

British Columbia

NUCLEAR EMERGENCY PLAN

2020

LETTER OF ENDORSEMENT

The British Columbia Nuclear Emergency Plan (BC NEP) sets out the provisions for a response to a nuclear emergency in the province. The BC NEP also provides a framework for coordinating federal planning, preparedness and response to a nuclear emergency within the Province of British Columbia (B.C.), or elsewhere which may affect the Province of B.C.

The BC NEP clarifies the roles and responsibilities of the participating provincial and federal organizations and the linkages between the emergency management organizations. The BC NEP references the Federal Nuclear Emergency Plan (FNEP 5th edition) that describes the specific interfaces, assets and coordination of support between the two levels of government during a nuclear emergency.

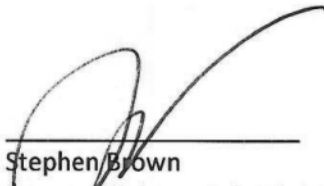
Signed on behalf of the British Columbia Ministry of Health:



Dr. Bonnie Henry
B.C. Provincial Health Officer

2020-09-30

Date of Endorsement



Stephen Brown
Deputy Minister, B.C. Ministry of Health

Oct 2 / 20

Date of Endorsement

PREAMBLE

This plan represents a joint effort between a number of agencies within the Province of British Columbia (B.C.). While the risk of a nuclear emergency occurring in B.C. is low; it is acknowledged that there is a need to prepare for such an event. This document outlines the current state of provincial planning for nuclear emergencies and will be updated on a regular basis as lessons are learned through exercises and emerging best practices.

This plan has been approved as the B.C. Nuclear Emergency Plan (BCNEP). Hereafter, this document will be referred to as the BCNEP.

PLAN MAINTAINANCE

The BCNEP and its supporting documents are managed and maintained by the emergency management unit of the B.C. Ministry of Health.

Inquiries or comments on the BCNEP or its supporting documents should be directed to:

EMERGENCY MANAGEMENT UNIT

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The BCNEP and its supporting documents are evergreen documents. The plan will be reviewed periodically and updated as required. As part of this review, partners will be asked to provide any requests for modifications. Minor amendments will be approved by the B.C. Ministry of Health and the affected government institutions. Major updates will be sent to all partners for review and approval.

Requests for amendments to the plan must be submitted in writing to the above point of contact.

Substantive changes to procedures, strategies, mandates or points of contact affecting the plan must be provided within 30 days of the changes taking effect.

AMENDMENTS AND CONTROL

The B.C. Ministry of Health's emergency management unit maintains a distribution list of all recipients of the BCNEP. Holders of the plan are responsible for verifying and maintaining current distribution information for their organization, and for informing the emergency

management unit point of contact of any required changes to the distribution lists.

NOTE TO READERS

Titles of Acts, plans, and supporting documents are formatted in *Italics*.

LIST OF AMENDMENTS				
DATE (<i>m/yr</i>)	EDITION	SECTIONS AFFECTED	STATUS	INSERTED BY (<i>Name or initials</i>)
September 2020	1 st Edition	Appendix E, G	Complete	Edits by Health Canada, implemented by MoH EMU
April 2020	1 st Edition	Letter of endorsement updated	Complete	Edits by Health Canada, implemented by MoH EMU
April 2020	1 st Edition	Format Updates to all sections. Health Canada content updates.	Complete	Edits by Health Canada, implemented by MoH EMU
July 2019	1 st Edition	Format Updates to all sections. Health Canada content updates.	Complete	Edits by Health Canada, implemented by MoH EMU
November 2018	1 st Edition	Page 32 Federal Communications	Complete	Public Safety Canada

CONTENTS

PREAMBLE.....	3
PLAN MAINTAINANCE.....	3
AMENDMENTS AND CONTROL	4
NOTE TO READERS	4
ABBREVIATIONS	9
1. Overview	10
1.1 PURPOSE	10
1.2 AUTHORITIES.....	10
1.3 SCOPE.....	10
1.4 RELATIONSHIP TO OTHER RESPONSE DOCUMENTS	11
• <i>B.C. Emergency Management System (BCEMS):</i>	11
• <i>Comprehensive Emergency Management Plan (CEMP):</i>	11
• <i>Public Health and Medical Services Annex to the All-Hazard Plan:</i>	11
• <i>B.C. Chemical, Biological, Radiological, Nuclear and Explosives (CBRNE) Response Plan:</i>	11
• <i>B.C. Hazardous Material Response Plan:</i>	11
• <i>Cross-border Health Emergency Management Arrangements:</i>	12
• <i>Federal Emergency Response Plan (FERP):</i>	12
• <i>Federal Nuclear Emergency Plan (FNEP):</i>	12
• <i>Generic Criteria and Operational Intervention Levels for Nuclear Emergency Planning and Response (2018):</i>	12
• <i>Statement of Intent Between the Department of Energy of the United States of America and the Department of Health of Canada Regarding Nuclear and Radiological Emergency Management and Incident Response Capabilities (2014):</i>	12
2. Planning Basis.....	13
2.1 NATURE OF THE HAZARD AND RESPONSE.....	13
2.2 PLANNING FRAMEWORK FOR NUCLEAR EMERGENCY MANAGEMENT	14
• <i>2.2.1 Response Goals</i>	14
• <i>2.2.2 Planning Principles and Requirements</i>	14
2.3 CATEGORIES OF NUCLEAR EMERGENCIES AND PLANNING LINKS.....	15
• <i>2.3.1 Category A: An Emergency at a Nuclear Power Plant in Canada</i>	15
• <i>2.3.2 Category B: An Emergency at a Nuclear Power Plant or Research Reactor in the United States or Mexico</i>	15

