
Project report: Education material for first
responders in radiological Emergency
(EMFREM)

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Abstract

First responders play a critical role in managing radiological emergencies, yet insufficient knowledge of radiation protection may lead to unsafe practices and reduced willingness to participate in such incidents. This project aims to compare current education and training practices across the Nordic region, identify gaps, and propose an optimal basic curriculum for radiation protection, including effective methods for initial and continuing education. A workshop held in Reykjavík in June brought together representatives from Nordic countries to discuss hands-on training, equipment, detectors, and digital learning resources. In addition, a survey assessing knowledge and willingness to respond to radiological emergencies was conducted among first responders as part of a master's thesis at the University of Iceland in spring 2025. The project delivers a proposed guideline for an curriculum and summarizes key findings from the workshop and working group discussions. There is also extensive list of available online educational resources for first responders. Ranging from books, videos and games that help first responders to learn to deal with radiological emergencies in a safe manner.

Key words

First responders, Education, Radiological Emergencies, Curriculum, Radiation Protection

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Final Report from the NKS-B EMFREM (Contract: AFT/B(25)7)

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1. Introduction

First responders to an accident must have basic knowledge of radiation protection and the risks related to responding to a radiological emergency. Lack of knowledge and competence may lead to unsafe procedure and inadequate action to keep responders and the public safe. Lack of willingness to participate in response to emergency with radiation aspect is also a factor in emergency preparedness

In this text, the term “first responders” is used in a general way to describe professionals and volunteers that might be among the first to arrive and intervene at the scene of an accident. Definitions, duties and responsibilities differ between the Nordic countries.

There are manual and guidelines for how to deal with radiological emergency for first responders but not a comprehensive curriculum. The aim of this project is to share how the different Nordic countries teach and train their first responders. Also to define optimal curriculum for basic radiation protection education for first responders and propose methods for delivery of the material that might facilitate primary and continuing education.

One workshop was held in Reykjavík in June, where topics related to basic education for first responders were discussed. Topics included hands on training, equipment and detectors and online educational and training resources. The representative of each countries presented how things were done in their countries and outside speakers gave presentations on related issues.

Part of the project was to assess knowledge amongst first responders and their willingness to participate in activities during radiological emergencies in the Nordic countries. A survey was made as a part of a radiography students master level thesis in the spring 2025 at the University of Iceland.

One of the deliverables of this project is a proposed guideline for optimal curriculum for first responders and the results of the workshop and discussion among the working group is in the conclusion chapter.

2. Workshop in Reykjavik

A workshop was planned and held in Reykjavik for a day and a half in June 2025. All the participating organizations were represented at the workshop and there was a presentation about the status of education and training of first responders from each country and Per Inge Ohrstrand also introduced MELODY - A harmonized CBRN training curriculum for first responders and medical staff. In addition, Søren Albrecht Lassen from the Danish Health Authority took part and presented *Danish 3-weeks course for emergency task force leaders* and there were also three representatives from the Icelandic Coastguard. There were two online speakers: Muzna Assi talked about *IAEA Manual for First Responders to a Radiological Emergency* and Stig Grønvold talked about *CBRN training at the Royal Norwegian Navy*, and two Icelandic guest speakers: Viktor Örn Guðlaugsson introduced *ICE-SAR rescue teams – Education and training* and Klara Bjartmars spoke about *LEARNCOVE, Compliance and Training Management Software at the Icelandic Coast Guard*.

Detailed program and participation list can be found in Appendix 1.

It was decided by the participants in the workshop that everyone should write a short chapter about the situation in their countries around the topics we discussed and presented in the workshop:

- How is the education and training conducted in each country
- Is there a common curriculum for basic training of first responders
- Is there any special system for registering knowledge and competence
- Is there any online resources used
- Hands on training

The reports from each country are in Appendix 2.

The country reports and discussions showed differences between countries and revealed various interpretation of the IAEA recommendations. It was suggested that organizational issues and lack of resources may play an important role there. A further work on the harmonization on training between the countries is needed.

The results of an Icelandic survey amongst first responders, *Survey of emergency responders' knowledge and willingness to work during accidents involving radiation*, were presented in the workshop and the main results are summarized in next chapter.

A list of available resources was compiled, see chapter 5.

The conclusion of the workshop was not to make a common Nordic curriculum for first responders. The situation differs between the countries, and many responders do not have any RN education in their curriculum. Nevertheless, in chapter 4 there are recommendations for basic topics that are important to include in such curriculum.

3. Survey amongst Icelandic first responders

Survey of emergency responders' knowledge and willingness to work during accidents involving radiation in Iceland was done during the spring 2025. It was based on previous surveys from other countries; Rebmman et al 2019: *Firefighters' and Emergency Medical Service Personnel's Knowledge and Training on Radiation Exposures and Safety* and Sultan et al 2020: *Emergency Healthcare Providers' Perceptions of Preparedness and Willingness to Work during Disasters and Public Health Emergencies*, plus some additional questions about confidence, trust and training. The survey was distributed through various channels and got 113 responses from firefighters (n=76) and other first responders.

When asked about training in different disaster scenarios, none of them considered their training related to radiological/nuclear incidents to be sufficient and 68% said they had no training at all on that subject, see Table 1.

Table 1. Answers to the question: Have you had any training?

	No, none	Yes, some	Yes, sufficient
Disaster management	26.5%	59.3%	12.4%
Chemical incidents	22.1%	69.9%	8.0%
Radiological/nuclear incidents	68.1%	31.9%	0%
Mass casualty incidents	1.8%	46.0%	51.3%

The total score in 15 knowledge questions was 57%, very similar to the results of Rebmman et al (USA, 2019). The score was highest in questions about protective measures (five questions) and lowest in questions about decontamination (five questions). Table 2 shows the questions that were most often answered wrong in the two studies.

When asked about their willingness to work in different scenarios (natural disaster, chemical incident, severe bombing, radiological/nuclear incident and dirty bomb), significantly fewer said they were willing to come to work in scenarios involving radiation than other scenarios, see Figure 1.

