NKS-469
ISBN 978-87-7893-564-9

RNSARCARDS Exercise Evaluation Report

Natalia Andreassen
Rune Elvegård

Nord University, Norway

February 2023

Abstract

On 29 and 30 September 2022, two exercises were conducted to test and improve the first version of the Nordic action cards (RNSARCARDS v. 1.0) for maritime search and rescue operations involving radioactive and nuclear emergencies (RNSAR: Radiological/Nuclear Search and Rescue). The exercise contributors were: Nord University, Norwegian Radiation and Nuclear Safety Authority, Joint Rescue Coorindation Centre North Norway, Danish Emergency Management Agency, Icelandic Coast Guard and Icelandic Radiation Safety Authority. The main training audience in the exercises were search and rescue mission coordinators from both Norway and Iceland, as well as radiation experts from Norway, Iceland, and Denmark. The scenario was played out in three different positions off the coasts of Denmark, Norway, and Iceland. The scenario involved a nuclear-propelled vessel encountering problems with the cooling system in a reactor. There was a risk of an ongoing release of radionuclides into the air, and the measured levels of radioactivity had increased substantially.
The exercise achieved its overall purpose of testing and determining how to improve the action cards for search and rescue operations in a maritime radiological/nuclear emergency. The Exercise-I has improved participants' understanding of the roles and responsibilities, and the use of the action cards. The exercise-II has provided an opportunity to test the functionality, applicability and structure of the RNSAR action cards among the involved experts.
These exercises were conducted under the project RNSARCARDS, led by the Norwegian Radiation and Nuclear Safety Authority.

Key words

Maritime search and rescue, radiological and nuclear emergency, emergency response, Nordic, exercise

NKS-469
ISBN 978-87-7893-564-9
Electronic report, February 2023
NKS Secretariat
P.O. Box 49
DK - 4000 Roskilde, Denmark
Phone +45 4677 4041
www.nks.org
e-mail nks@nks.org

RNSARCARDS EXERCISE EVALUATION REPORT

Bodø/online 29 – 30 September 2022

Project: RNSARCARDS Operationalization of RAD and SAR cooperation in RN rescue operations
Financed by: NKS - Nordic Nuclear Safety Research

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Nordic nuclear safety research
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Report Authors

Natalia Andreassen, Nord University

Rune Elvegård, Nord University

Exercise Contributors

Rune Elvegård, Nord University

Oscar Mork, Norwegian Radiation and Nuclear Safety Authority

Mikel Dominguez Cainzos, Joint Rescue Coordination Centre, North Norway

Agnieszka Hac-Heimburg, Danish Emergency Management Agency

Marielle Bakklund, Joint Rescue Coordination Centre, North Norway

Øyvind Aas-Hansen, Norwegian Radiation and Nuclear Safety Authority

Inger Margrethe Eikelmann, Norwegian Radiation and Nuclear Safety Authority

Natalia Andreassen, Nord University

Snorre Greil, Icelandic Coast Guard

Kjartan Guðnason, Icelandic Radiation Safety Authority

Gísli Jónsson, Icelandic Radiation Safety Authority

Emmi Ikonen, Joint Rescue Coordination Centre, North Norway

Report Reviewers

Emmi Ikonen, Joint Rescue Coordination Centre, North Norway

Øyvind Aas-Hansen, Norwegian Radiation and Nuclear Safety Authority

PROJECT: RNSARCARDS: Operationalization of RAD and SAR cooperation in RN rescue operations

PROJECT FINANCED BY: NKS-B program, NKS-Nordic Nuclear Safety Research

PROJECT LEAD: Øyvind Aas-Hansen, Norwegian Radiation and Nuclear Safety Authority

PROJECT COORDINATOR: Mikel Dominguez Cainzos/Emmi Ikonen, Joint Rescue Coordination Centre, North Norway

PROJECT PERIOD: 1 January 2022–30 June 2023

KEYWORDS: maritime SAR, radiological and nuclear emergency, emergency response, Nordic, exercise

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INTRODUCTION

1.1 ABOUT THE RNSARCARDS PROJECT

The RNSARCARDS project, led by the Norwegian Radiation and Nuclear Safety Authority, focuses on the operationalization of harmonized guidelines and recommended procedures for search and rescue (SAR) mission coordinators and radiation experts in Nordic countries. The project is financed by NKS-Nordic Nuclear Safety Research, and the project period is 1 January 2022–30 June 2023.

