

ANALYSIS OF CAPABILITY TO RESPOND TO RADIOLOGICAL/NUCLEAR EMERGENCIES IN THE ARCTIC

EPPR Consensus Summary Report
February 2025



EMERGENCY PREVENTION,
PREPAREDNESS AND RESPONSE

Analysis of Capability to Respond to Radiological/Nuclear Emergencies
in the Arctic EPPR Consensus Summary Report February 2025

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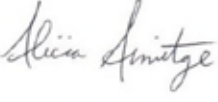

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1. INTRODUCTION

The Emergency Prevention, Preparedness, and Response (EPPR) Working Group (WG) under the Arctic Council conducts projects to facilitate the incorporation of strategies in preventing, being prepared for, and responding to a wide range of emergencies in the Arctic. Emergency response activities are impacted by the Arctic's unique climate, harsh conditions, long distances, and limited infrastructure.

The EPPR Radiation Expert Group (RAD EG) was established in December 2019 to ensure the EPPR mandate in relation to radiological and nuclear emergencies is implemented. The *Analysis of Capability to Respond to RN Emergencies in the Arctic* project was conducted to assess the emergency response capabilities available within the Arctic to respond to radiological/nuclear (RN) emergencies. The project builds on the *Radiological/Nuclear Risk Assessment in the Arctic* published in January 2021, which assessed the risk potential for emergencies due to RN material and related activities that pose a threat in the Arctic. Four emergency scenarios were identified with increasing or moderate risk within the Arctic over the next 10 years:

- A Nuclear Powered Vessel (NPV) emergency (moderate increasing risk);
- A Transit of a Floating Nuclear Power Plant (FNPP) emergency (moderate increasing risk);
- A Small Modular Reactor (SMR) emergency (low increasing risk); and
- A transportation of nuclear materials emergency (low increasing risk)

The Arctic emergency response capabilities of each Arctic State (AS) were considered in relation to the scenarios identified and assessed in the *Analysis of Capability to Respond to RN Emergencies in the Arctic - EPPR Full Technical Consensus Report* (hereafter referred to as the *EPPR Capabilities Full Technical Consensus Report*).

This *EPPR Consensus Summary Report* provides a summary of the project findings.