Table 2. Proportion of correct answers in questions that were most often answered wrong

	Iceland	USA
Radiation Protective Measures		
First responders need to wear a self-contained breathing apparatus when responding to a radiation event because lungs are the most sensitive organs to radiation exposure	40%	30%
Radiation Exposure Effects		
The biggest threat at the site of a radiological dispersal device detonation is from the explosion rather than the radioactive material	27%	28%
Decontamination		
Removal of clothing eliminates most radiation contamination	37%	49%
All equipment used for radiation decontamination must be discarded after use.	13%	40%
People who have been exposed to radiation must be decontaminated to prevent exposure to others.	18%	13%
Full-body patient decontamination is needed after radiation contamination	3%	11%

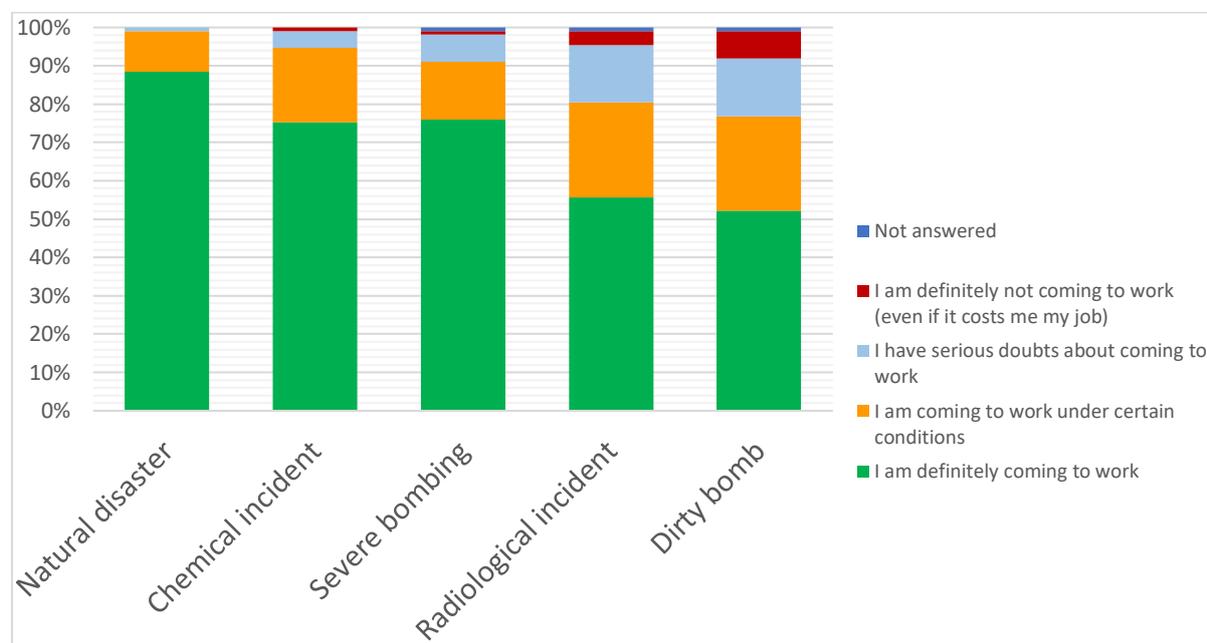


Figure 1. First responders' willingness to work in different scenarios (natural disaster, chemical incident, severe bombing, radiological/nuclear incident and dirty bomb)

Almost all felt confident about their own competency in a natural disaster scenario, but very few felt confident in scenarios involving radiation (Figure 2). The pattern of answers to questions about confidence in their managers and co-worker’s competency, and if their safety would be ensured, was very similar to the pattern in figure 2.

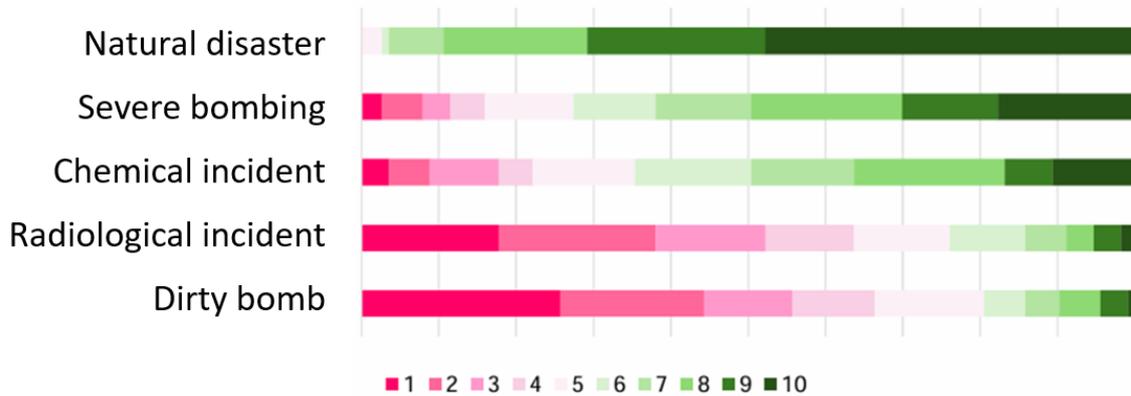


Figure 2. First responders’ perception of their own competency and their own safety. 1 = not confident and 10 = very confident.

The study showed that there is a lack of knowledge about radiation amongst first responders in Iceland. This probably affects people's willingness to work and is reflected in a lack of confidence in one’s own, co-worker’s and manager’s knowledge, and in one’s own safety.

4. Recommended curriculum for first responders

The conclusion of the workshop was not to make a common Nordic curriculum for first responders but to present recommendations for basic topics that should be included in such curriculum, i.e. to form a guideline.

The benefit of a minimum RN education is that if first responders encounter radiological incident or encounter radiation sources in their job, they can promptly, confidently and safely complete their task and will not hesitate to conduct lifesaving action if needed.