The RNSARCARDS Project Partners

Radiation authorities

- Norwegian Radiation and Nuclear Safety Authority [DSA]
- The Danish Emergency Management Agency [DEMA]
- The Icelandic Radiation Safety Authority [IRSA]

Search and Rescue (SAR) authorities

- Joint Rescue Coordination Centre, North Norway [JRCC-NN]
- Finnish Border Guard [FBG]
- Joint Rescue Coordination Centre, Denmark [JRCC Denmark]
- Icelandic Coast Guard [ICG]

Academic partner

- Nord University

Project Goals

The primary goal of the RNSARCARDS project is to develop template action cards for use by Nordic SAR mission coordinators (SMCs) and RAD authority officers on duty to conduct an effective sea rescue operation when RN material is involved.

In the project, radiation protection authorities and rescue coordination centers from Norway, Iceland, Denmark, and Finland develop action cards for effective coordination and communication in maritime incidents with a radiological and nuclear scenario. Nord University is contributing as an academic partner in this project and ensures knowledge exchange, development, didactical planning, and evaluation of exercises.

RNSARCARDS project will develop action cards to be used by the on-duty RAD authority officer and the SMC to conduct an effective maritime rescue operation when radiological and nuclear materials are involved. Furthermore, RNSARCARDS will evaluate and subsequently update the use of RNSARBOOK, the Nordic handbook for search and rescue in a maritime radiological/nuclear emergency.

1.2 ABOUT THE RNSARCARDS EXERCISES

On 29 and 30 September 2022, two exercises were conducted to test and improve the first version of the Nordic action cards (RNSARCARDS v. 1.0) for maritime search and rescue operations involving radioactive and nuclear emergencies (RNSAR: Radiological/Nuclear Search and Rescue). This was achieved with contributions from the main training audience (invited radiation protection experts and invited SMCs from each partner country) and the help of observers from the project partners. The participants in the exercises were SMCs from both Norway and Iceland, as well as radiation protection experts from Norway, Iceland, and Denmark.

The scenario was played out in three different positions off the coasts of Denmark, Norway, and Iceland. The scenario involved a nuclear-propelled vessel encountering problems with the cooling system in a reactor. There was a risk of an ongoing release of radionuclides into the air, and the measured levels of radioactivity had increased substantially. Incidents with a risk of the release of radionuclides are characterized by potentially high consequences and low probability, which may also mean that rescue professionals may not have much experience in dealing with these types of rare events.

The exercises were held in a hybrid format—with in-person participation at Nord University/Nordlab in Bodø and online participation. Two approaches were chosen for the RNSARCARDS: tabletop (TTX) and functional exercise.

TTX exercise design is a well-used tool for enhancing understanding of collaboration. This form of exercise was chosen to achieve a shared understanding of plans, roles, and responsibilities, as well as shared language and terminology between participants.

Functional exercises have the purpose of practicing the function of a system or testing the use of actual procedures or facilities. The functional exercise design was chosen to achieve collaborative development of common action cards, interoperability, and collaborative communication between the involved authorities among the Nordic countries.

2 EXERCISE

In this section, we provide more details about the RNSARCARDS exercises. We describe the purpose of the whole exercise, the learning objectives of each exercise, the participants involved, the information package they received to prepare for the exercise, and the scenario description.

2.1 PURPOSE AND LEARNING OBJECTIVES OF THE EXERCISES

Purpose of the exercises

- Test and improve the action cards for search and rescue operations in a maritime radiological/nuclear emergency (RNSARCARDS v. 1.0).

Learning objective for Exercise I (TTX)

- Increase understanding of the different roles and responsibilities of SMCs and RAD advisors on duty involved in RNSAR operations.
- Identify any differences in the understanding and use of the action cards between actors and across countries.

