> How much knowledge do firefighters need to know and how can all the knowledge be translated into standard operational procedures?
> How dangerous is the situation after a fire?
> Safe distances?
> Safety precautions?

8 Tables composed for the new challenges

8.1 Electric vehicles

Participant's Name	Country	Legislation	Risk mitigation	Incident management
Anna Lotta Vylund, Yvonne Nasman, Valentin Goran	Sweden	Has a lot of electric cars		https://www.msb.se/sv/Insats--beredskap/Brand--raddning/Trafikolycka/Raddning-e-fordon/ https://www.msb.se/sv/Insats--beredskap/Brand--raddning/Trafikolycka/Raddning-e-fordon/Kunskapsoversikt-/ http://cursnet.srv.se/fortb/e-fordon/a001_räddning_e_fordon_räddning_e_fordon.html
Ando Vainjarv	Estonia	No	No	Knowledge transfer through the experience of instructors; no procedure on paper
Goran Lorentzen	Norway	No	No	Knowledge transfer through the experience of instructors; no procedure on paper

Vesa Kujanpää	Finland	No; there are not many electric cars in Finland	No	Start putting together the educational materials
Tomas Sarauskas	Lithuania	No	No	There is a course for incident management in electronic learning; in Lithouanian
Adrian Bralewski	Poland	No	No; in conceptual phase; working on it	In conceptual phase; working on it, based on information of car producers
Ralf Gerd Simon, Jens Klink	Germany	No	No	https://www.vda.de/en/topics/safety-and-standards/rescue/rescue-recovery-vehicles-with-high-voltage-systems https://publikationen.dguv.de/dguv/pdf/10002/i-8664.pdf
Dale Mason	United Kingdom	No	no	Generic procedures emergency response guide https://www.ukfrs.com/guidance/search?keyword=hybrid%20vehicles
Dutch delegation	Netherlands	No	No	Fire tactics modern vehicles (in Dutch) https://www.ifv.nl/kennisplein/Documents/20160926-BA-Brandweeroptreden-bij-incidenten-met-moderne-voertuigen.pdf “brainbox” training programme Youtube video
CTIF	World			https://godr.sdis86.net/godr/godr-sr-en/index.html (many languages)

8.2 LNG

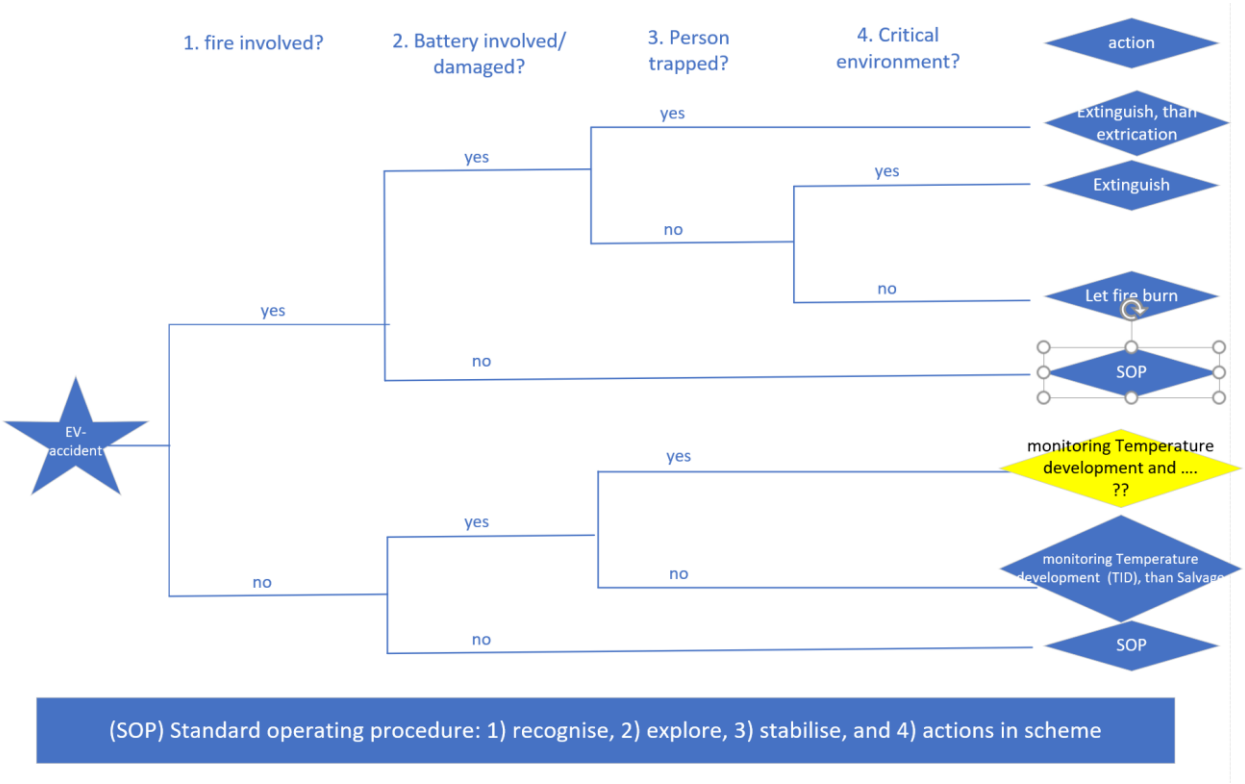
Participant's Name		Legislation	Risk mitigation	Incident management
Anna Lotta Vylund, Yvonne Nasman, Valentin Goran	Sw	Yes: https://www.transportstyrelsen.se/globalassets/global/publikationer/sjofart/nationella-riktlinjer-for-bunkring-av-flytande-metan.pdf	unknown	Guidelines present for incident management in Swedish: https://www.msb.se/externdata/rs/7331cf43-3b39-4fef-b235-b6c355a6a84a.pdf https://www.msb.se/sv/Om-MSB/Lag-och-ratt/Gallande-regler/Brandfarliga-och-explosiva-varor/SRVFS-20047/ https://www.msb.se/sv/Om-MSB/Lag-och-ratt/Gallande-regler/Brandfarliga-och-explosiva-varor/MSBFS-20133/
Ando Vainjarv	Ee	Not yet	Not yet	Not yet
Goran Lorentzen	No	unknown	unknown	No specific guidlines for LNG
Vesa Kujanpää	Fi	unknown	unknown	General guidlines for hazardous materials available on internet in Finnish https://www.ttl.fi/ova/metaani.pdf
Tomas Sarauskas	Lt	There are some regulations, but LNG is only used for industrial applications, not in transport (yet)	No	no