•	2.3.3 Category C: An Emergency Involving a Nuclear-Powered Vessel in Canada	17
•	2.3.4 Category D: Other Nuclear Emergencies or Potential Threats in North America	18
•	2.3.5 Category E: A Nuclear Emergency Occurring Outside of North America	19
3.	PLANNING CONTEXT	20
4.	PREPAREDNESS	22
4.1	DETECTION	22
4.2	TRAINING	22
•	Nuclear Emergency Response Management:	22
•	METER: Basic Concepts of Radiation and Protection Principles:	22
•	METER Course:	22
•	Field Response Training:	22
4.3	EXERCISES	23
4.4	CAPABILITIES	23
4.5	RESOURCES	23
5.	KEY AGENCY ROLES AND RESPONSIBILITIES	24
5.1	SITE OPERATORS AND LICENSEES	24
5.2	FIRST RESPONDERS	24
5.3	LOCAL AUTHORITIES	24
•	5.3.1 Health Authorities	25
5.4	PROVINCE OF B.C.	26
•	5.4.1 Ministry of Health and Other Health System Organizations.....	26
•	5.4.2 Emergency Management BC (EMBC).....	27
•	5.4.3 Ministry of Environment and Climate Change Strategy (MoE).....	27
•	5.4.4 Ministry of Agriculture	27
•	5.4.5 Government Communications and Public Engagement (GCPE)	28
5.5	FEDERAL GOVERNMENT	28
•	5.5.1 Public Health Agency of Canada (PHAC).....	28
•	5.5.2 Health Canada	28
•	5.5.3 Department of National Defence / Canadian Armed Forces (DND/CAF).....	28
•	5.5.4 Public Safety Canada.....	29
•	5.5.5 Canadian Nuclear Safety Commission (CNSC).....	29
•	5.5.6 Federal Summary of Responsibilities	29

5.6	FEDERAL COMMUNICATIONS	30
5.7	INTERNATIONAL.....	30
6.	RESPONSE STRUCTURE	31
6.1	ORGANIZATIONAL CHART	31
6.2	KEY RESPONSE STRUCTURES/ENTITIES.....	32
	• 6.2.1 B.C. Emergency Management System	32
	• 6.2.2 Emergency Operations Centres.....	32
	• 6.2.3 Provincial Regional Emergency Operations Centres (PREOC) / Provincial Emergency Coordination Centre (PECC)	32
	• 6.2.4 Health Emergency Coordination Centre.....	32
	• 6.2.5 Federal Nuclear Emergency Plan – Technical Assessment Group.....	33
	• 6.2.6 Federal Nuclear Emergency Plan Designated Officials and Response Teams.....	33
	• FNEP Duty Officer (DO):	33
	• FNEP TAG Liaison Officers (FTLOs):	34
7.	OPERATIONAL ELEMENTS	35
7.1	TECHNICAL ASSESSMENT	35
7.2	RISK COMMUNICATIONS	35
	• 7.2.4 Principles	35
	• 7.2.5 Informing the Public.....	36
7.3	ENVIRONMENTAL MONITORING	36
7.4	WORKER PROTECTION	36
7.5	COUNTERMEASURES / PROTECTIVE ACTIONS.....	36
7.6	MEDICAL RESPONSE.....	37
7.7	DE-ESCALATION AND THE TRANSITION TO RECOVERY.....	37
8.	RESPONSE PROTOCOLS.....	38
9.	FEDERAL / PROVINCIAL ACCOUNTABILITIES AND CO-ORDINATION.....	41
9.1	BCNEP/FNEP RESPONSE LEVELS AND TRIGGER CRITERIA.....	41
9.2	FEDERAL / PROVINCIAL NOTIFICATIONS.....	44
	• 9.2.4 Initial Notifications.....	44
	• 9.2.5 Subsequent Federal Notifications and Fan-out.....	44
	• 9.2.6 International Notifications.....	44
9.3	COLLABORATIVE TECHNICAL ASSESSMENT	45
9.4	FEDERAL FIELD OPERATIONS IN SUPPORT OF B.C.	45

9.5	INTERNATIONAL CO-ORDINATION	45
9.6	FEDERAL / PROVINCIAL LIAISON AND CO-ORDINATION	46
	• 9.6.1 National Co-ordination	46
	• 9.6.2 Federal-Regional Co-ordination	47
	• 9.6.4 Federal-Provincial Co-ordination – Other Provinces and Territories.....	48
9.7	FEDERAL COMMUNICATIONS	48
9.8	FEDERAL SUPPORT CONCERNING COUNTERMEASURES	49
9.9	FEDERAL SUPPORT FOR DE-ESCALATION AND RECOVERY	49
10.	FNEP RESOURCES AND SERVICES.....	50
	10.1 REQUESTING FNEP RESOURCES.....	50
	APPENDIX A: Bibliography.....	51
	APPENDIX B: Glossary	52
	APPENDIX C: Summary of Radiation Resources in B.C. Health Authorities	56
	APPENDIX D: Radiation in General.....	57
	Appendix E: Common Communication Errors Made in Assessment of Radiological Health Hazards	58
	APPENDIX F: Canadian Nuclear Safety Commission Recommended Turn-Back Dose Rates and Maximum Permissible Dose	61
	APPENDIX G: Details of Federal Nuclear Emergency Plan Resources and Services.....	62
	PREPAREDNESS	62
	• Coordination Committees	62
	• Coordination and Committee Meetings with BC	62
	• Training	63
	• Exercises.....	64
	RESPONSE	65
	• Technical Assessments.....	65
	• Radiological Risk Assessment and Modelling Capabilities.....	65
	• Surveillance and Environmental Monitoring Assets	66
	RECOVERY	69
	Notes.....	70

ABBREVIATIONS

BCCDC	British Columbia Centre For Disease Control
BCEHS	British Colombia Emergency Health Services
BCERMS	British Columbia Emergency Response Management System
BCNEP	British Columbia Nuclear Emergency Plan
CBRNE	Chemical, Biological, Radiological, Nuclear and Explosives
CCG	Central Coordination Group
CNSC	Canadian Nuclear Safety Commission
DND/CAF	Department of National Defence/Canadian Armed Forces
ECC	Emergency Coordination Centre
ECCC	Environment and Climate Change Canada
EMBC	Emergency Management British Columbia
ESF	Emergency Support Function
EOC	Emergency Operations Centre
FERMS	Federal Emergency Response Management System
FERP	Federal Emergency Response Plan
FNEP	Federal Nuclear Emergency Plan
FNEP TAG	Federal Nuclear Emergency Plan Technical Assessment Group
FPS	Fixed-Point Surveillance network
GAC	Global Affairs Canada
GOC	Government Operations Centre
HCRPB	Health Canada Radiation Protection Bureau
HECC	Health Emergency Coordination Centre
HEMBC	Health Emergency Management British Columbia
HPOC	Health Portfolio Operations Centre
IAEA	International Atomic Energy Agency
MDEC	Ministers-Deputies Emergency Committee
MHO	Medical Health Officer
HLTH	Ministry of Health
NERS	National Emergency Response System
PECC	Provincial Emergency Coordination Centre
PHO	Provincial Health Officer
PNEMA	Pacific Northwest Emergency Management Arrangement
PREOC	Provincial Regional Emergency Operations Centre
PHAC	Public Health Agency of Canada
PS	Public Safety Canada