Learning objective for Exercise II (Functional)

- Test the functioning of RNSAR action cards between the involved SMCs and the RAD advisors on duty.
- Test the applicability of RNSAR action cards for decision-making processes within and between the involved organizations.
- Test RNSAR action card structure and action pattern.

2.2 PARTICIPANTS

Scenario and design

Rune Elvegård	Nord University	Norway
Oscar Mork	Norwegian Radiation and Nuclear Safety Authority	Norway
Øyvind Aas-Hansen	Norwegian Radiation and Nuclear Safety Authority	Norway
Mikel Dominguez Cainzos	Joint Rescue Coordination Centre Northern Norway	Norway
Marielle Bakklund	Joint Rescue Coordination Centre Northern Norway	Norway
Natalia Andreassen	Nord University	Norway

Main training audience and observers

Name	Organization	Country
Agnieszka Hac-Heimburg	Danish Emergency Management Agency	Denmark
Inger Margrethe Eikelmann	Norwegian Radiation and Nuclear Safety Authority	Norway
Oscar Mork	Norwegian Radiation and Nuclear Safety Authority	Norway
Øyvind Gjølme Selnæs	Norwegian Radiation and Nuclear Safety Authority	Norway
Marielle Bakklund	Joint Rescue Coordination Centre Northern Norway	Norway
Snorre Greil	Icelandic Coast Guard	Iceland
Kjartan Guðnason	Icelandic Radiation Safety Authority	Iceland
Gísli Jónsson	Icelandic Radiation Safety Authority	Iceland

DISTAFF

Rune Elvegård	Nord University	Norway
Oscar Mork	Norwegian Radiation and Nuclear Safety Authority	Norway
Mikel Dominguez Cainzos	Joint Rescue Coordination Centre Northern Norway	Norway
Agnieszka Hac-Heimburg	Danish Emergency Management Agency	Denmark
Natalia Andreassen	Nord University	Norway
Emmi Ikonen	Joint Rescue Coordination Centre Northern Norway	Norway

Figure 1 RNSARCARDS exercise participants, Photo: Natalia Andreassen

The photo shows (from left to right) Agnieszka Hac-Heimburg (Danish Emergency Management Agency), Inger Margrethe Eikelmann (Norwegian Radiation and Nuclear Safety Authority), Marielle Bakklund (Joint Rescue Coordination Center Northern Norway), Mikel Dominguez Cainzos (Joint Rescue Coordination Center Northern Norway), Oscar Mork (Norwegian Radiation and Nuclear Safety Authority), Emmi Ikonen (Joint Rescue Coordination Center Northern Norway), Natalia Andreassen (Nord University), and Rune Elvegård (Nord University). On the screen (from left to right) are Snorre Greil (Icelandic Coast Guard), Gísli Jónsson (Icelandic Radiation Safety Authority), and Kjartan Guðnason (Icelandic Radiation Safety Authority).

The exercise participants were of various backgrounds, with some having relevant experience in maritime SAR operations involving radioactive and nuclear emergencies:

