

Exchange of Experts

April 2nd & 3rd 2024

Field report



Nederlandse Academie voor
Crisisbeheersing en Brandweezorg
Postbus 7010
6801 HA Arnhem
Kemperbergerweg 783, Arnhem
www.nipv.nl
info@nipv.nl
026 355 24 00

Colofon

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Auteurs J. Veeneklaas, R. Weewer
Contactpersoon R. Weewer

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Wij hechten veel belang aan kennisdeling. Delen uit deze publicatie mogen dan ook worden overgenomen op voorwaarde van bronvermelding.

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1 Objectives

The Netherlands Institute for Public Safety (NIPV) reaches out to other countries to exchange and share knowledge regarding modern societal risks and incident mitigation. We know that in this field little knowledge is shared through official reports. It is a profession in which knowledge, expertise and experience can mostly be found in the heads of the experts. Therefore, NIPV has organised a meeting with professionals from Ukraine, a country that has plenty of knowledge regarding civil protection, occupational health of fire fighters, fire safety engineering modelling and CBRNE. These subject areas are also studied by NIPV. By Exchanges of Expert sessions we strengthen the bonds between experts in our countries.

The main objective of the Exchange of Experts in April 2024 at NIPV was, of course, to share knowledge, but also to strengthen networks in order to collaborate and continue to share knowledge in mutual fields of interest. We hoped this exchange would enable participants and their institutes to work in a strong coalition and create a strong network for further knowledge exchange.

The participants have exchanged results of experiments and model calculations on fire spread and smoke spread and they shared their experience with various FSE models. Furthermore participants shared knowledge about mitigation of gas emissions. The benefit was a mutual exchange of the developments in the Ukraine and The Netherlands as well as signing a Memorandum of Understanding.

The aim of this field report is to share the most important lessons from this exchange, not only with participants, but also with experts that have not participated in this exchange. Hopefully, many other fire safety experts can benefit from this knowledge through the use of this field report. Participants are open for questions.

The Exchange of Experts Programme is funded by the European Commission. CN-APELL RO, Romania, is the programme coordinator, supported by its consortium partner – the General Inspectorate for Emergency Situation – IGSU, Romanian Ministry of Internal Affairs.

2 General program

The Exchange of Experts took place in Arnhem, The Netherlands, and was organised by NIPV. The program of the Exchange covered two days, April 2nd and 3rd. A list of participants FROM Ukraine and The Netherlands can be found in chapter 5 and a detailed program of the Exchange is presented in chapter 6.



All participants of the Exchange of Experts on April 2nd 2024 standing next to the National Firefighter memorial in Arnhem

The general program consisted of introductions of experts and the institutes involved and their objectives and field of interest. Following that, experts presented their fields of interest and results of studies on different subjects. Apart from the participants from Ukrainian universities, various experts in mutual fields of interest from NIPV joined the program. On Tuesday also a memorandum of understanding (MoU) was signed by the general director of NIPV and representatives from the National University of Civil Protection of Ukraine (Kharkiv) and the Lviv State University of Life Safety. With this MoU, parties underlined their intention to collaborate in knowledge sharing and organising future common projects.

3 Report

3.1 Tuesday 2nd of April | Exchange of Experts

After arrival at NIPV at 09.00 AM, participants were welcomed by Annemieke Hendriks (manager of the research group fire safety of NIPV), Lieuwe de Witte (professor of fire safety engineering), Johanna Veeneklaas (researcher) and Ricardo Weewer (professor of fire service science). Everyone shortly introduced themselves. The program was shared and the history of the NIPV-building was told. The first part of the day was dedicated to getting to know each other, and especially getting to know the fields of interest in order to determine subjects for further exploration.

Annemieke Hendriks, Wouter de Nooy and Lieuwe de Witte – Knowledge, Quality of Research and Education at NIPV

Mrs. Hendriks gave an introduction on the organization of the fire service within 25 safety regions and how they collaborate. She also presented the organizational structure of NIPV, with a focus on the independent Dutch Academy of Crisis management and Fire safety of which she is manager. The role of NIPV is to support the policy-making Ministry by developing the normative base. The Ministry of Justice and Safety is responsible for putting norms into laws. In Ukraine these roles are similar.