1. Overview

1.1 PURPOSE

The purpose of the BCNEP, which also serves as the Federal Nuclear Emergency Plan (FNEP) B.C. Annex, is to describe the provincial response to an accidental or unintentional nuclear emergency, including the specific interfaces between B.C. local, regional, provincial, federal-regional and federal emergency management organizations.

While the plan is designed for accidental or unintentional events, elements of this plan may be used to address radiological consequence management of deliberate or malicious acts (see Section 1.3 Scope).

1.2 AUTHORITIES

The BCNEP is prepared by the B.C. Ministry of Health under the authority of the provincial *Emergency Program Act* (1996) and the *Emergency Management Program Regulation* (1994). The act sets out the preparedness, response and recovery roles and responsibilities of the Province and local authorities. The regulation requires all provincial ministers to develop emergency plans and procedures and designates key ministers for specific hazards.

Under Schedule 1 of the *regulation*, the B.C. Minister of Health is designated as the key minister for “hazardous spills” involving radiation and is required to set out the manner in which and the means by which the provincial government will respond.

The FNEP is issued under the authority of the federal Minister of Health, in accordance with the provisions of Article 6 of the federal *Emergency Management Act* (2007). The FNEP is a multi-departmental plan that is endorsed by designated deputy ministers, and agency presidents, on behalf

of federal organizations that have specific responsibilities under the plan.

The designated roles and responsibilities for federal government institutions in the FNEP also apply to federal-regional organizations.

In accordance with the federal *Emergency Management Act*, Article 6, the FNEP B.C. Annex (i.e. the BCNEP) constitutes a pre-existing arrangement between the Province of B.C. and the federal government to provide specific assistance (technical/scientific/operational) during a nuclear emergency.

1.3 SCOPE

The BCNEP is designed as a flexible, fully scalable provincial plan. The continuum of potential nuclear accidents in B.C. includes those that do not reach the threshold of an emergency, are handled by licensees and/or first responders, are managed within provincial capabilities, exceed provincial response capabilities and require federal assistance, or involve a federal mandate in the province. Components of the BCNEP may be used to support the response to any nuclear accident along this continuum. It is also important to note that there are many FNEP resources and services that support overall preparedness and response to nuclear emergencies (see Appendix G).

This plan is focused on accidental or unintentional nuclear emergencies, but the arrangements herein may be used in support of the *B.C. Chemical, Biological, Radiological, Nuclear or Explosive (CBRNE) Response Plan* to support prevention and mitigation measures, provide technical support to planned events and no-notice security activities, and/or address radiological consequence management of deliberate or malicious acts.

The BCNEP uses the following nuclear emergency event categories to coincide with those used in the FNEP:

CATEGORY A: An emergency at a nuclear power plant in Canada;

CATEGORY B: An emergency at a nuclear power plant in the United States or Mexico;

CATEGORY C: An emergency involving a nuclear-powered vessel in Canada;

CATEGORY D: Other nuclear emergencies or potential threats in North America;

CATEGORY E: A nuclear emergency occurring outside of North America.

1.4 RELATIONSHIP TO OTHER RESPONSE DOCUMENTS

The BCNEP is designed to augment existing operational plans at many levels, e.g. licensees, site operators, first responders, and regional health authorities. It is one plan in a framework of related emergency plans, policies, procedures and agreements, including the following:

- *B.C. Emergency Management System (BCEMS):*

BCEMS is a provincial emergency management system founded on the principles of the Incident Management System and includes common language, span of control, and management by objective and scalability. It ensures a consistent, coordinated and organized response to emergency events and disasters, and is used across ministries and jurisdictions in B.C.

- *Comprehensive Emergency Management Plan (CEMP):*

B.C.'s CEMP consists of the *All-Hazard Plan*, support annexes and hazard specific annexes. The *All-Hazard Plan* outlines the operational structure and responsibilities of the Provincial Emergency Coordination Centre (PECC) and the Provincial Regional Emergency Operations Centres managed by Emergency Management BC (EMBC) for all of government. The plan is the basis for the response to the danger, or risk, posed by all types of hazards in British Columbia. The response actions as outlined in the CEMP will guide the provincial integrated response for a nuclear incident/emergency.

- *Public Health and Medical Services Annex to the All-Hazard Plan:*

This annex to the CEMP describes how the B.C. health system will respond to major emergencies or disaster events, including the provision of health care and the promotion and protection of public health.

- *B.C. Chemical, Biological, Radiological, Nuclear and Explosives (CBRNE) Response Plan:*

The purpose of the plan is to outline the co-ordinated response of provincial, regional and municipal organizations to a CBRNE event where higher levels of federal or inter-provincial support may be required. It does not include response to a routine hazardous material event.

- *B.C. Hazardous Material Response Plan:*

The plan is an integral facet of the B.C. Ministry of Environment's Environmental Emergency program and provides the approach that will be taken by the provincial government to the threat and occurrence of major accidental spills, emissions and discharges of hazardous materials into the environment.

- *Cross-border Health Emergency Management Arrangements:*

B.C. has a number of cross-border memorandums of understanding and other arrangements to support cross-border collaboration, including:

- Memorandum of Understanding on Public Health Emergencies between British Columbia and Alberta;
- Pacific Northwest Emergency Management Arrangement (PNEMA);
- Memorandum of Understanding in Public Health Emergencies between the Province of British Columbia and the State of Washington; and
- Pacific Northwest Border Health Alliance.