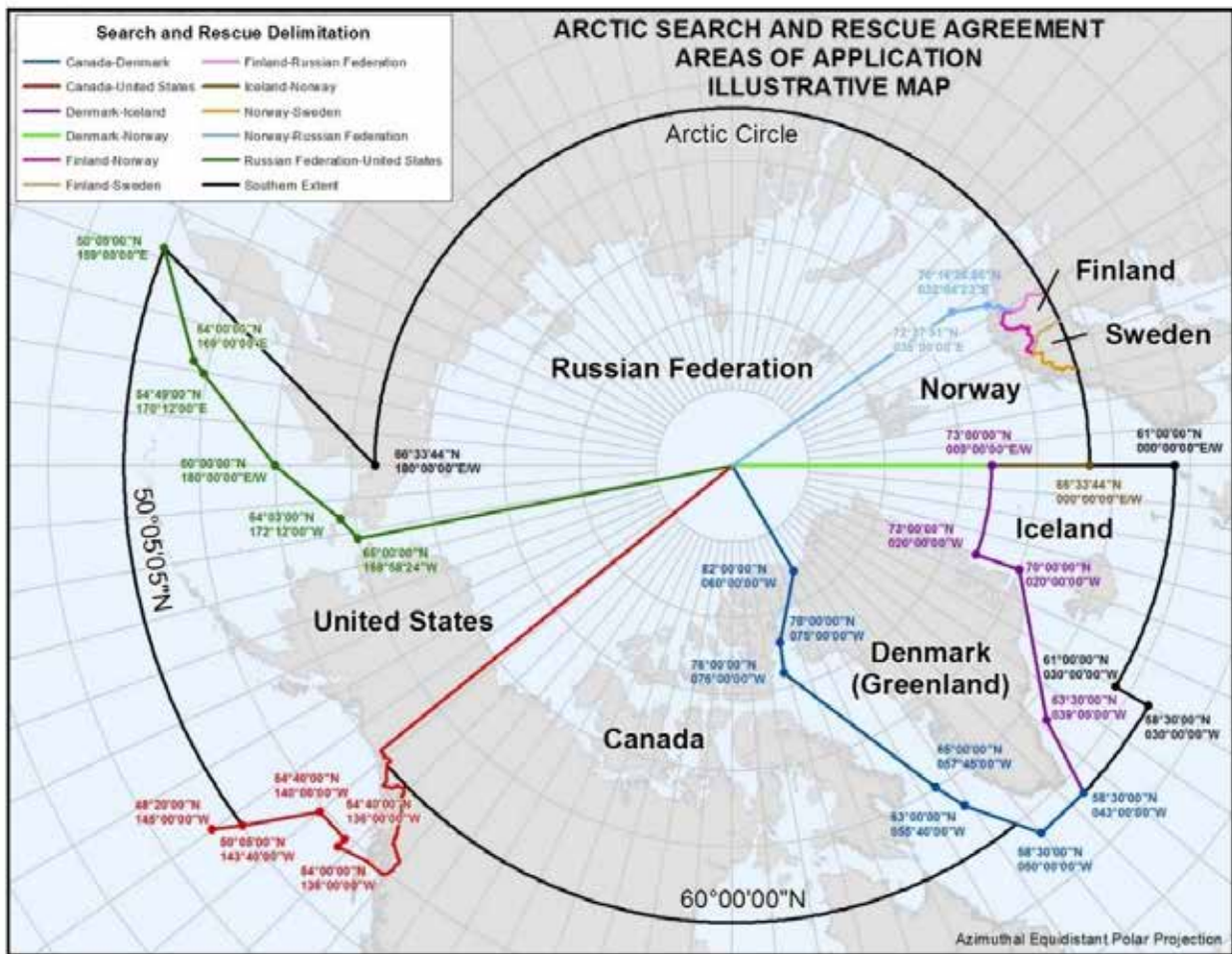
2. GOAL

The goal of this project was to analyse the capabilities, capacity (the level or the degree to which a capability can be delivered to meet the expected need), and competency (the extent to which skillsets have been developed to support the professional delivery of a capability) available in the Arctic to respond to RN emergencies previously identified as moderate or increasing risk.

The analysis identified opportunities for improvement (OFI) and gaps in the capabilities available in the Arctic to respond to RN emergencies including those originating from Nuclear Powered Vessels (NPV); transit of Floating Nuclear Power Plants (FNPP); Small Modular Reactors (SMR); and transportation of nuclear materials. Best practices (BP) were also identified.

The AS's Areas of Responsibility (AOR) are defined by the previous Radiological / Nuclear Risk Assessment in the Arctic [1] as shown in Figure 1.

Figure 1: Arctic Search and Rescue Areas of Responsibility [1]



3. SCOPE

Four emergency scenarios with moderate or increasing risk within the Arctic over the next 10 years were identified by the previous Radiological / Nuclear Risk Assessment in the Arctic [1]. The Arctic Council Member States potentially impacted by these emergency scenarios as well as the perceived level of risk and projected risk trend over the next 10 years (i.e., increasing (↑)) are summarized in Table 1. These emergency scenarios were considered within this current project to identify enhancement opportunities or gaps in the capability of AS to respond. It is recognized that some of the opportunities identified through this project are related to the current response capabilities but also are related to future capability requirements as the risk is expected to increase over time.

Table 1: Member States AORs Potentially Impacted by Emergency Scenarios [1]

Emergency Scenario	Risk	Canada	Finland	Iceland	Kingdom of Denmark	Norway	Russian Federation	Sweden	United States
Nuclear Powered Vessel (NPV) Emergency	↑	✓		✓	✓	✓	✓		✓
Transit of a Floating Nuclear Power Plant (NPP) Emergency	↑					✓	✓		
Small Modular Reactor (SMR) Emergency	↑	✓					✓		✓
Transport of Nuclear Materials Emergency	↑	✓		✓	✓	✓	✓		✓

Legend	Low Risk	Moderate Risk	High Risk	Extreme Risk
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For the purpose of the assessment, each of the identified Arctic emergencies were assumed to have occurred and an emergency response was in progress. Since the emergency was assumed to be ongoing, preventative measures were not considered. It was beyond the scope of the assessment to verify the effectiveness of AS preparedness activities and AS response activation speeds. The ability of individual AS to meet national regulations and international standards was also not assessed.