Some questions were asked about the commissioners of NIPV's research. Lieuwe and Annemieke elaborated on this subject by explaining how the research is paid for and by whom. NIPV can do research under its own conditions and with its own funding, but research can also be financed by external clients (for example: a Ministry). Information on how research is financed in Ukraine was also shared.

The strategic research agenda of NIPV and the long-range research program were explained by Lieuwe, and Wouter focused on the Dutch University System. The way the NIPV assures the quality of research was also discussed, namely by an external visitation and the assignment of internal reviewers and advisory groups. In order to learn from mistakes, NIPV attaches great importance to having an open research culture.

After this opening presentation, the experts gave individual presentations regarding their field of expertise.

3.1.1 Expert presentations

Daria Doroshenko - Features of training professional rescuers at the National University of Civil Protection of Ukraine

Daria presented on how the university trains (future) fire fighters in 5 years: organization, faculties and specialties of the National University. NUCPU also offers a course on (extreme) psychology and one on practical training in which students are taught to rescue victims, learn sign language and the training of drone operations. Now with the attacks of Russia, rescue training in extreme conditions is offered. The university has many international collaborations with universities across Europe (like Poland and Bulgaria).

The presentation was followed by a discussion about how fire fighters (crew members and officers) are trained in Ukraine and The Netherlands.



Kostiantyn Afanasenko - Main scientific areas of fire safety at NUCPU

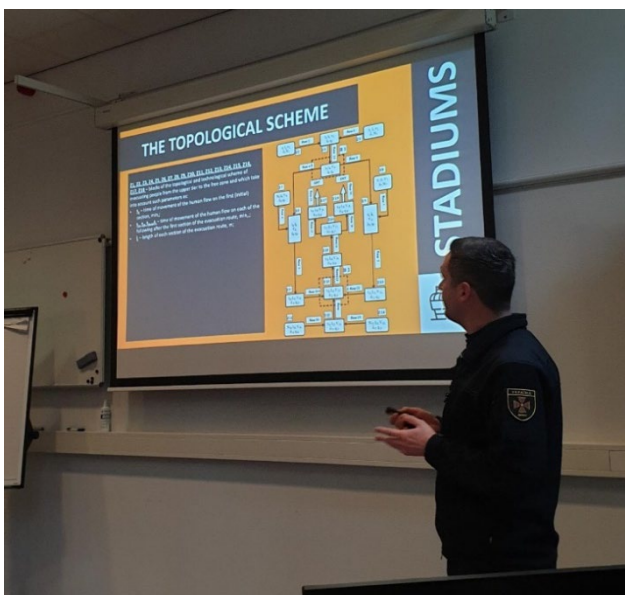
Kostiantyn showed us the software the university uses with respect to building information modelling. For example, Ventus is very useful for smoke extraction systems and Pathfinder for modelling evacuation in emergency situations. The university also possesses scientific equipment and studies the strength properties of fire hoses.



Dmytro Kobylkin - Safety management of infrastructure objects

Dmytro presented his recent work on modelling logistics and crowd management. Using logistical models he calculates the evacuation time needed for large buildings with many people or different infrastructure objects, a stadium, and an airport. This raised some questions about the outcome of the calculations, as people do not always behave rationally by using the shortest route.

Another subject Dmytro was working on is visual modelling of traffic interchange. What is the shortest route to transport goods from A to B and what if the best route is blocked? What is the second best? Conclusion is that car transport is less risky. Dmytro's latest research is on visual modelling of cross-border logistics between Poland and Ukraine. There was some discussion about what software to use (eligible and not too expensive).



Maksym Kustov – scientific potential at the NUCPU

With 50 professors and 160 PhD's, the university publishes various official scientific journals that contain fire safety. Among other subjects, the main specialization is civil safety and environmental protection technology and CBRN. The university conducts multiple scientific projects regarding fire safety with the goal of increasing fire resistance and efficiency in fire extinguishing. This results in new fire resistance composite materials and development of new automatic alarm systems.



Linda van der Ven – Education on industrial safety

Linda started her presentation with a quiz about The Netherlands, which introduced the Dutch main industry: chemical and pharmaceutical companies. The risk profile of the 400 Dutch so called Post Seveso companies was explained and the (fire risk) consequences concerning these companies. Fortunately, there is a strong cooperation between NIPV and LEC IV (Centre of expertise on Industrial Safety, with Safety Region Rotterdam-Rijnmond). Because it is expected that much more ammonia will be transported through the Netherlands the fire service needs to be even more prepared for a large incident. Linda mentioned a recent study of the effect of water screens to disperse clouds of hazardous gases. This subject is also of interest for the Ukrainian experts. Unfortunately, the research shows that the effect is probably very small.