- *Federal Emergency Response Plan (FERP):*

This plan establishes overall governance for emergency management at the federal level and includes the Federal Emergency Response Management System (FERMS) and the National Emergency Response System (NERS). Emergency support functions have been identified for federal departments.

- *Federal Nuclear Emergency Plan (FNEP):*

The FNEP is an annex to the FERP and, with the FERP, is the plan under which the Government of Canada will respond to a major nuclear emergency requiring a coordinated federal response in areas of federal jurisdiction, and in support of impacted provinces and territories. The FNEP supports rapid mobilization of federal radiological assessment and other specialized capabilities required to manage the potential health risks associated with radiological or nuclear emergency.

- *Generic Criteria and Operational Intervention Levels for Nuclear Emergency Planning and Response (2018):*

This document has been prepared as part of Health Canada's responsibilities as the lead department for the FNEP. The document recommends dosimetric and operational quantities, in terms of generic criteria and operational intervention levels to assist with nuclear emergency planning and response and the implementation of protective actions. Protective actions considered include: stable iodine thyroid blocking; sheltering; evacuation; temporary relocation; restriction of the distribution and ingestion of potentially contaminated drinking water, milk and other foods and beverages; personal decontamination; medical follow-up; and restriction of activities for off-site workers.

- *Statement of Intent Between the Department of Energy of the United States of America and the Department of Health of Canada Regarding Nuclear and Radiological Emergency Management and Incident Response Capabilities (2014):*

The purpose of the Statement of Intent (SOI) is to provide a framework for cooperation between the Department of Health of Canada and the Department of Energy of the United States to enhance radiological and nuclear security for major public events and minimize the actual or potential radiological consequences to health, environment and property of an incident involving nuclear or radiological material worldwide.

2. Planning Basis

2.1 NATURE OF THE HAZARD AND RESPONSE

Radiation is energy that comes from a source and travels through material or space. Radiation can be classified as ionizing or non-ionizing. Ionizing radiation has sufficient energy to remove electrons from atoms or molecules. The loss of an electron results in the formation of a charged atom, called an ion. The ionization of molecules can lead to radiolysis (i.e., breaking chemical bonds and formation of highly reactive free radicals which in turn may react chemically with neighbouring materials even after the original radiation has stopped).

The average Canadian is exposed to 2-3 millisieverts (mSv) of background radiation annually from things such as radon, rocks and soil, food, and cosmic radiation from space. A Computed Tomography (CT) scan can expose a patient to between 5 and 30 mSv

(Health Canada, 2012). Only very high levels of exposure to radiation cause any acute health effects (e.g., hematopoietic, gastrointestinal and/or neurological/vascular syndrome).

Radioactive materials are detected using instrumentation applicable to the type of radiation present (i.e., alpha, beta, gamma and/or neutron). Appendix D provides more information on radiation in general.

The hazards associated with an emergency covered by this plan are the actual or potential radiological impacts on health, safety, property and the environment resulting from an uncontrolled release of radioactive material into the environment that may result in public exposure above regulatory or guideline levels. Such exposures may be short-term or long-term and may be received through various pathways (see Figure 1).

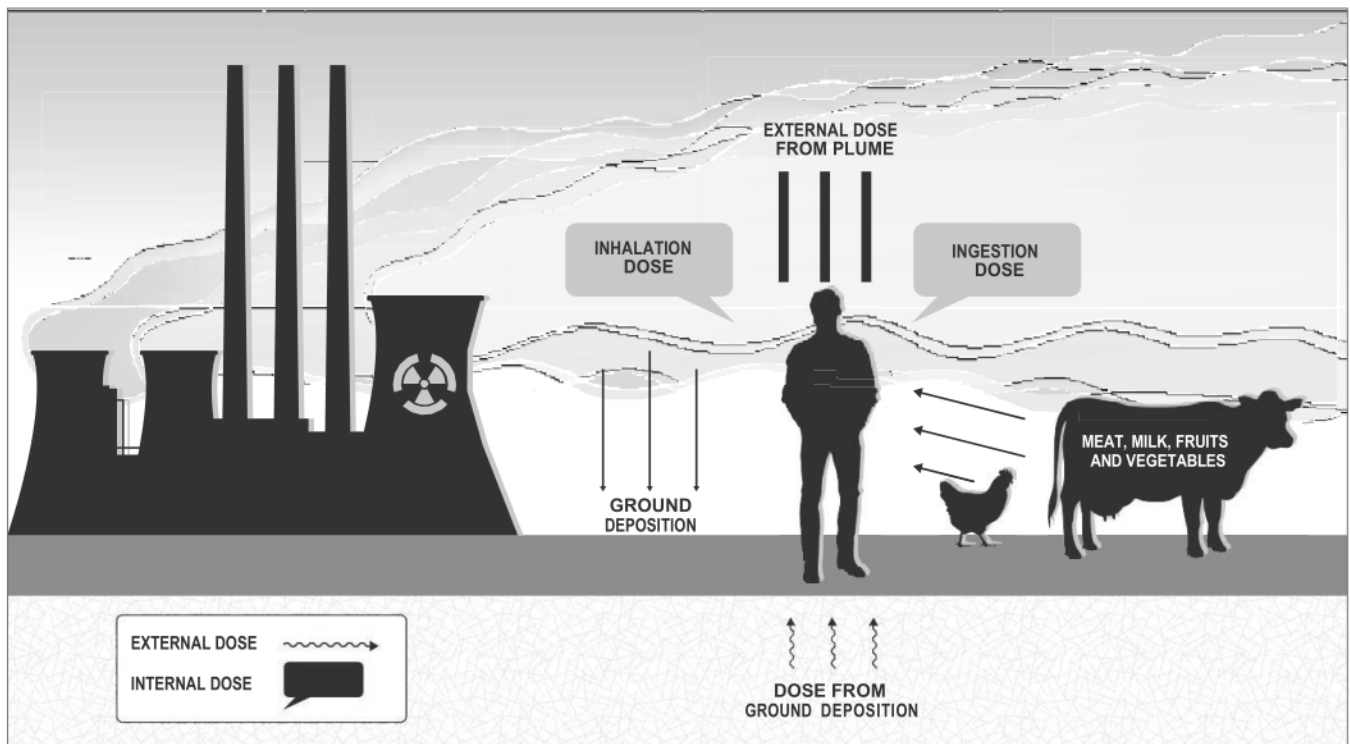


Figure 1: Exposure Pathways

Response to nuclear emergencies requires timely interventions or protective actions to reduce or control the magnitude, duration and pathways of exposure and to mitigate the impacts on health, safety, property and environment. As emergency interventions may carry their own risks and costs, they should be optimized to maximize the benefit of the interventions and keep any resulting doses (e.g., for first responders) and residual radiological risk “as low as reasonably achievable,” taking into consideration economic and social factors (International Commission on Radiological Protection, 2009).