Presentations and discussion during the two-day EMFREM workshop in June in Iceland revealed the following, related to a potential common curriculum for first responders in the Nordic countries.

- There are considerable differences between the countries in the structure and management of the fire departments, police force, civil defence and other first responders.
- The structure and duration of education and training of first responders' professions, e.g. police and firefighters vary between countries and within counties. The involvement of the radiation safety authorities in the radiation protection education of first responders is different.
- The basic police education includes some CBRN training (few hours) in Norway and Sweden, but not in Finland, Denmark and Iceland.
- It is probably not realistic to expect more than few hours education (if any is allocated) to be included in the basic curriculum of first responders.
- Where there is some CBRN training included in the basic training of first responders the focus of the RN is on self-protection.
- First responders should have basic knowledge to handle all types of CBRN threats. It would be best to address all these hazards as a whole where the RN is not an isolated part.
- The RN part of CBRN training might be given less attention since dangerous chemicals, biological threats and explosive are probably a more likely concern than ionizing radiation.
- The emphasis in CBNRE education of first responders may be different between countries, e.g. basic training for all, focus on educating scene coordinators etc.
- Some courses on radiation protection and CBRN, on-line or one site, are available in all the Nordic countries except Iceland. These courses are provided by radiation safety authorities, civil protection authorities and / or educational institutions.
- Short videos (< 10 minutes) that are easy to access at any time (with computers, phones etc.) seem to work well.
- In countries with Nuclear Power Plants there is generally higher level of education and training of first responders within the NPP planning zones.

- Radiological incidents are more likely to occur than nuclear events. In the preparation of basic training material, the focus should be considered. Nuclear weapons are generally excluded
- Radiation detectors, dose limits and reference levels are important but not necessary part of the basic curriculum if time is a limited factor.
- First people to arrive play crucial role and the importance of life saving actions needs to be highlighted
- More time and resources should be allocated to the education of commanders. They should be able to take command of a scene including radioactive sources.
- Concise basic education/training material could be useful for a wider audience, e.g. emergency call operators (to enable them to understand RN situations) and medical staff that may be unreasonably worried about their own health while treating people injured in RN incidents.

Recommended basic curriculum

The term „basic curriculum“ refers to a minimum of information and/or training that should optimally be given to all first responders. More training is needed for CBRNE units, commanders, scene coordinators etc.

Target group: All first responders that could encounter RN incidents.

Duration of training: 1 – 2 hours

Mode of delivery: Preferably online, individually paced (i.e. if not a part of larger course), for example a module with short videos.

Most important subjects:

- Incidents with radiation sources should not delay lifesaving actions
- Basics of the different types of radiation and the risks of ionising radiation
- The three principles of radiation protection: time, distance and shielding
- Contamination and decontamination
- The use of personal protective equipment
- Labels and marking for radiation sources and basic evaluation of packages

In more detail the suggested curriculum should include:

- Incidents with radiation sources should not delay lifesaving actions
 - Principles how to do lifesaving as safely as possible
 - Advance notices in the following medical care chain
- Basics of the different type of radiation and the risk involved with ionising radiations
 - Radiation versus radioactivity
- The three principles of radiation safety: time, distance, shielding
 - Inverse square law is very powerful in certain cases (but not in case of fallout)
 - Some idea of worktimes related to Emergency Worker dose constraints
- The use of personal protective equipment
 - Gloves, face masks, goggles
 - When are Tyvek type disposable overalls necessary
 - Baseline: FFP3, goggles, and disposable gloves
- Contamination and decontamination
 - Do not touch suspected items unless necessary
 - Touch suspect items with longer tools, if you need to move them
 - Wash hands, change clothes, shower
 - What is clean enough? Is small residue on the skin acceptable?
 - Contamination measurements (person is clean enough)
- Labels and marking for radiation sources and basic evaluation of packages
 - Are packages intact?

Other important subjects such as the use of radiation detectors, safety perimeters around an incident and estimating safe dose or work time in a radiation field should be left to advance training for commander and special CBRN units. These groups should also get a more detailed and thorough education in the subjects listed up in the basic curriculum.

If first responders are equipped with radiation detectors, they should be familiar with their function and be trained to use them effectively.

It should be noted that a lot of work is done at the radiation and nuclear authorities in the Nordic countries to make education material for first responders and help with education and training along with other various agencies and institutions. The situation is different in each country and the level of cooperation with first responders vary. Sharing educational and training material can be helpful along with discussion about

different approaches to teaching, training and how to deliver it. This report gives a good view of the situation in the Nordic countries and list up helpful online resources that are available, both internationally and in the Nordic countries.

5. Resources

Below are listed various educational and training sources in English and Nordic languages. Not all material fit the recommendation laid down in the conclusion chapter. Listed training material often include other threats for first responders. Some of it should be considered only for more advanced education and organisers.

MELODY¹

MELODY is a standardized European training curriculum focused on CBRN (Chemical, Biological, Radiological, and Nuclear) response, designed for first responders and medical personnel, including ambulance drivers, paramedics, and emergency department staff.

The training is aimed at professionals from organizations responsible for managing emergencies involving accidental or deliberate CBRN incidents that demand immediate intervention.

The online training is open to everyone (registration needed). It is available in many languages including Finnish and Swedish.

Norway has also translated and adopted MELODY, and the course packages are available to the individual First Responders who register at a Norwegian portal.

Farlige Stoffer – App in Google Play and App store

Firefighters and other responders can use the Danish Emergency Management Agency's app to quickly look up information when hazardous chemical substances are suspected. The tool provides guidance for safe handling during chemical incidents and allows users to access relevant physical and chemical data.

The app combines content from two Danish books used by the Danish emergency services, "Indsatskort for kemikalieuheld" and "Førsteindsats ved kemikalieuheld".