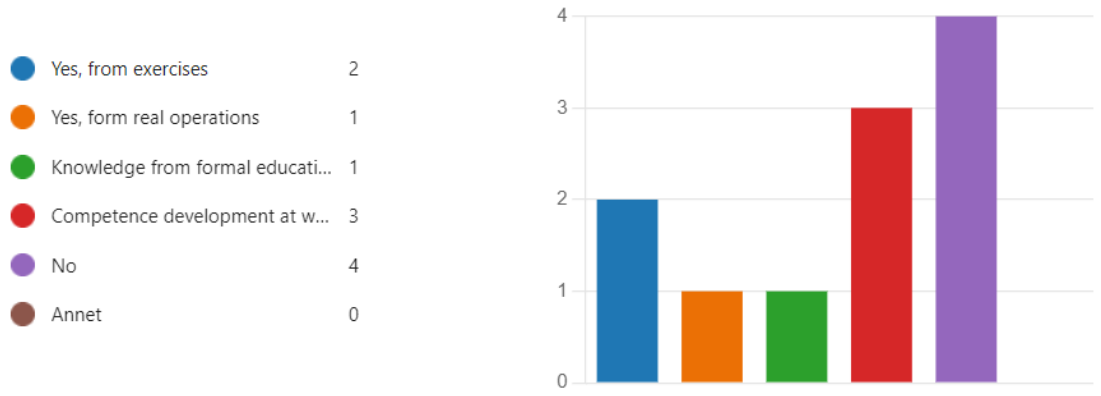


Figure 2 Participants' prior experience

The participants had backgrounds in radiological and nuclear safety authorities (RAD experts) and search and rescue authorities (SMCs).

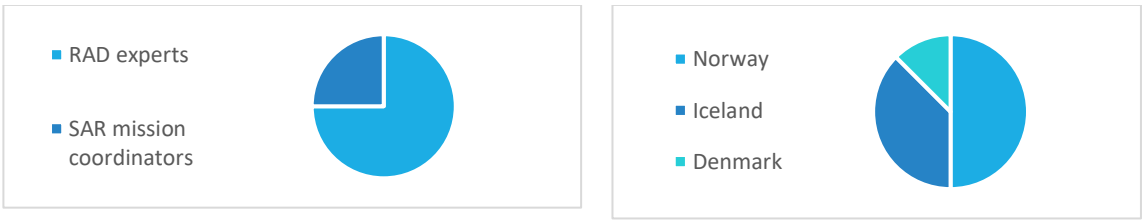


Figure 3 Participants' background

2.3 INFORMATION PACKAGE

The information package was sent to all participants two days in advance. It was recommended that the main training audience and the observers prepare for the exercise by browsing the complete RNSARCARDS information package before the event.

The information package content was as follows:

- Agenda
- Purpose of the exercise
- Learning objectives
- Organization and structure of the TTX and the functional exercise
- Introduction to scenario
- The first draft of Nordic action cards (RNSARCARDS v. 1.0, 16 September 2022 edition)
- The first edition of the RNSARBOOK (31 March 2022 edition)

2.4 SCENARIO

A nuclear-propelled freighter NV Arctic Transporter is performing routine maintenance of the technical system of their reactor. A cloud of superheated steam from one of the pipes injures an unlucky technician, who suffers a severe skin burn. A crew member on board performs basic first aid, but the ship is now requesting medical evacuation for the injured technician. Due to maintenance, the propulsion has been shut down, and the ship is drifting.

Figure 4 RNSARCARDS exercise scenario location in the Nordic countries

3 MAIN FINDINGS

During the exercise, the following action cards were used: assessment of the incident, determination of the restriction area, arrival to the scene of the incident, boarding, rescue operation on board the distressed vessel, evacuation, and emergency towing, and decontamination. The participants used the current version of the RNSAR action cards during the exercise, and then reflected on the major learning points throughout the exercise. They also came up with concrete suggestions for what should be removed and what should be added to each action card. A summary of learning points and action card improvements are presented in this section.

3.1 SUMMARY OF LEARNING POINTS

- The RNSAR cards are very useful for understanding the kinds of information needed to solve a RAD situation in a SAR operation.
- Concepts and terminology should be understandable to both SMCs and RAD experts.
- The communication language should not be advanced.
- Action cards should contain converting charts (e.g., micro Sievert, milli Sievert, and the roentgen equivalent man [rem]).
- Action cards should provide information on roles and responsibilities of SMCs and RAD advisors on duty involved in RNSAR operations.
- Organizations should be aware of possibilities and limitations within areas of responsibility (between RAD and SAR authorities, and between different countries in the Nordic region).
- Action cards should guide the right questions for various involved parties.
- Organizations should have mutual knowledge of regulations and agreements.
- When possible, RAD and SAR should interact face-to-face.
- There is a lack of mutual organizational knowledge between RAD and SAR.
- Roles and available capacities in Norway, Iceland, and Denmark are highly different.
- Knowledge of each other's capacities will improve cooperation.
- Exercises are a great opportunity to train communication, cooperation, and collaboration between RAD and SAR authorities (e.g., SAR and coast guards thrive on using operational procedures and action plans constantly, whereas RAD authorities are more theoretical/academic).
- Action cards should set up a unified incident command system that eases the delegation and delineation of tasks.
- The cards should enhance the understanding of radiation safety for rescue workers as well as seamen aboard the distress vessel.
- The cards will be very useful when finished. The use of the action cards should be discussed country-specific. Each organization should, however, emphasize that this is a "template" for the national ones. If each Nordic nation has the same template, it will be easier to assist other nations when asking for assistance.
- The cards can eventually become a good decision-making tool.