Jan Jacobs – CBRN in practice

Jan presented how the CBRNE-expertise is organized in The Netherlands. There is plenty of expertise in the safety regions and there are some specialist organizations with whom the fire service collaborates if there is an incident. However, there are very little CBRNE-incidents in The Netherlands. In the past, every fire station was educated to mitigate a large spill of chemicals applying chemical protective clothing. However, considering the small number of incidents and the time and energy needed to keep up the skills, the Dutch Fire Service developed a new vision. First response can be rescue and small spills by every station, but larger incidents are dealt with by specialist fire stations.

Kalev Kuklane - Modeling protective clothing

As it was noticed that all three institutes are working on protective clothing for firefighters, Kalev shared the Dutch research on this subject. He started with introducing himself and his major focus areas on ergonomics, human factors and thermal stress. He then answered the question “What do firefighters want?”. Three main wishes are a location monitoring system, an automated calling system and more comfortable protective clothing. Other needs from fire fighters are built-in measurement of dehydration, temperature and movement detection. Unfortunately, there are some limitations to modify the personal protective clothing, because the system aims for maximal protection.

3.1.2 Signing Memorandum of Understanding

After the first day of presentations a memorandum of understand between the three institutes was signed by IJle Stelstra, general director NIPV, Oleksandr Sviatkievic on behalf of Lviv State University of Life safety, and Yurii Kliuchka on behalf of the National University of Civil Protection of Ukraine (Kharkiv).

This was a very memorial moment where the three institutes committed themselves to continuing sharing knowledge and finding ways to collaborate in research projects and exchanges.



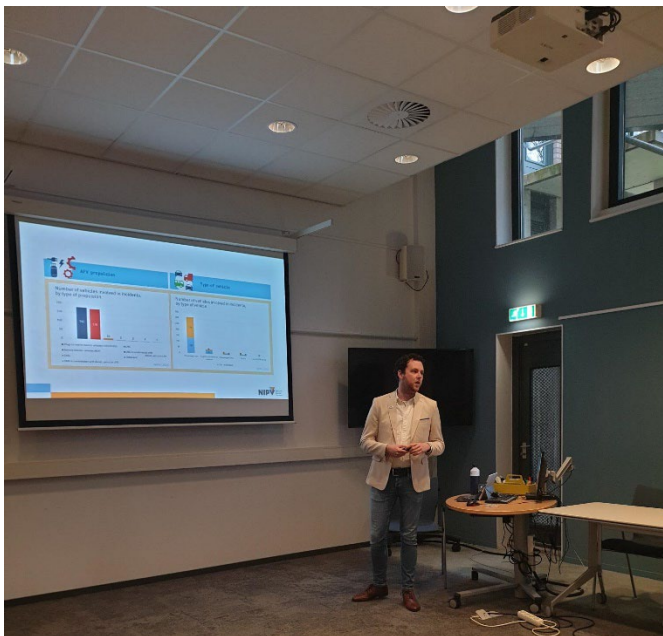
3.2 Wednesday 3rd of April | Exchange of Experts

3.2.1 Expert presentations

Tom Hessels – Lithium-ion battery fires prevention and suppression

Presently, there are many more electric vehicles (EV) on the road than before, and we want to learn from fires in and other incidents concerning EV. Tom presented the statistics on fires in EV (dashboard). These statistics also concern special fires (train with many EV's on board and a fire at a company owning many small EV's). In 2022 in about 45 % of the fires, the battery was involved. Another lesson is that there is a very low chance of electrocution (none recorded). Only one EV-fire followed an accident (so, also very low chance).

The first choice of extinguishing technique is either fire-access in the battery pack and placing the battery in a submersion container, but in first instance, without water (if the incident is stabilized). Tom also elaborated on the characteristics and the consequences of thermal runaway. He finished with two upcoming research projects.