[Manual for First Responders to a Radiological Emergency | IAEA²](#)

The aim of this publication is to provide practical guidance for the first responders who will respond during the first few hours to a radiological emergency and for the national officials who would support this early response. This publication provides guidance in the form of action guides, instructions and data that can be easily applied by a State to build a basic capability to respond to a radiological emergency. New edition expected at the end of 2025

¹ <https://melodytraining.wixsite.com/melody>

² <https://www.iaea.org/publications/7606/manual-for-first-responders-to-a-radiological-emergency>

[Home - IAEA Portable Digital Assistant for First Responders to a Radiological Emergency](#)³

An online webtool to provides first responder with action guides and instructions for use in a radiological emergency. It is based on the material in the IAEA Manual for first responders to a Radiological Emergency. Ideally used when it has been integrated with national and local emergency arrangements including translation. Can be stored locally on computers and phones (has a small memory footprint).

[Emergency Preparedness and Response \(EPR\) - Training courses | IAEA](#)⁴

The IAEA offers a range of trainings covering emergency preparedness and response. Training is offered in different formats, including classroom workshops, practical sessions, exercises, virtual reality and webinars.

Detailed information about course content, eligible participants and registration can be found on the individual training pages.

[IAEA NS-IEC e-learning modules include First Responders to a Radiological Emergency](#)⁵

This introductory e-learning course trains first responders in the fundamentals of managing radiological emergencies. Across five interactive modules, learners explore types of radiological incidents, command and control principles, hazard identification, appropriate response actions, and role-specific guidelines. The course includes downloadable infographics for quick reference and ends with a final test and feedback survey required to earn a certificate. An optional memory game helps reinforce basic protection guidelines.

FIRST RESPONDERS HANDBOOK Hazardous Materials CBRNE

This handbook, developed through Nordic cooperation under the Haga Declaration, was created by representatives from fire and rescue services, EMS, and police in Sweden and Norway. It serves as a checklist and decision-support tool for first responders during the first 30 minutes of a hazardous materials incident.

[English version \(2016\)](#)⁶

[Swedish version \(2019\)](#)⁷

³ https://www-pub.iaea.org/MTCD/Publications/PDF/EPR-First_Res-PDA/html/default.htm

⁴ <https://www.iaea.org/services/education-and-training/training-courses/iec-e-learning-courses>

⁵ <https://elearning.iaea.org/m2/course/index.php?categoryid=138>

⁶ https://www.dsb.no/siteassets/rappporter-og-publikasjoner/handboker/msb_bok_firstrespondershazardous_eng_web.pdf

⁷ <https://www.msb.se/sv/publikationer/forst-pa-plats-vid-handelser-med-farliga-amnen-cbrne--atgardskalender/>

[Norwegian version \(2016\)](#)⁸

[Icelandic version \(2019\)](#)⁹

CBRNe Knowledge - ENCIRCLE¹⁰

Website with links on books, scientific papers, databases and more (2021). A good resource for those who study CBRN, organize CBRN response and preparedness or arrange CBRN education and training. The website is part of the ENCIRCLE project funded through the European Union's Horizon 2020 research and innovation programme. ENCIRCLE aims to strengthen the EU's resilience to CBRN (Chemical, Biological, Radiological and Nuclear) threats by building a competitive, innovative and sustainable European CBRN industry.

Radiation emergencies (WHO)¹¹

Informational website of the World Health Organization about radiation emergencies. The focus is on health effects and information for medical professionals.

[TMT handbook \(2009\)](#)¹²

A handbook for triage, monitoring and treatment of people exposed to ionizing radiation following a malevolent act

Swedish Civil Contingencies Agency

[Online CBRN courses \(in Swedish\)](#)¹³

[Short films about various topics related to CBRN and civil protection \(in Swedish\)](#)¹⁴

Canadian Nuclear Safety Commission - Gamma Gear Video Game¹⁵

Gamma Gear Video Game was designed to teach how radiation is emitted from radioactive decay, and how to detect radioactive sources and protect themselves from radiation. It features two common radiation detectors Thermo Scientific RadEye PRD and Canberra InSpector 1000 and can be helpful tool for first responders. It would take

⁸ https://www.dsb.no/siteassets/rappporter-og-publikasjoner/handboker/p1600412-handbok-for-nodetatene_web.pdf

⁹ https://downloads.ctfassets.net/8k0h54kbe6bj/2kbtbqDcZdixGXuwMXYMDk/f3ef7b958a09cc2a910ab78836768a28/Handb_k_CBRNE.pdf

¹⁰ <https://encircle-cbrn.eu/resources/cbrn-knowledge/>

¹¹ https://www.who.int/health-topics/radiation-emergencies#tab=tab_1

¹² <https://www.who.int/publications/m/item/tmt-handbook>

¹³ <https://www.msb.se/sv/utbildning--ovning/alla-utbildningar/?educationalsubject=162&amountToShow=50&sortOrder=Alphabetic>

¹⁴ <https://rn-film.msb.se/starta.html>

¹⁵ <https://www.cnsccsn.gc.ca/eng/resources/learning-portal/gamma-gear-game/>

less time to teach these basics with a short presentation, but the game gives the first responder a better interactive training on how to locate and approach radioactive sources and this approach might be more helpful for some people that have more difficulty with learning from reading og listening to presentations. The game can be played through a browser.

Nordic nuclear safety research (NKS) – helpful reports

NKS is a Nordic collaboration platform that strengthens nuclear and radiation safety through shared research, competence building, and emergency preparedness. It connects experts across the Nordic countries, supports coordinated responses to nuclear incidents. Reports from all projects are available on the NKS website, nks.org but here below are links to two project concerning preparednes and responding to a maritime radiological/nuclear emergency.

[RNSARBOOK](#)¹⁶

The Nordic RNSARBOOK provides harmonized guidelines for planning and training related to maritime search and rescue operations involving radiological or nuclear materials. Aimed at SAR and RN authorities, it clarifies roles, responsibilities and coordination needs, helping Nordic countries prepare for safe and efficient responses to RN-related emergencies at sea.