2.2 PLANNING FRAMEWORK FOR NUCLEAR EMERGENCY MANAGEMENT

2.2.1 Response Goals

In addition to the goals outlined in the *B.C. Emergency Management System*, the *International Atomic Energy Agency (IAEA) GSR Part 7* identifies the following practical goals of response to a nuclear emergency at all levels of jurisdiction:

- Regain control of the situation and mitigate consequences;
- Save lives;
- Avoid or to minimize severe deterministic effects;
- Render first aid, to provide critical medical treatment and to manage the treatment of radiation injuries;
- Reduce the risk of stochastic effects;
- Keep the public informed and to maintain public trust;
- Mitigate, to the extent practicable, non-radiological consequences;
- Protect, to the extent practicable, for the resumption of normal social and economic activity.

2.2.2 Planning Principles and Requirements

Nuclear emergency management activities and measures are based on international safety standards and guidance. The objective of these preparations is to execute the following essential elements of a nuclear emergency response in a manner that is effective, timely and coordinated.

B.C.’s response will implement the following principles at a provincial level:

- The identification of an emergency or potential emergency situation, initial assessment, and notification;
- The implementation of coordinated response structures and preparation for mobilization of resources upon receipt of notification;
- Make arrangements for the protection of emergency workers;
- The provision of accurate and complete information on all aspects of the event to the appropriate government departments and agencies, elected officials, other countries, international organizations, the media and the public;
- The implementation of optimized protective actions to protect health, safety, property and the environment from a variety of radiological hazards;
- The mobilization of necessary resources, including logistics, scientific and communication resources over the duration of the emergency to mitigate the radiological consequences;
- The provisions for human and environmental radiological monitoring, and dose assessments;
- The co-ordination of national emergency arrangements and capabilities with international emergency arrangements;
- The preparation for the transition from an emergency situation to recovery;
- The involvement of relevant parties during all phases of emergency management; and

- The provision of accurate and appropriate public information.

2.3 CATEGORIES OF NUCLEAR EMERGENCIES AND PLANNING LINKS

The FNEP divides nuclear emergencies into categories according to the potential scope of impacts on Canada and the scale of federal response expected for a severe event.

To ensure consistency, the BCNEP follows federal categories. This section identifies the planning links for these categories.

2.3.1 Category A: An Emergency at a Nuclear Power Plant in Canada

Category A includes all major nuclear emergencies occurring at nuclear power plants that could lead, or have led, to off-site radiological consequences and could require the implementation of emergency plans by affected utilities, municipalities/regions and provinces. Category A emergencies have the potential to require the most comprehensive federal government response due to their potential scope, and the corresponding federal role for regulation, nuclear liability, and interprovincial and international liaison.

Provinces that could be most impacted by a nuclear emergency at a licensed nuclear power plant in Canada are Ontario, Quebec, New Brunswick, and Nova Scotia, which host such facilities or are within a few hundred of kilometers of Canadian nuclear power plants. B.C. does not have a nuclear power plant and the closest Canadian nuclear power plant is in Ontario. A Category A incident anywhere in Canada would likely have economic and trade implications for the whole country (e.g., food exports).

2.3.2 Category B: An Emergency at a Nuclear Power Plant or Research Reactor in the United States or Mexico

Category B events are major nuclear emergencies at nuclear power plants or research reactors outside Canada but within North America.¹ These events could have direct and indirect impacts on Canada or Canadians in the United States or Mexico or could result in requests for assistance under bi- or multilateral international agreements. Such events could require the implementation of emergency plans by affected municipalities/regions in B.C. and the BCNEP.

Of particular relevance for the BCNEP are the Columbia Generating Station, Benton County, Washington State, USA, the Hanford Site, Benton County, Washington State, USA and the Washington State University reactor, Pullman, USA.

The Province would consider activating PNEMA, an inter-jurisdiction agreement between Alaska, Idaho, Oregon, Washington, the Yukon and British Columbia for co-operating during emergency events, including the provision of emergency management assistance requested by the impacted member jurisdiction. In a nuclear event, B.C. would verify the need for assistance and contact PNEMA's International Coordination Group (ICG). The ICG exercises overall co-ordination and control of all activations of the PNEMA system and would co-ordinate among PNEMA leadership and B.C. to compile resource lists offered by member signatories.

Relevant portions of the FNEP and the BCNEP will be used to support the domestic and international response, including the provision of support to B.C. and to Global Affairs Canada (GAC). Actions could include responding to requests from B.C. for assistance with risk assessments, trans-boundary consequence management and protective actions, protecting Canadians living or travelling in the affected areas, and controlling food and material imports into Canada.

¹ Research reactors are not usually part of FNEP Category B, but have been included exceptionally for B.C.