During this project it was recognized that the capability to respond (i.e., for the protection of the public) may not be a viable solution for all communities if populations get displaced or land is contaminated. While immediate response capabilities for the protection of the public and emergency workers was the focus of this project, it is noted that the EPPR RADIATION REPORT may wish to further explore the risks and consequences posed by RN emergencies in the Arctic. Examining vessel transit passageways and exploring the potential consequences of future SMR sites may serve to minimize the impact on existing Arctic communities in the event of an RN emergency.

The analysis was limited to information provided by Arctic Council Member States/organisations (or nation representatives) through questionnaire responses and the provision of relevant documents available in English (or those that can be translated with publicly available translation tools). Previous reports published by the EPPR including the Radiological / Nuclear Risk Assessment in the Arctic [1] and the RADSAR Report [2] were leveraged where required.

The report was written with the expectation of international distribution within the Arctic Council and the general public and does not knowingly contain any confidential information. As such, most military capabilities and resources are out of scope for this project, contingent to the specifications by each AS.

4. ANALYSIS OF ARCTIC RN EMERGENCY RESPONSE CAPABILITIES

To assess the existing RN emergency response capabilities available in the Arctic, a questionnaire was distributed to AS representatives from the EPPR RAD EG. Information collected included emergency response plans, policies and procedures, emergency response training, training exercises, activities and practices, infrastructure and infrastructure locations, and available resources. The survey responses were supplemented through the use of information contained in the EPPR RADSAR Report [2] and English language documentation (e.g., plans and procedures) provided by the AS. Information available from public sources was also used to fill some information gaps.

The information collected was assessed for its ability to allow for an effective and efficient response to an RN emergency in the Arctic based on the four defined emergency scenarios. The International Atomic Energy Agency (IAEA) international standard for nuclear emergency preparedness and response (GSR Part 7) [3] was used as a baseline for identifying necessary activities and capabilities to perform an effective response.

The assessment criteria used for the project are detailed in the EPPR Capabilities Full Technical Consensus Report.

The AS capabilities were qualitatively assessed against the criteria using the information and documentation provided by each AS¹. A score from one (unsatisfactory) to five (best practice) was assigned according to the scoring legend in Table 2. A detailed analysis of the capabilities of each AS and the rationale behind the assigned scores is presented in Annex A of the EPPR Capabilities Full Technical Consensus Report.

The qualitative assessment allowed for the identification of gaps (absence of capability) and opportunities for improvement (limited or restricted capability) in the overall RN emergency response capabilities in the Arctic. The key findings were summarized in consideration of the expected RN risk landscape over the next 10 years. Recommendations were identified, with the goal of improving Arctic RN emergency response capabilities.

Table 2: RN Emergency Response Capability Scoring Legend

Score	Definition	Score	Definition
Unk. ²	Unknown	3	Satisfactory
N/A	Not Applicable	4	Excellent
1	Unsatisfactory	5	Best Practice
2	Needs Improvement		

¹ Scores for the Kingdom of Denmark are subdivided by Greenland (GL) and the Faroe Islands (FO) when jurisdictions and/or emergency response capabilities differ between the two Arctic regions.
² Insufficient information available to complete assessment.