[RNSARCARD](#)¹⁷

RNSARCARDS provide quick operational guidance for coordinating maritime search and rescue during radiological or nuclear emergencies. They help the radiation authority and the search and rescue mission coordinator form a shared operational picture, assess risks and take appropriate actions. Based on the Nordic RNSARBOOK, the cards serve as a template for developing national procedures.

¹⁶ https://www.nks.org/en/nks_reports/view_document.htm?id=111010214698439

¹⁷ https://www.nks.org/en/nks_reports/view_document.htm?id=111010214698458

Appendix 1: Workshop Agenda and participation list

NKS EMFREM

Education Material for First responders in Radiological EMergency

Reykjavík Marina - Berjaya Iceland Hotels Workshop in Reykjavík, Iceland 10-11th of June 2025

Tuesday, 10 th June 2025	
09:00 – 09:15	Welcome and opening of the meeting Practical arrangements Introduction of participants
09:15 – 09:45	Country presentation – DSA – Per Inge
09:45 – 10:15	Country presentation – SSM – Josefine Palmcrantz
10:15 – 10:30	<i>Coffee break</i>
10:30 – 11:00	Country presentation – STUK – Petri Smolander
11:00 – 11:30	IAEA Manual for First Responders to a Radiological Emergency – Muzna Assi online presentation
11:30 – 12:30	Lunch
12:30 – 13:00	Country presentation – DEMA – Jan Erik Skaarup
13:00 – 13:30	Country presentation – IRSA – Gísli Jónsson
13:30 – 14:00	Danish 3-weeks course for emergency task force leaders – SIS – Søren Albrecht Lassen
14:00 – 14:15	<i>Coffee break</i>
14:15 – 14:45	Survey about training and willingness of first responders in Iceland – HÍ – Jónína Guðjónsdóttir
14:45 – 15:15	ICE-SAR rescue teams – Education and training – Viktor Örn Guðlaugsson
15:15 – 15:45	Discussion on the current status on education and training of first responders in Nordic Countries

The Icelandic Radiation Safety Authority invites participants to dinner at 19:00 on the 10th of June, more information later

Wednesday 11 th June 2025	
09:00 – 09:30	MELODY - A harmonized CBRN training curriculum for first responders and medical staff – Per Inge
09:30 – 10:15	CBRN training at the Royal Norwegian Navy – Stig Grønvold online presentation
10:15 – 10:30	<i>Coffee break</i>
10:30 – 10:50	LEARNCOVE, Compliance and Training Management Software at the Icelandic Coast Guard – Klara Bjartmarz
10:50 – 12:00	<i>Summary and next steps in the project</i>
12:00	<i>End of workshop</i>

Participants at the workshop in Reykjavík

Birgir Þór Guðmundsson	The Capital Region Fire Department
Gísli Jónsson	Icelandic Radiation Safety Authority (IRSA)
Henrik Öberg	Icelandic Radiation Safety Authority (IRSA)
Hlynur Gíslason	The National Police Commissioner in Iceland
Jan Erik Skaarup	The Danish Emergency Management Agency (DEMA)
Jónína Gujónsdóttir	University of Iceland (HÍ)
Josefine Palmcrantz	The Swedish Radiation Safety Authority (SSM)
Klara Bjartmarz	The Icelandic Coast Guards
Muzna ASSI	International Atomic Energy Agency
Per Inge Ohrstrand	Norwegian Radiation and Nuclear Safety Authority (DSA)
Petri Smolander	Radiation and Nuclear Safety Authority in Finland (STUK)
Søren Albrecht Lassen	Danish Health Authority, Radiation Protection (SIS)
Stig Grønvold	Royal Norwegian Navy
Viktor Örn Guðlaugsson	Landsbjörg, Icelandic association for search, rescue & injury prevention

Appendix 2. Country reports

Denmark (DEMA) - Danish first responders

In Denmark, a set of guiding principles within the Danish cross-sectoral incident response and crisis management system, governs planning, preparedness, response and coordination at the tactical, operational and strategic level:

1) REFIL¹⁸, Guidelines for Incident command, which provides a common doctrinal framework for cross sectoral command/control and coordination.

2) The Danish National Risk Profile¹⁹, which establishes a shared understanding of national risk scenarios, informs cross-sectoral readiness and associated common points of reference.

The education and training of first responders are organized across several sectors, reflecting the distinct operational roles of the police, prehospital medical services and the fire and rescue services. As a result, first responders below the level of incident commander are educated through different curricula and training systems, depending on their organizational affiliation and statutory responsibilities. The police, prehospital medical services and the fire and rescue services operate under separate educational frameworks and curricula where learning objectives, and training methods differ significantly between sectors. Training below the role of incident commander is primarily sector-specific and decentralized.

Within the fire and rescue domain, both the National and the municipal fire and rescue services follow a common national curriculum. This ensures a shared doctrinal and technical foundation across the sector. However, the practical training of first responders at the manual level is conducted in separate training systems, reflecting differences in organizational structure, operational focus, and local and regional operational requirements. RN training is a part of the local operational requirements and scaled to the risk-based assessment dimensioning of the municipality.

In contrast, midlevel leadership and command training are standardized across the fire and rescue services. In accordance with Danish legislation, incident commanders from the police, fire and rescue services and the prehospital medical services, are educated jointly at DEMA's national training center. This approach ensures a uniform command doctrine, terminology, and strengthens interoperability and cooperation during multi-agency and cross-sector incidents.

¹⁸ <https://www.brs.dk/da/nyheder-og-publikationer/publikationer2/alle-publikationer/2023/refil-2023/>

¹⁹ <https://www.brs.dk/en/nyheder-og-publikationer/publikationer2/alle-publikationer/2022/national-risk-profile/>

Radiological and nuclear response training and exercises

In the Danish national emergency response system, responsibility for radiological and nuclear matters is shared between the Danish Emergency Management Agency (DEMA) and the Danish Health Authority's Radiation Protection division (SIS) (see next chapter). DEMA serves as the lead agency in incidents involving nuclear material, while SIS is the lead authority for incidents involving radiological sources and holds overall responsibility for radiation protection and public health., also during nuclear incidents.