3.2 ACTION CARDS IMPROVEMENT

The participants also discussed how to improve the action cards. The suggested improvements were mostly aimed at developing and fine-tuning the structure and potential use of the RNSARCARDS.

Figure 5 Participants during TTX, Photo: Rune Elvegård

Summary of the improvement points

- RNSAR action card structure has to be simplified to help in decision-making in a difficult scenario.
- The language of the cards needs to be simpler.
- All abbreviations and acronyms must be outlined, since there are people with very different backgrounds using them.
- The cards should be divided into two sets: one for nuclear transport, and one for nuclear-powered transport.
- A harmonized look and structure would be beneficial, so that users become familiar with the most important points in the same position on a page or in a box with the same color, etc.
- The cards should be thoroughly hyperlinked so that users can quickly jump between referenced places.
- Improve the risk assessment part to include a flow chart.
- To make an action card for work, many of the topics should be placed on one page to make decisions and act quicker, which allows less reading and more action.

4 EXERCISE EVALUATION

In this section, we preset the exercise evaluation method and the sources that were used to improve the RNSAR action cards and exercise evaluation. We include the figures on achievement of the exercise learning objectives and scenario evaluation.

4.1 EVALUATION METHOD

The evaluation method included several sources with the purpose of identifying recommendations for developing the action cards, challenges to their use, improving the existing draft of the action cards, and evaluating the exercises. The sources included feedback received during discussions on the exercise day, a questionnaire for individual feedback, and a debriefing session the day after the exercise. The debriefing session was planned for discussion and thorough analysis of the necessary changes needed for each action card.

A questionnaire was prepared in MS Forms to collect individual written responses on the following points:

1. Participants' background and experience
2. Learning points of the participants
3. Understanding or use and functioning of the action plans
4. The structure and action pattern in the draft RNSAR cards
5. Achievement of the learning objectives
6. Any necessary improvements in each action card
7. Evaluation of the scenario and exercise

The sources included both qualitative and quantitative data. All answers were anonymized and provided to the project partners for further work on improving the action cards. Feedback was also used for the development of the exercise evaluation report.

4.2 ACHIEVEMENT OF THE LEARNING OBJECTIVES

The participants were asked to rate the achievement of all five learning objectives from Exercise I and II.