5. CAPABILITY SCORE RESULTS

Table 3: Arctic RN Emergency Response Capabilities Overview

#	Assessment Criteria	Canada	Finland	Iceland	Kingdom of Denmark	Norway	Russian Federation	Sweden	United States	ARCTIC AVERAGE
Organization										
1	Authorities for emergency preparedness and response, and managing operations in an emergency response	4	4	4	GL: 4 FO: 4	4	Unk.	4	4	4.0
2	Managing the medical response in a nuclear or radiological emergency	1	3	3	GL: 3 FO: 3	3	Unk.	3	3	2.8
Communication										
3	Communicating with the public and providing instructions, warnings and relevant information to the public throughout a nuclear or radiological emergency	4	4	4	GL: 4 FO: 4	4	4	4	4	4.0
Identifying, Notifying, and Activating										
4	Identifying and notifying a nuclear or radiological emergency and activating an emergency response	4	4	4	GL: 4 FO: 3	4	Unk.	4	4	3.9
5	Requesting, providing and receiving international assistance for emergency preparedness and response	4	5	5	GL: 5 FO: 5	5	4	5	4	4.7
Logistical Support, Facilities, and Equipment										
6	Logistical support and facilities for emergency response	2	4	3	GL: 3 FO: 2	5	Unk.	4	2	3.1
Protecting Emergency Workers										
7	Protecting emergency workers and helpers in an emergency	2	3	Unk.	GL: 2 FO: 3	2	Unk.	3	3	2.6
Taking Protective Actions										
8	Taking urgent protective actions, early protective actions, and other response actions	2	3	2	GL: 2 FO: 1	3	Unk.	3	2	2.3
Training, Drills, and Exercise Programmes										
9	Training, drills and exercises for emergency preparedness and response	2	3	2	GL: 2 FO: 1	4	5	3	2	2.7
Emergency Preparedness Activities										
10	Plans and procedures for emergency response and coordination of emergency preparedness and response	3	4	3	GL: 3 FO: 2	3	Unk.	3	3	3.0
NPV Emergency Response										
11	Plans, training, and expected response time for an NPV emergency	2	N/A	2	GL: 2 FO: 2	4	Unk.	N/A	2	2.3
Transit of FNPP Emergency Response										
12	Plans, training, and expected response time for an FNPP transit emergency	N/A	N/A	N/A	N/A	4	Unk.	N/A	N/A	4.0
SMR Emergency Response										
13	Plans, training, and expected response time for an SMR emergency	2	N/A	N/A	N/A	N/A	Unk.	N/A	Unk.	2.0
Transportation of Nuclear Materials Emergency Response										
14	Plans, training, and expected response time for a transportation of nuclear materials emergency	2	N/A	2	GL: 2 FO: 2	4	Unk.	N/A	Unk.	2.4

6. KEY FINDINGS

This section highlights the key findings pertaining to RN emergency response capabilities available in the Arctic in consideration of the expected RN risk landscape over the next 10 years. A total of nine (9) gaps and six (6) opportunities for improvement were identified.

Table 4: Identified gaps in Arctic RN emergency response

#	Criteria	Finding
1	Organization	The Canadian AOR does not have arrangements in place for the provision of appropriate medical screening and triage, medical treatment and longer term medical actions for those people who could be affected in an RN emergency.
2	Logistical Support, Facilities and Equipment	There are no facilities within the AOR for Canada, and limited facilities within the United States AOR and the Faroe Islands capable of performing RN first response actions (initial investigation, monitoring, and decontamination). For most of these AS, the availability of First Responders trained to respond to an RN incident are non-existent within the AOR or are dependent on location and current operational conditions. The availability of RN equipment in Canada's AOR was not identified.
3	Logistical Support, Facilities and Equipment	Canada, Iceland, and the Kingdom of Denmark (Greenland and the Faroe Islands), do not have vessels capable of responding to RN emergencies in the Arctic. The availability of vessels in the United States AOR is dependant on the location, season, and operational readiness factors. Capabilities in this area are especially important for Canada, Iceland, the Kingdom of Denmark (Greenland and the Faroe Islands), Norway, the Russian Federation, and the United States since these AS can potentially be impacted by marine emergencies such as NPV emergencies and FNPP transit emergencies. NPV and FNPP transit emergencies are also identified as the emergencies with the highest risk (moderate and increasing) over the next 10 years.
4	Protecting Emergency Workers	No regulations were identified in Greenland for the protection of emergency workers responding to a RN emergency. The expected First Responders in the event of a marine incident in the Canadian AOR (i.e., Canadian Coast Guard) are not aware of regulations in place to support emergency workers in the event of an RN emergency within the Arctic.

Table 4: Identified gaps in Arctic RN emergency response (Cont.)