Until recently, there has been a limited degree of attention directed toward radiological and nuclear (RN) issues in relation to first responders. In particular, the police and the prehospital medical services conduct very limited RN training and possess limited equipment for the detection of radiological and nuclear hazards. The challenge for the fire and rescue service has not primarily concerned basic/introductory training in RN response, which is deemed adequate, but lies in maintaining operational capability and knowledge to detect, measure, and effectively respond to incidents involving radiological or nuclear hazards.

Responsibilities DEMA have several distinct roles in the field of radiological and nuclear (R/N) training for first responders. The agency is responsible for defining the basic RN training curriculum for both municipal and National fire and rescue services, while also maintaining responsibility for the development and training of more specialized RN emergency response capabilities in the national rescue service. Training is conducted at different organizational levels and formats depending on the target audience and operational needs. The training combines classroom-based instruction with practical drills and field exercises. Courses range from short introductory modules of several hours to more comprehensive programs lasting days or weeks. Training themes encompasses hazard identification, the use of personal protective equipment, operation and use of relevant radiation detection instruments, team-based tactics, decontamination procedures, applicable radiation safety rules and regulations and information management.

Exercises

Exercises are conducted jointly with the fire and rescue services, police, prehospital medical services, and, where relevant, military defence units. The exercises can be scenario-driven and may include elements of cross-border cooperation. Several regional and national-level exercises is conducted, supplemented by regular smaller scale exercises at the municipal level.

Municipal scale: Small “everyday incidents” with a first responder focus, mainly practical and “hands-on“

Regional scale: Larger CBRN exercises that involves joint multi-sector response and coordination, between 4-6 times pr. Year.

National scale. These exercises, called KRISØV, have been conducted bi-annually since 2005 and done using a mix of tabletop elements and field exercises, simulating complex emergency scenarios. Involves the full spectrum of the national crisis management system, including the national governmental level. Exercises are scenario-driven and involve cross-border cooperation with neighbouring countries. Based on specific incident scenarios, the training and exercise activities focus on both technical response capabilities and command-level coordination between first responders, local authorities, and national stakeholders. Key elements include the establishment of incident command systems and controlled zones, hazard detection and monitoring, casualty management and mass decontamination, protection of critical infrastructure, and effective communication and information management.

DEMA and SIS strive to maintain a strong role in ensuring adequate preparedness by providing expertise, training, operational capacities and readiness.

Denmark (SIS) - Training of First Responders in radiological incidents

Danish Health Authority, Radiation Protection offers training for first responders in Denmark. The training is given at different levels and at different setups depending on the target audience.

- SIS gives expert support to first responders (available 24/7/365)
- Theoretical training on radiological principles
- Tabletop exercises on specific radiological scenarios
- Cross-sector exercises in the different police districts
- Targeted training for local first responders at companies with a specific radiological risk.

Theoretical training is given by SIS in one day during a three weeks course for first responders. The 1-day introduction to radiological incidents include basic theoretical information on radiation risks and how to mitigate them, demonstration on practical use of instruments, shielding material, source containers, etc. The theoretical training is afterwards complemented by practical exercises in the different police districts. The exercises are planned each year by the national CBRNE training exercise coordination group.

- Exercises are arranged in the different police districts
- Exercises for blue-lights-services
- Exercises follow a predefined script book
- At least one exercise per police district every second year.

Given a specific radiological scenario, the exercises focus on tactical coordination between first responders, police, paramedics and other parties.

- Setup of controlled zones
- Management of casualties
- Radiological measurements and survey
- Decontamination
- Communication.

Finland - (CB)RN-training for first responders in Finland

In Finland all first responder organizations have their own basic training programs. Police University College is the main teaching organization of the Police. It is a national level college that grants bachelor's degree in Police Services as the basic degree of their three years long education. Rescue Services Academy grant Firefighter and Emergency Center Operator diplomas (1.5 years, 90 credits), sub-officer in rescue services diplomas (60 cr) and Bachelor of rescue services (4 years, 240 cr) that is required to work as a fire officer. Emergency medicine has two tracks: basic EMT training in a vocational school or bachelor's degree in emergency medicine. Several municipal vocational schools give out the basic level diplomas and several Universities of Applied Sciences give out bachelor's degrees as part of their nursing programs.

In the basic police officer education, only a brief lecture is given regarding CBRN-incidents, mainly to help the officers identify one, but doesn't give any tools to work in one. Basic training also trains the officers to use basic personal protective equipment (PPE), mainly full-face masks as protection against crowd control agents etc. Rescue Services Academy's courses have specific curriculum for dangerous good accident response, but they heavily emphasize chemical incidents, which are by far the most prevalent of all CBRN incidents. Students learn to use PPEs, such as SCBA and isolating chemical suits, but also other PPEs. Emergency Medicine does not have any specific CBRN curriculum, but it has several relevant subjects such as hospital/patient hygiene (use of PPEs) and identifying poisonings, use of x-ray machines in hospitals (very basic radiation protection).

Ministry of Interior maintains a basic CBRN training course on the eLearning site that is open for all forementioned first responder organizations. It contains roughly 24 hours of lecture material on CBRN with teacher's voice track embedded to the PowerPoint slides. The learning material contains two hours of RN specific material.

Police University College arranges special CBRN course for special police units responsible for CBRN matters in the regional police departments. The course has a dedicated day for RN incidents with theory and hands-on training with radiation sources and real instruments. The training focuses on illicit use of RN-materials, but the training can be applied to RN accidents. There is also a special course for management of

CBRN incidents for commanding police officers. That course also has a dedicated day for RN incidents and concentrates more on variety of RN scenarios and inter-agency cooperation.

Rescue Services Academy has a CBRN course for First Responders. It is not given on a regular basis, but mostly when there is dedicated funding for it. The course is meant for all first responder organizations, and it is recommended to collect all local actors from Wellbeing Services County to make the relevant actors get in contact with each other and arrange further training and exercises locally. The course has a dedicated day for RN incidents and usually one of the training scenarios is an RN incident.