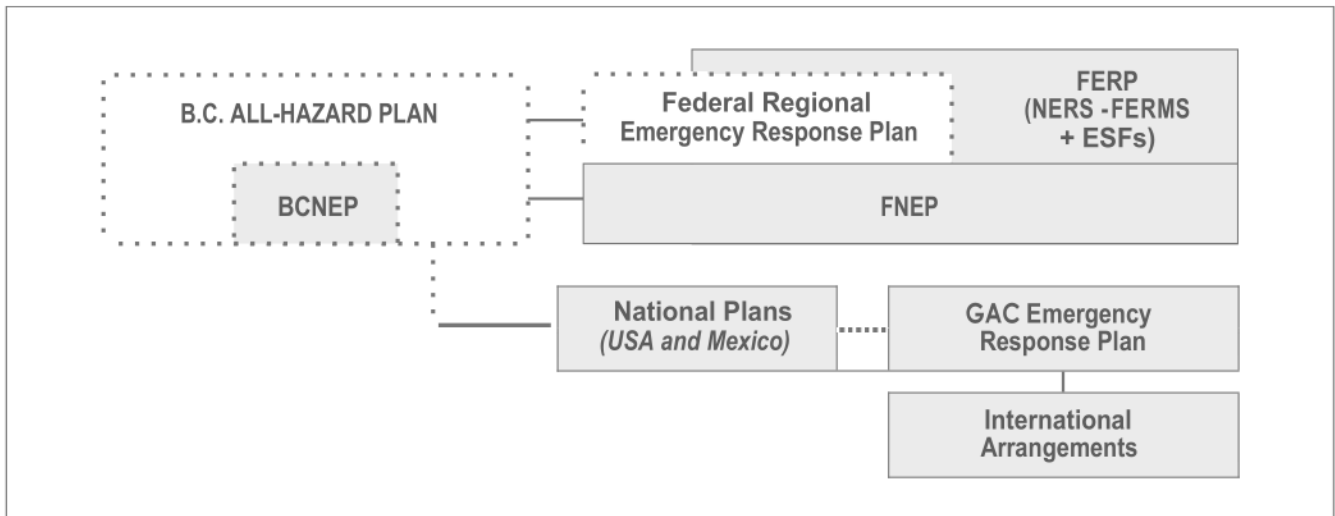


Figure 2: Planning Relationship for CATEGORY B emergencies at a nuclear power plant or research reactor in the US or Mexico. Dashed Lines indicate inclusion as applicable.

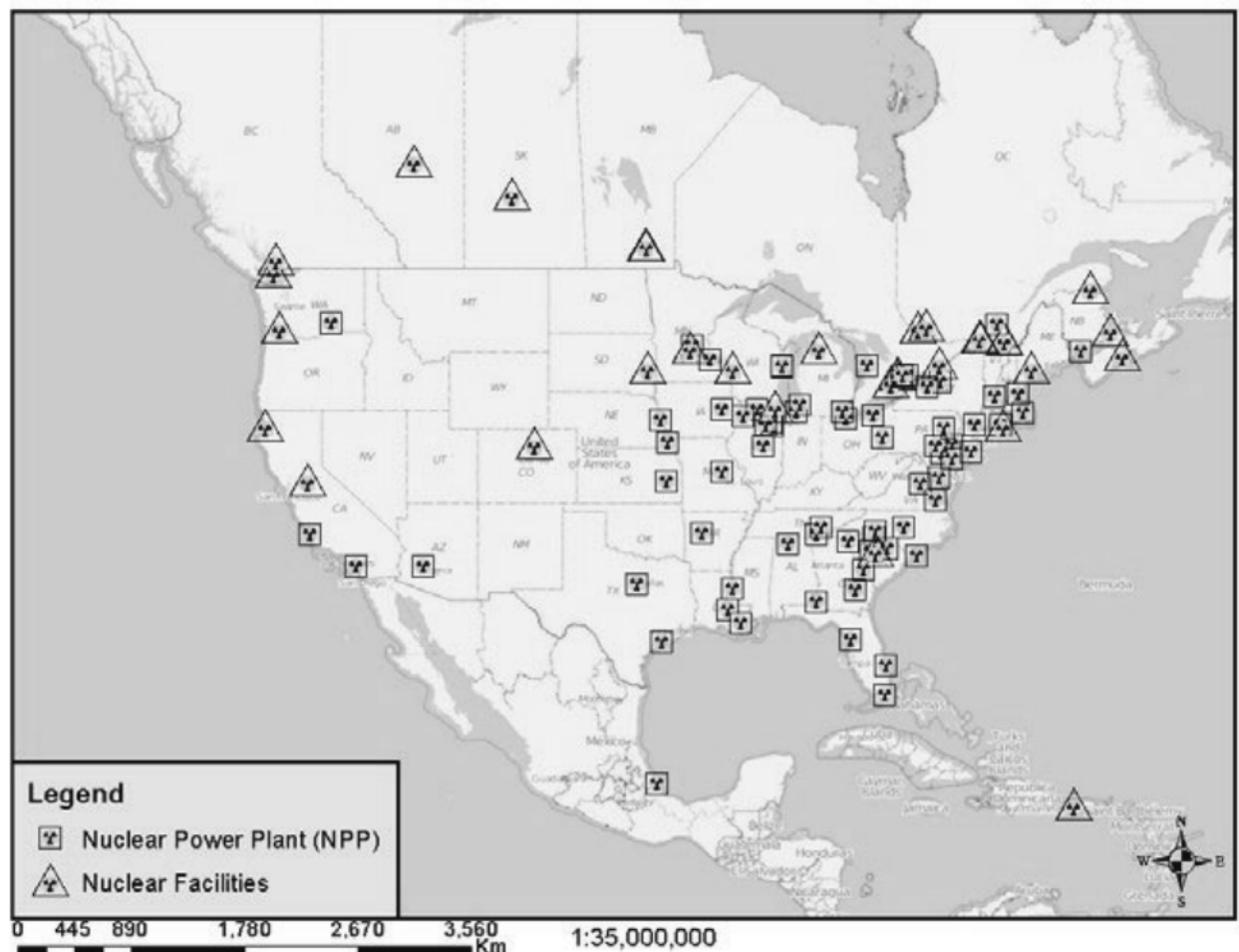


Figure 3: Nuclear power plants and facilities in North America

2.3.3 Category C: An Emergency Involving a Nuclear-Powered Vessel in Canada

Category C includes emergencies involving nuclear powered vessels or vessels carrying fissionable material in port or in transit in Canadian waters. The Department of National Defence and the Canadian Armed Forces (DND/CAF) is responsible for overseeing the safety of visits of foreign military nuclear-powered vessels to Canadian ports and is the Canadian on-site authority in the event of an emergency. Category C events could require the implementation of emergency plans by affected

municipalities, including the application of urgent protective actions. In B.C., there are only two ports authorized to host a military nuclear-powered vessel – Canadian Forces Base Esquimalt and the Canadian Forces Maritime Experimental and Test Ranges at Nanoose Bay.