Oleksandr Lazarenko - Research of the fire hazard of a lithium-ion power cell (Panasonic NCR18650B)

This particular power cell is used in Tesla vehicles. Unfortunately, statistical data are very scarce, but Lazarenko uses Australian data that are quite up-to-date. He shared some statistics about fires in Tesla cars that showed increasing problems with EV's (collisions, damaged battery packs, overcharging, most Tesla models have 2000-4000 battery cells in one pack). The temperature with respect to thermal runaway temperature is 170° C.

Oleksandr thereafter presented an experiment on the critical indicators of the Panasonic power cell when exposed to excess currents. He described the operation of the element safety valve, but due to corrosion this valve does not work. Flame temperature (900 Celsius) and the average element temperature (700 Celsius). The more cells, the fewer seconds it takes to reach the consequences mentioned, depending on the type of battery (brightly burning and sometimes no burning). For example, 40 Amperes take 36 seconds. Vertical pressure did not cause a burning of the batteries.

Following this, Oleksandr presented an article on the priority order of actions of the crew commander and an operational rescue scheme of forces and means for extinguishing an EV (in rural and urban areas). He also mentioned research on overarching and risk of fire.



Volodymyr-Petro Parkhomenko - Fire protection of wood using metal-coordinated epoxy-amine compositions

Volodymyr described the development of a technology for fire protection of wood and a fire resistance test of wood. To reach this goals, experimental research with materials with different content of CuSiF6 (0, 44 and 66) is carried out. Hardly combustible materials have also lower fire hazard parameters (the self-ignition point, rate of flame propagation velocity). Uncoated wood, wood coated with and without flame retardant correlated with fire hazard parameters.



Ruud van Liempd – The need for performance based design in The Netherlands

Ruud is a researcher at NIPV with a specialty in FSE; he is also an operational fire fighter. He gave a talk about the current situation regarding performance-based design and about changing circumstances in rules and risks. For example, in Eindhoven a high-rise wooden building is planned, which is of some concern for the fire service. Other changes are the amount of plastics in cars, and the ageing of the population. Rules and legislations are lagging behind the changing circumstances. Another problem is the fact that human behaviour is not sufficiently taken into account. This is also recognizable in Ukraine (in contrast to the problems of high-rise buildings and buildings with wood). Ruud finished his presentation with future goals and a discussion on characteristics of fires (main fire causes) in The Netherlands and the problems presented by solar panels.



Pim van Rede - Numerical modelling of under ventilated fires

Pim benchmarked CFD-simulations against large-scale experiments. CFD (used method in the experiment is Fire Dynamics Simulator) is used to predict movement of smoke in buildings, but has some limitations. Pim showed a movie of the large-scale experiments and discussed the lifecycle of a confined compartment fire, concerning fire growth and smoke-layer formation. Ventilation controlled fires generate more CO and much less O₂ (in confined rooms, contrary to well ventilated rooms). Numerical modelling is predominantly done using CFD-approach. The state-of-the art model shows promising results, but these simulations are heavily dependent on mesh size (therefore expensive) and not practical for large-scale application.



4 Conclusions

4.1 Evaluation of objectives

The objectives of this exchange were to explore mutual fields of interest, to share existing knowledge on some of the mutual fields of interest and to create a basis for further collaboration in the future. Although the period of this exchange (two days) was very short, we succeeded in getting a good overview of mutual fields of interest and sharing some knowledge on Fire safety modelling and the application of models for Fire safety engineering, Electrical vehicle fires, battery fires and CBRNE. This first exchange and signing of the memorandum showed there is plenty of knowledge to share and options for collaboration in the future. A platform for knowledge sharing and contact was set up to support future collaboration and an agenda for future online meetings was agreed on.

4.2 General conclusions

There are many common topics of interest. Although this exchange focussed on fire safety, it was concluded that the Ukrainian Universities have also plenty of expertise on civil protection, resilience and crisis psychology. These subjects are of great interest to NIPV, because in The Netherlands these are rather unexplored territory at present. Politicians in The Netherlands are concerned about the level of resilience in Dutch society and asked NIPV to do more research on this topic. In addition, CBRNE, personal protective clothing, firefighting and modelling are topics where more expertise can be shared in the future.