#	Criteria	Finding
5	Protecting Emergency Workers	Access to dosimeters and personal protective equipment suitable for operations in an RN emergency is limited within the Arctic for Canada, Iceland, the Kingdom of Denmark (Greenland and the Faroe Islands), Sweden, and the United States. Norwegian emergency responders are believed to have access to RN personal protective equipment; however, it is unclear whether all emergency responders have access to this equipment or only those associated with licensed facilities.
6	Taking Protective Actions	Equipment and personnel to support response actions, including atmospheric release abatement capabilities are limited or not available within the AOR for Canada, Iceland, the Kingdom of Denmark (Greenland and the Faroe Islands), and the United States. Decontamination capabilities are also limited or not available within the AOR for Canada, the Kingdom of Denmark (Greenland and the Faroe Islands), and Sweden.
7	Training, Drills, and Exercise Programmes	Emergency responders within the Arctic receive minimal RN emergency response training in Canada, the Faroe Islands, and the United States. Personnel available to respond to marine emergencies in the Arctic (i.e., coast guard) do not receive RN training in Canada, Iceland, and the Kingdom of Denmark (Greenland and the Faroe Islands). Capabilities in this area are especially important for Canada, Iceland, the Kingdom of Denmark (Greenland and the Faroe Islands), Norway, the Russian Federation, and the United States since these AS can potentially be impacted by marine emergencies such as NPV emergencies and FNPP transit emergencies. NPV and FNPP transit emergencies are also identified as the emergencies with the highest risk (moderate and increasing) over the next 10 years.
8	NPV Emergency Response	Resources and personnel with applicable training available to support an NPV RN emergency response are limited within the AOR for Canada, Iceland, the Kingdom of Denmark (Greenland and the Faroe Islands), and the United States (depending on the location, season, and operational readiness factors). The response time for emergency responders to support an NPV emergency is expected to be on the order of days for the majority of these AS.
9	Transportation of Nuclear Materials Emergency Response	The response time for emergency responders to support a transportation of nuclear materials emergency in Canada and the Kingdom of Denmark (Greenland and the Faroe Islands) is expected to be on the order of days. Response times to such emergencies are expected to take multiple days as a result of RN response capabilities being available in other areas of the AS but not stationed within the AOR.

Table 5: Identified opportunities for improvement in Arctic RN emergency response

#	Criteria	Finding
1	Organization	The infrastructure, equipment, resources and training within the Arctic to manage the medical response in the event of an RN emergency are limited to basic decontamination in most AS. Hospitals within the AOR have limited decontamination equipment available. In many instances, suitable hospitals are thousands of kilometers away from the AS AORs with no documented plans in place for their use in case of an RN emergency.
2	Protecting Emergency Workers	Norwegian regulations for the protection of emergency responders were identified as requiring updates.
3	Taking Protective Actions	It is recognized that for many of the AS, the current RN activity does not merit certain protective actions, including evacuation. Evacuation plans for populations within the AOR have not been developed for Canada, Iceland, and the Faroe Islands. However, the development of evacuation plans and/or plans to support other protective actions (e.g., distribution of iodine tablets) should be considered if the risk of an RN emergency is expected to increase in the coming years.
4	Training, Drills, and Exercise Programmes	Although national RN emergency exercise programmes exist, no RN emergency response exercises were identified within the AOR for Canada, the Faroe Islands, or the United States. As a result, it is anticipated that local governments and/or responders may not undergo the necessary exercises required to support their response or the coordination of response activities with federal agencies.
5	Emergency Preparedness Activities	The Faroe Islands have a general emergency preparedness plan for major incidents but do not have a plan specific to RN emergencies. The Canadian Coast Guard response plans do not have a specific RN component. Conversely, the Icelandic national Chemical, Biological, Radiological, Nuclear and Explosives (CBRNE) emergency response plan accounts for RN emergencies but does not focus on events at sea.
6	SMR Emergency Response	It is recognized that for the applicable AS, the current state of SMR activity does not merit fully developed plans, training and applicable response capabilities. However, preparation of these emergency preparedness and response capabilities should be considered if the risk of an RN emergency is expected to increase in the coming years.