Finnish Defence Forces also offers their military CBRN courses to civilian authorities either as a dedicated course or civilian authority personnel can also join the courses given to military personnel. The course curriculum contains several courses dedicated to reconnaissance, sampling and decontamination in CBRN incidents. Courses are arranged based on the yearly course schedule. Number of yearly courses range from one to three on most years.

STUK does not give out any regular courses on management or other matters related to RN incidents. However, STUK participates in the courses mentioned above by assigning an instructor for the dedicated RN incident days by request and if resources are available. Personnel from the first responder organizations can also attend on request the basic training course given for the volunteer radiation measurement teams managed by STUK. The dedicated RN incident day on the forementioned courses when given by STUK instructor includes radiation and radioactivity basics, health effects of radiation, radiation and contamination protection methods, decontamination, basic radiation measurements, and basic radiation source location methods.

Iceland - Education and Training of First Responders for Radiological or Nuclear Emergencies

The threat of a major nuclear or radiological emergency in Iceland is very low and high activity radiation sources are only used in couple of places in Iceland. The nearest nuclear power plant is over 1000 km away in Scotland. Therefore, it is no surprise that there is little focus on RN education and training in first responder's curriculum in Iceland. When the Icelandic government decided to welcome nuclear submarines from the USA to Iceland coastal waters and harbours it became obvious that knowledge and competence of first responders to deal with CBRN emergencies had to be improved.

The time and the curriculum of education and training for first responders varies a lot as should be expected.

Fire fighters must finish 120 hours of education as trainee. To become a professional firefighter, they receive additional 540 hours of education with CBRN as a part of the

curriculum. The RN part is around 2-3 hours where the Icelandic Radiation Safety Authority has provided teachers and material. The focus of the RN education from the Icelandic Radiation Safety Authority (IRSA) is to give basic understanding of ionizing radiation, radiation protection (included PPE) and that lifesaving action should not be delayed.

The Police academy is a two-year diploma at university level. It is also possible to take bachelor's degree by adding a year to the studies. There is no CBRN material in the Police academy curriculum.

The course to become an Emergency Medical Technician (EMT) in Iceland is 260 hours were there are 96 hours of practical exercises. The course is usually finished in 5-7 weeks. There is no CBRN training for the basic EMT course in Iceland.

There are special forces within the Police and the Coast guard that have had education and training in CBRN and are competent to deal with CBRN related emergencies. There are regularly exercises that IRSA conduct with these branches of the police and coast guard and provide re-education on RN subjects. IRSA also has a good cooperation with the department of Custom Enforcement where the agency provides education and equipment to do gamma mobile surveys around our harbours and airports.

Regular first responders in Iceland do not have any radiation detectors available, but there are some detectors at the biggest fire departments in Iceland. The special forces at the Police and the Coast guard do have adequate equipment to discover RN threats in an emergency and IRSA has detectors ready to hand out to first responders if needed.

Iceland does not have any nation wide registry for RN knowledge or competence but some employers have their own system to register education and training of their staff.

There is no online RN training material for first responders in Icelandic.

Norway - national situation – First Responders and (CB)RN-competence

In Norway the Police, Fire and Rescue Service and the Ambulance services each have different education systems. The education system consists of the basic competence building for each service conducted before they start their practice in the services. Additional specialised competence building is added later in their careers. The basic competence building varies between the services. For the police, The Police Academy is a three year Bachelor study, the Fire and Rescue Services joined that concept in 2023 also with a three year study. For the Fire and Rescue Service the competence building is more complex since the majority of the Fire fighters are part-time fire fighters who has a regular job, but support crisis management in a rotation system. The basic competence building for these are limited to various courses. To become an ambulance worker in Norway, you can either complete a four-year vocational education at upper secondary

school (Health and Social Care, VG2 Ambulance Studies) followed by two years of apprenticeship, or you can pursue a three-year bachelor's degree in paramedicine at a college or university. Both educational paths require either a trade certification exam (for the vocational route) or authorization (for the paramedic route) before you can apply for registration with the Health Personnel Register in order to work in the profession.

First responders share a common curriculum for incident scene management. In Norway, the emergency services train together in various scenarios. These include large fires, traffic accidents, mass influx situations, PLIVO (ongoing life-threatening violence) incidents and CBRNE. Focus in the First Responders basic competence building is on their primary tasks, and “need to know competence”. The amount of information defined as “need to know” has grown in our modern society where complexity is growing year by year. This means that there is limited time available for other subjects which are less likely to occur and may therefore be defined as “nice to know competence”. A consequence is that the CBRN-competence building at the Police Academy focus only on self protection and the use of personal respirators and protective suits. For the Fire and Rescue Services they do address CBRN, but focus is the C due to the challenges posed by various poisonous chemicals, which is part of the Fire and rescue Services daily life.

CBRN-events in general does not occur on a regular basis and as a consequence of this CBRN-competence building is first of all competence delivered through various courses after completing the services regular basic competence building.

The services on-scene leaders are the primary audience for CBRNE-courses, due to the fact that they have the most urgent need to be able to identify threats, understand consequences and decide on urgent threat- and consequence reduction actions, and then direct their resources to act. There are now regular regional 3-day CBRNE-courses throughout the country where on-scene leaders from the First responders together with supporting resources from the Civil Defence and the Armed Forces together conduct CBRN-competence building on how to deal with different CBRNE-threats in the immediate response phase.

The CBRNE-course, SPS-41, is based upon a common curriculum issued by The Ministry of Justice in 2011. The course provides insight in CBRNE-threats and ways and means to deal with these, through lectures and student discussions on how to manage different CBRNE-challenges by utilizing normal procedures, but building understanding that some challenges may require additional competence or capacities.

The services register competence building activities by individuals on the persons information card, but the information is not aggregated as a form of services overview of total competence or lack of so.