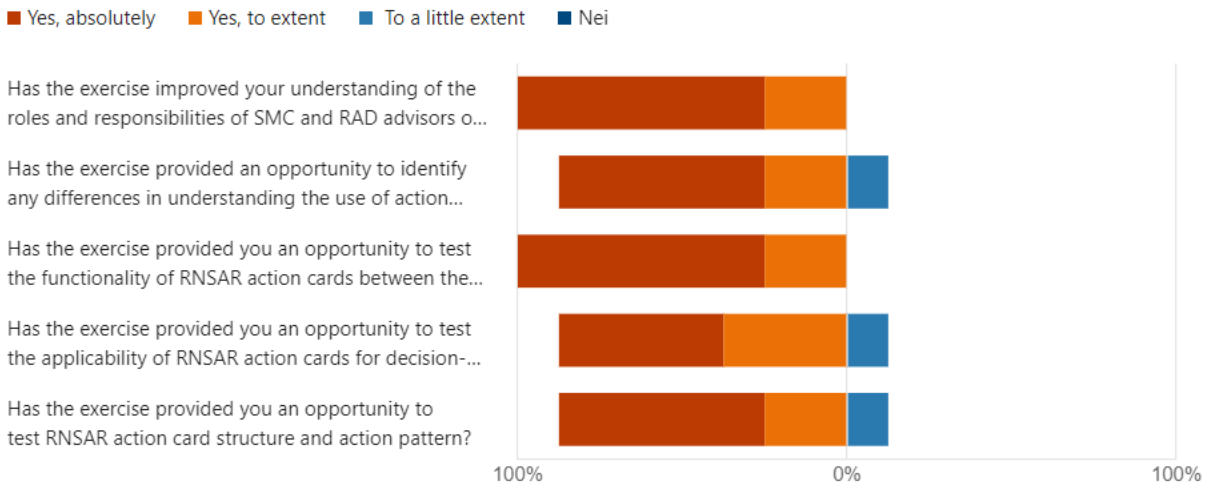
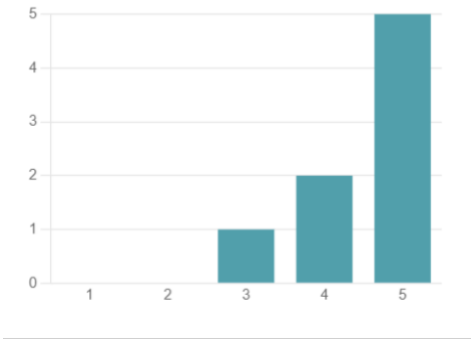


Figure 6 Achievement of the learning objectives

4.3 EVALUATION OF THE SCENARIO AND EXERCISE

The scenario was rated as realistic and credible, and the participants were satisfied with the exercise. The following figures show the rate of the participants' answers.

Realism and credibility of the scenario. Average rate 4.5



Overall, how did you like the exercise? Average rate 4.75

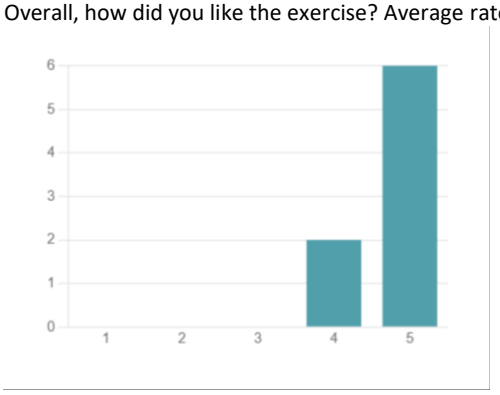


Figure 7 Evaluation of the scenario and exercise

Participants' feedback

- It was very educational for me, especially to arrive at a better understanding of which simulation parameters might be more applicable in "real" situations.
- Functional exercise was interesting because it highlighted decision-making better, as well as improvisation and cooperation. TTX was a really good warmup. I think it worked really well to have this kind of format.
- The TTX was useful for obtaining an overview of the task and the situation.
- The combination of functional exercising and discussion is a really fruitful way of exercising. Both to have action and then a discussion that you can relate to works really well.
- The exercise was really well planned and conducted, and the role players did an extraordinary job. There was a relaxed, no-fault atmosphere during the exercise.
- I have not done a similar functional exercise before.
- Very constructive in regard to content and areas of improvement.
- I am very pleased with the exercise; I learned a lot.
- The cooperation with the coast guard was very good. Time demand during discussions may differ in regards to the experience and knowledge of the participants.

5 CONCLUSION AND THE WAY FORWARD

The exercise achieved its purpose of testing and determining how to improve the action cards for search and rescue operations in a maritime radiological/nuclear emergency from the perspective of SMCs and RAD advisors on duty involved in RNSAR operations.

To this end, two approaches within the RNSARCARDS were chosen: TTX and functional exercise. These options were chosen because the TTX exercise is a tool for achieving a shared understanding of concepts, roles, and responsibilities in RNSAR operations among participants, and the functional exercise helped to test and practice the action cards, thus improving their functionality. The choices offered a hypothetical but realistic scenario in different locations to allow for generalizing the functioning of the action cards in the Nordic region.