The FNEP may be implemented on the specific request of DND/CAF and/or B.C., via the Government Operations Centre. The federal government will be responsible for communication with the international community according to established arrangements.

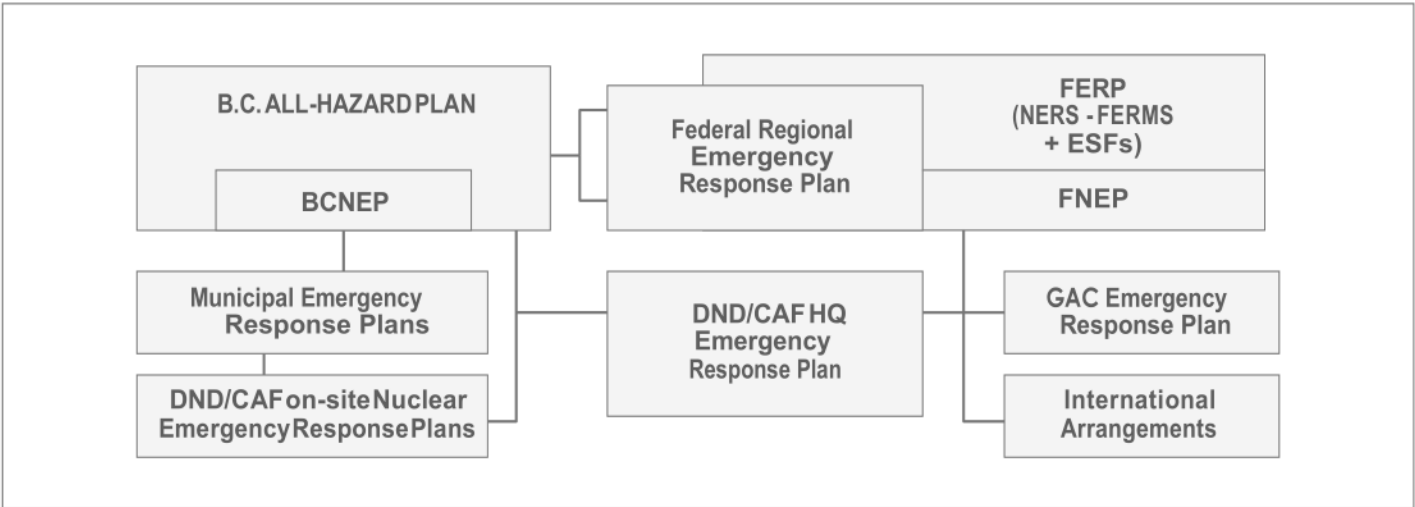


Figure 4: Planning relationships for Category C emergencies involving a nuclear-powered vessel in Canadian waters

2.3.4 Category D: Other Nuclear Emergencies or Potential Threats in North America

Category D includes other nuclear emergencies or potential threats in North America that may require a multi-departmental or multi-jurisdictional response to deal with radioactive contamination or exposure of people, property and the environment. Examples of Category D events include, but are not limited to:

- Events involving nuclear facilities (e.g., research reactors such as the TRI-University Meson Facilities laboratory in Vancouver), ports, or activities (e.g., during transportation or licensed use of nuclear devices or radioactive substances) in B.C.;

- Inadvertent dispersal of radioactive contamination (e.g., a re-entry of a nuclear-powered satellite);
- Widespread radioactive contamination of food supplies, property or the environment;
- Malicious acts resulting in human exposure to unshielded radiological sources (when elements of the FNEP and BCNEP may be used in conjunction with other plans).

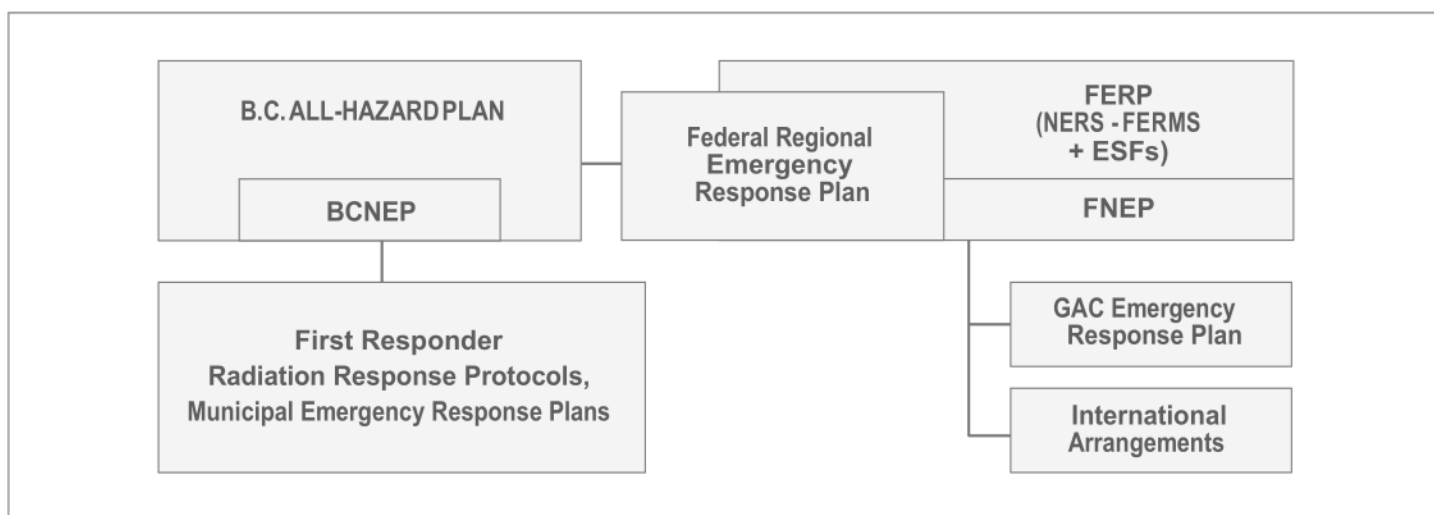


FIGURE 5: Planning relationships for Category D – other serious nuclear emergencies or threats to North America.