Norway has adopted the EU on-line CBRNE-competence building system MELODY, and the course packages are available to the individual First Responders who register at the NAKOS-portal and ask for access.

The Norwegian Directorate for Civil Protection has developed e-learning programs and planning frameworks for incident scene management and major disaster response, which support interdisciplinary collaboration between the emergency services. This has been made available to the emergency services and implemented in education and professional development days held within each sector.

A large part of the workday for first responders is dedicated to practical training—whether it's rehearsing simple procedures or simulating major incidents. Such training is often conducted within each sector, but cross-sectoral practical exercises are planned throughout the year. In addition, there is a well-established practice of debriefing after real-life situations, which helps improve planning and interagency collaboration

Sweden

Basic training for emergency services includes knowledge of the risks of ionizing radiation and the role of the emergency services according to the Civil Protection Act and the civil protection ordinance with radioactive substances. The training has a theoretical basis and also includes practical exercises with stations where students encounter sharp substances.

The overarching objective of the Civil Protection Act is civil protection for all of Sweden with consideration given to local conditions – for life, health, property and the environment, against all types of incidents, accidents, emergencies, crises and disasters. The act defines the responsibilities of individuals, local authorities and government in cases of serious accidents, including radiological emergencies. The act also contains provisions on how rescue services shall be organised and operated, and stipulates that a rescue commander with a specified competence, and far-reaching authority, is to be engaged in all emergency response operations.

The Civil Protection Ordinance states that county administrative boards are responsible for emergency response operations in cases where the public needs protection from a radioactive release from a nuclear installation, or in cases where such a release seems imminent. The ordinance also states that the Swedish Radiation Safety Authority (SSM) shall advise on radiation measurements and coordinate and assist with radiation protection assessments for rescue services.

The Swedish Civil Contingencies Agency (MSB) is responsible for courses, continuation training and in-service training for personnel of the Swedish fire and rescue services. Customised training courses are offered in the fields of emergency preparedness, crisis

management, hazardous substances, fire prevention and rescue services for local authorities and the private sector.

SSM offers a number of training courses in cooperation with MSB. The courses vary in length, usually ranging from one to several days, and include different components, both theoretical and practical. The courses are conducted with focus on active learning in collaboration, including lectures, discussions, and scenario-based exercises.

Over the past few years SSM has regularly, both online and in place, offered:

- Ionizing Radiation and Radiation Protection,
- Radiation Protection in Emergency Preparedness,
- SaphyRAD (Intensimeter),
- Remediation and Decontamination in Emergency Preparedness,
- The Swedish Emergency Preparedness, and
- Radiation Monitoring in Emergency Preparedness.

The courses are intended for those who have a role within the Swedish emergency preparedness system, work in the rescue services, first responders or for other reasons require knowledge of ionizing radiation and radiation protection.

In addition to these recurring courses, SSM provides dedicated training and education for the county administrative boards, which are responsible for rescue services during a radiological emergency involving a nuclear power plant and for rescue commanders.

Approximately 4 times a year, digital seminars are held on current topics, where experts from applicable authorities give lectures and answer questions, where first responders also have the opportunity to participate.

A common curriculum is used as well as the calendar for First Responders -

<https://www.msb.se/sv/publikationer/forrst-pa-plats-vid-handelser-med-farliga-amnen-cbrne--atgardskalender/>

Other training needs are identified, among other methods, via surveys to relevant stakeholders (e.g. via the training group).

The majority of the training is based on identified needs from each actor; to the greatest extent possible adapted to local conditions in each county, in accordance with the legislative requirements.

The aim of the SSM-held basic course “Radiation Protection in Emergency Preparedness”, which is attended by the county administrative rescue leaders, amongst others, is that participants upon completion should be able to:

- explain the radiological consequences in connection with accidents at nuclear facilities,

- explain the biological effects of radiation, including both acute and late health effects,
- apply the concepts of radiation types, activity, dose, and dose rate,
- apply the system of radiation protection and regulation before, during, and after an incident,
- apply radiation protection measures for the public and for workers.

There is no special or common system for registering knowledge and competence. After completing basic training and education, students seek employment at employers who in their turn follow up on the training needs based on skills required/demanded at current employment. . Neither MSB nor SSM have a registry of what skills are available within other authorities or which training has been conducted. Course participants are registered, but not in a registry available for others.

MSB controls the skills provided in the training courses run by MSB, see above. Note that no further training is given to all "first responders" within the rescue services after completing basic training, only to those who work at one of MSB's national CBRN resources.

Online resources are used. There is a web-based theoretical training, equivalent to theoretical training in classroom.

LINK to online training courses (including nuclear energy preparedness and measurements with Saphyrad):

<https://www.msb.se/sv/utbildning--ovning/alla-utbildningar/?educationalsubject=162&amountToShow=50&sortOrder=Alphabetic>

LINK to filmed material for education:

<https://www.msb.se/sv/verktyg--tjanster/radioaktiva-och-nukleara-amnen---informationsfilm/>

Basic training includes hands on training in the form of indication of actual radiation sources. This is also included in further training of reinforcement resources, and further training if necessary.

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Abstract max. 2000 characters	First responders play a critical role in managing radiological emergencies, yet insufficient knowledge of radiation protection may lead to unsafe practices and reduced willingness to participate in such incidents. This project aims to compare current education and training practices across the Nordic region, identify gaps, and propose an optimal basic curriculum for radiation protection, including effective methods for initial and continuing education. A workshop held in Reykjavík in June brought together representatives from Nordic countries to discuss hands-on training, equipment, detectors, and digital learning resources. In addition, a survey assessing knowledge and willingness to respond to radiological emergencies was conducted among first responders as part of a master's thesis at the University of Iceland in spring 2025. The project delivers a proposed guideline for an curriculum and summarizes key findings from the workshop and working group discussions. There is also extensive list of available online educational resources for first responders.

Ranging from books, videos and games that help first responders to learn to deal with radiological emergencies in a safe manner.

Key words

First responders, Education, Radiological Emergencies, Curriculum, Radiation Protection,