4.3 Other conclusions and take aways

- > Crisis psychology and after-care for fire fighters is a topic of mutual interest that is put on the agenda for the next meeting.
- > Logistical models can be applied to predict possible transport options in case of road or train road blocks.
- > Using CFD models is sometimes hampered, and comparison with experimental data is necessary to optimize the models.
- > When cylindrical batteries are damaged, the succeeding fire can easily reach 900 degrees Celsius and caused by aging, there is the probability the overpressure vents do not work and the complete battery can be ruptured and launched.
- > The dispersion of toxic and combustible gas clouds using water screens is not as good as expected; further research is needed and expectations should be tempered.

- > Although the number of EV-fires is still increasing, the number of fires caused by battery failure and charging errors is relatively small, at least smaller than is predicted or expected.

- > Using wood as building material has its challenges. A performance-based approach may be applicable. On the other hand, it may be possible to apply protective epoxy with copper silicon flame retardant to protect wood and improve fire safety in sustainable buildings.

5 List of participants

Participants Exchange of Experts	Country/Alliance
Dmytro Kobylkin	Ukraine
Olha Menshykova	Ukraine
Volodymyr-Petro Parkhomenko	Ukraine
Oleksandr Lazarenko	Ukraine
Oleksandr Sviatkevych	Ukraine
Maksym Kustov	Ukraine
Olha Lytvynenko	Ukraine
Kostiantyn Afanasenko	Ukraine
Daria Doroshenko	Ukraine
Yurii Kliuchka	Ukraine
Linda van der Ven	The Netherlands
Jan Jacobs	The Netherlands
Kalev Kuklane	The Netherlands
Pim van Rede	The Netherlands
Ruud van Liempd	The Netherlands
Tom Hessels	The Netherlands
Lieuwe de Witte (host)	NIPV
Ricardo Weewer (host)	NIPV
Johanna Veeneklaas (host)	NIPV
Annemieke Hendriks (host)	NIPV

6 Program

2 april 2024	Activity	Notes
08.30	Pick-up hotel-NIPV	Fire service dress code or casual
09.00 - 09.15	Welcome to the participants (introduction, program)	
09.15 - 10.15	Presentations about NIPV (professorships, quality assurance research, knowledge management & department COVB)	Annemieke Hendriks, Pascal Martens
10.15 -10.45	Presentation Daria Doroshenko	Features of training professionals rescuers at the National University of Civil Protection of Ukraine
10.45 - 11.00	Coffee break	
11.00 - 11.30	Presentation Kostiantyn Afanasenko	Main scientific areas of fire safety at NUCPU
11.30 - 12.00	Presentation Lviv	Safety management of infrastructure objects
12.00 - 13.00	Lunch	Pick-up lunch at restaurant, tables at foyer
13.00 -13.30	Presentation Maksym Kustov	The main scientific CBRNE areas in the NUCPU
13.30 - 14.15	Presentation Linda van de Ven	LEC-IV
14.15 -14.30	Coffee break	
14.30-15.15	Presentation Jan Jacobs	Hazmat response, CBRN and crisis management
15.15 -15.45	Presentation Kalev Kuklane	Personal protective clothing / Modular Protection Concept
15.45 - 16.45	Wrap-up + snack and drink	
17.30	Signing MoU	Room S-BOiN
18.30	Dinner with experts, rectors, managing board and NIPV representatives	Bilderberg hotel

3 april 2024	Activity	Notes
08.30	Pick-up hotel-NIPV	
09.00 - 09.30	Presentation Tom Hessels	Energy transition (lithium-ion battery fires prevention and suppression)
09.30 - 10.00	Presentation Lviv	Research of the fire hazard of a lithium-ion power cell Panasonic NCR18650B
10.00 - 10.15	Coffee break	
10.15 - 10.45	Presentation Lviv	Fire protection of wood using metal-coordinated epoxy-amine compositions
10.45 - 11.15	Presentation Ruud van Liempd	The need for performance based design in The Netherlands
11.15 - 11.45	Presentation Pim van Rede	Numerical modelling of underventilated fires: benchmarking CFD-simulations against large-scale experiments
11.45 - 12.30	Wrap-up and lunch	Restaurant NIPV at 11.45h for 15 pers.
12.30	Travelling to BOCAS	
14.00 - 17.00	Connecting theory and practice	Visit Training centre FRS Amsterdam (Bocas)
	Connecting theory and practice	Visit FRS Schiphol airport dealing with modern risks
19.00	Dinner and closing EoE	Amsterdam