7. RECOMMENDATIONS

Based on the key findings of the assessment, a series of recommendations were identified, with the goal of improving Arctic RN emergency response capabilities, to address both immediate response needs and anticipated response needs as the risk of some of the identified emergencies is expected to increase. The following is a summary of the recommended actions to address these findings. A full list of the recommendations can be found in the EPPR Capabilities Full Technical Consensus Report.

- While it was identified that although many robust mutual aid agreements are in place to support multiple AS in RN emergency response in the Arctic, AS should ensure these agreements support all elements of response. Most notably is in relation to RN medical response capabilities including the provision of appropriate medical screening and triage, and treatment (e.g., decontamination).
- Applicable AS should consider investments in necessary infrastructure, equipment and training to support an effective and timely RN response in the Arctic. This includes:
 - Appropriate resources for hospitals located within the AOR;
 - Supplying appropriate RN equipment and training to facilities that currently support all-hazards emergency response;
 - Availability of equipped vessels within the Arctic AOR and multiple methods of transportation (e.g., air, land, marine) to respond to remote RN emergencies;
 - Supplying requisite RN protective equipment for local emergency workers and marine emergency response organizations;and
 - Providing RN specific training to emergency responders who receive all-hazards training.
- Applicable AS should consider how existing national RN emergency response plans, procedures and practices can be leveraged and extended to support operations within the Arctic AOR. This includes:
 - Ensuring regulations regarding the protection of emergency workers is reflected for Arctic emergency response workers;
 - Developing evacuation plans and plans for other protective actions for populations within the AOR related to possible RN emergencies; and
 - Extending training and exercise programs to specifically address RN emergencies in the Arctic
- Applicable AS should consider updates to their plans to reflect the unique emergency response requirements within the AOR. This may involve updating national plans to have a more direct focus on RN emergencies or may involve updating local response procedures to include RN emergencies at sea.
- With the expectation of the construction of SMR facilities in the coming years, applicable AS should consider the results of this assessment to ensure that the unique response needs to an RN emergency (e.g., training, equipment, facilities) in the Arctic are considered when developing and implementing these response capabilities.

8. CONCLUSION

Through the conduct of this assessment, it was found that the response capabilities for an RN emergency in the Arctic vary among Arctic Council Member States. Additionally, it was found that the response capabilities vary among assessment criteria. AS were found to be effective at identifying authorities and governance structures for managing an emergency response, but the availability of regulations, training and equipment for emergency workers was inadequate for many.

In general, it was identified that AS have at their disposal the necessary capabilities to respond to an RN emergency. However, for emergencies at remote locations or at sea, the response capabilities are not readily available. Some AS rely on bi-lateral and international agreements to supplement and support their response capabilities while others rely on response capabilities available from elsewhere within the AS country. In many of these instances, this has led to the expectation of delayed response times, often in the order of days.

For most AS, the unique RN emergency response requirements for the highest rated risks within the Arctic (i.e., NPV emergency, transit of FNPP emergency, SMR emergency and transportation of nuclear materials emergency), were not captured or reflected in emergency plans and procedures. The availability of training, facilities, and response equipment within the AOR was determined to be limited and, as a result, impacts the effectiveness of a response to these types of emergencies. Throughout this report it is recognized that while some of these response requirements are not immediately required within all AS, the availability of these capabilities will become more important as the risk of these RN emergencies continues to grow.

It is recommended that AS consider the outputs of this assessment and determine how plans, procedures, and resource investments can be updated to reflect the unique requirements of RN emergencies in the Arctic and how existing programs can be improved. This could consider the introduction of RN emergency response training into the all-hazards training programs of locally based emergency workers to improve response times and the increased availability of equipment, infrastructure, and resources to support an RN medical response within the AOR.

9. REFERENCES

- [1]** Emergency Prevention, Preparedness and Response (EPPR), "Radiological / Nuclear Risk Assessment in the Arctic EPPR Full Technical Report," (Draft), 2021.
- [2]** Emergency Prevention, Preparedness and Response (EPPR), "RADSAR Report," 2021.
- [3]** International Atomic Energy Agency (IAEA), "Preparedness and Response for a Nuclear or Radiological Emergency," General Safety Requirements No. GSR Part 7, 2015.

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