Adrian Bralewski	Pl	Thinking about LNG just started, the first stations are being built. No legislation yet	Risk assesments are being made at the moment	No
Ralf Gerd Simon, Jens Klink	De	Yes,similar to PGS 33 (NL)	Similar to NL	ERIC card system is used, no special LNG procedure Training at the school for dealing with gas leaks
Dale Mason	UK	Yes British compressed gases association code of practice 41 www.bcga.co.uk/assets/publications/CP41.pdf	unknown	Yes? General info in the national operational guidance of the fire service? www.ukfrs.com/guidance/
Dutch delegation http://www.safelng.nl/publicaties/	Nl	Yes: PGS 33 (in Dutch): https://publicatiereeksgevaarlijkestoffen.nl/publicaties/PGS33-1.html and https://publicatiereeksgevaarlijkestoffen.nl/publicaties/PGS33-2.html QRA guidelines (in Dutch): http://www.safelng.nl/1121-2/ interim policy (in Dutch): http://www.safelng.nl/lng-interm-policy/	Yes: PGS 33 (in Dutch): https://publicatiereeksgevaarlijkestoffen.nl/publicaties/PGS33-1.html and https://publicatiereeksgevaarlijkestoffen.nl/publicaties/PGS33-2.html Firefighter advice guidelines (in Dutch): https://www.ifv.nl/kennisplein/Documents/20161102-IFV-Handreiking-EV-advisering-LNG.pdf	Yes: Incident management guidelines (in English) https://www.ifv.nl/kennisplein/transportveiligheid-weg/publicaties/incidentmanagement-lng Training (in English): http://www.safelng.nl/lng-curriculum-training-field-exposure-fire-brigades/

8.3 CNG / hydrogen

Participant's Name	Country	Legislation	Risk mitigation	Incident management
Lotta Vylund, Yvonne Nasman, Valentin Goran	Sweden	Not for H2 For CNG	Not for H2 For CNG	For CNG yes For H2 no reference present
Ando Vainjarv	Estonia			
Goran Lorentzen	Norway	No	No	Standard Hazmat procedure
Vesa Kujanpää	Finland	No	No	Standard Hazmat procedure
Tomas Sarauskas	Lithuania	Not for H2	Not for H2	Local procedures when CNG buses present ; not for H2
Adrian Bralewski	Poland	Not for H2	Not for H2	Not for H2 ; CNG in process (LPG procedure)
Ralf Gerd Simon, Jens Klink	Germany	No	No	CNG as for all pressurised gases; H2 procedure (see reference)
Dale Mason	UK			Londen Fire Brigade Hydrogen Policy / Eranet: eversafe
Dutch delegation	Netherlands	No	No	https://www.ifv.nl/kennisplein/Documents/20180612-IFV-Waterstof-als-brandstof-voor-voertuigen-aandachtspunten-voor-incidentbestrijding.pdf

8.4 Decision scheme for the incident management of electrical vehicles (under construction)



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