The two exercises achieved their different learning objectives. The TTX exercise clearly improved participants' understanding of the roles and responsibilities of the action cards and provided information on roles and responsibilities, as well as the possibilities and limitations of each other's organization. The exercise also provided an opportunity to identify any differences in understanding the use of action cards. It revealed that the roles and available capacities in Norway, Iceland, and Denmark are highly different. The RNSAR cards are useful for understanding what kind of information is needed to solve a RAD situation in a SAR operation.

The functional exercise provided a good opportunity to test the functionality of the RNSAR action cards among the involved experts. Participants suggested that concepts and terminologies should be understandable to both SMCs and RAD experts, and that communication language should not be advanced. The action cards should help in understanding radiation safety for rescue workers as well as seamen abord the distress vessel. The functional exercise also provided a good opportunity to test the applicability of RNSAR action cards to decision-making processes within and between the involved organizations. Organizations should provide mutual knowledge of regulations and agreements, as well as organizational knowledge. In addition, action cards should contain converting charts to help with faster risk assessment. The participants concluded that the cards could eventually become a good decision-making tool.

The functional exercise also provided an opportunity to test the RNSAR action card structure and action pattern. The participants suggested that it is important that the action cards set up a unified incident command system that eases the delegation and delineation of tasks and guides the action. During the exercise, the participants indicated that the action cards should guide the right questions to various involved parties. A harmonized look and structure within a one-page format was recommended.

After the exercises, conclusions were drawn about which procedures and routines needed to be further developed. The participants in the exercise discussed how to improve the current structure and functioning of action cards, including the need to develop good procedures for risk assessment. Further, the routines should be divided into two sets—nuclear transport and nuclear-powered transport.

The exercise evaluation showed that the exercise was well planned, well conducted, had a high educational value, and was very constructive in regard to the content improvement of action cards. The role players highly acknowledged the usefulness of the approach of having a TTX first as a good warm-up to obtain an overview of the task and situation, followed by the functional exercise, which highlighted decision-making, improvisation, and cooperation. The participants also pointed to a good learning environment—a no-fault atmosphere—during the exercise.

Way forward

The improved action cards will help SMCs and radiation experts act and communicate in an appropriate and effective way. The authorities can achieve a better mutual understanding of risk and response action patterns, as well as gain knowledge of the limitations and possibilities of available capacities. As the participants pointed out, the action cards tested in the exercises are a good starting point for developing better cooperation at the operational level between the SAR and RAD authorities in the Nordic countries.

The feedback from the exercise revealed the need for more exercises to obtain input from users to help complete and harmonize the action cards. Exercising is a good way to review procedures and action cards from other organizations' perspectives. Different scenarios, types of exercises, and complexity levels can be utilized in the future. It is important to have both RAD experts and SMCs work together to achieve a shared understanding of the action cards.

To complete the exercise learning cycle, the action cards should be tested in full-scale exercise, followed by the revision and update of the RNSARCARDS version. Action cards are not static documents and should be continuously revised through regular exercises. For further systematic development of the procedures and action cards, there is a need to hold similar exercises that combine RAD and SAR themes or combine different types of exercises.

Acknowledgements

NKS conveys its gratitude to all organizations and persons who by means of financial support or contributions in kind have made the work presented in this report possible.

Bibliographic Data Sheet **NKS-469**

Title	RNSARCARDS Exercise Evaluation Report
Author(s)	Natalia Andreassen Rune Elvegård
Affiliation(s)	Nord University
ISBN	978-87-7893-564-9
Date	February 2023
Project	NKS-B / RNSARCARDS
No. of pages	14
No. of tables	0
No. of illustrations	7
No. of references	0
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Key words	maritime search and rescue, radiological and nuclear emergency, emergency response, Nordic, exercise

Available on request from the NKS Secretariat, P.O.Box 49, DK-4000 Roskilde, Denmark.
Phone (+45) 4677 4041, e-mail nks@nks.org, www.nks.org