2.3.5 Category E: A Nuclear Emergency Occurring Outside of North America

Category E includes all nuclear emergencies outside of North America. Such an emergency would be unlikely to require urgent protective actions or restrictions of food grown in Canada. However, an emergency distant from Canada may still require a coordinated and sustained federal and provincial response to deal with both international and domestic issues even if the direct radiological impacts on Canadian soil are calculated to be limited. In this instance, GAC will co-ordinate Canada's response to the emergency outside of North America.

The main focus of the response from other federal partners will be on assessing the radiological impact and protecting Canadians living or travelling in the affected country(ies), providing advice and implementing protective actions for diplomatic staff and Canadian citizens abroad, assurance monitoring for conveyances and travelers arriving in Canada, control of food and material imports into Canada from the affected areas, assessing direct and indirect impacts on Canada, and informing the public.

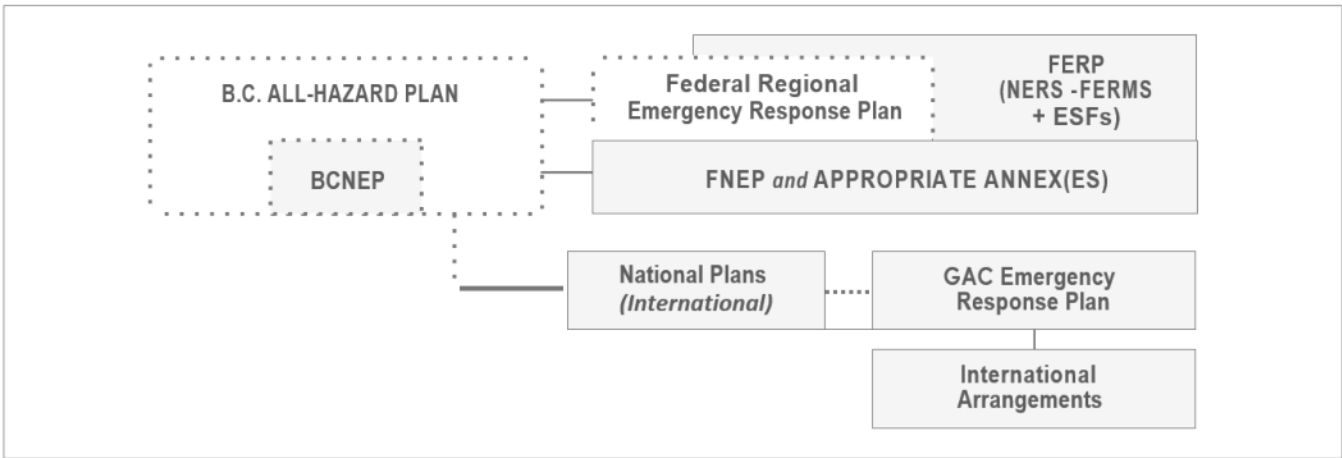


FIGURE 6: Planning relationships for a CATEGORY E nuclear emergency outside North America Dashed lines indicate inclusion as applicable/appropriate

3. PLANNING CONTEXT

Provinces that have nuclear power plants have developed specialized plans and extensive capabilities to address the potential for a major nuclear accident. B.C. manages other major risks (e.g. floods, fires) and recognizes nuclear accidents as a potential hazard of low risk for B.C., for which the province has minimal capability to respond. In addition, there are several resources located in British Columbia.

Table 1 outlines planning implications for B.C. with respect to each category of nuclear emergency.

This planning environment reinforces the need to:

- Maximize the use of existing operational plans and limited capabilities;
- Maximize inter-sectorial co-ordination to undertake rapid, integrated technical assessments in the event of an accidental nuclear emergency potentially affecting B.C. (see Section 7.1 Technical Assessment);
- When required, act promptly to undertake protective actions (see Section 7.5 Countermeasures/Protective Actions);
- When required, act quickly to establish environmental monitoring (see Section 7.3 Environmental Monitoring); and
- Ensure principled and sound risk communication (see Section 7.2 Risk Communication).



Table 1: Planning implications for nuclear emergency categories

CATEGORY OF NUCLEAR EMERGENCY	CONTEXT	PLANNING IMPLICATIONS FOR B.C.
A: AT A NUCLEAR POWER PLANT IN CANADA	B.C. does not have a nuclear power plant, and the closest Canadian nuclear power plant is in Ontario.	➤ The BCNEP would likely not be activated, but the technical assessment, risk communications and environmental monitoring components could be used.
B: AT A NUCLEAR POWER PLANT OR RESEARCH REACTOR IN THE US OR MEXICO	The closest US nuclear power plant to B.C. is the Columbia Generating Station on the Hanford Site near Richland in southeastern Washington State, over 400 km from B.C. It is a boiling water reactor that delivers about 10% of the state's power supply. The Hanford Site is also undergoing extensive clean up following the years when it had nine reactors that produced plutonium for the US Defence program.	➤ A worst-case emergency in this category (e.g., a severe accident at the Columbia Generating Station nuclear power plant) could eventually result in complex patterns of contamination of food, milk and rainwater several hundred kilometers away (IAEA, 2013). While this situation would not involve urgent treatment or evacuations, the BCNEP would likely be activated with a focus on technical assessment, environmental monitoring, protective actions (e.g., food and water restrictions) and risk communications.
	Washington State University in Pullman, about 300 km from B.C., has the only research reactor in the state. This is a large research reactor and therefore is included in this category.	
C: INVOLVING A NUCLEAR-POWERED VESSEL	Foreign nuclear-powered vessels occasionally (i.e. a few times a year on average) dock at the Canadian Forces Base Esquimalt and the Canadian Forces Maritime Experimental and Test Ranges outside NanOOSE Bay on Vancouver Island.	➤ Naval reactors have considerably lower power ratings and contain less radioactive material than nuclear power plants and operate at low or zero power while alongside a Canadian naval port. ➤ However, a catastrophic accident could result in a release of radioactive material causing injuries to those nearby if protective actions are not taken. Several jurisdictions would be involved in managing the response and the BCNEP would be activated with a focus on technical assessment, protective actions and risk communications.
D: OTHER EMERGENCIES OR THREATS IN B.C. OR ELSEWHERE IN NORTH AMERICA	BC currently has two particle accelerators located at the TRI-University Meson Facility in Vancouver and at Redlen Technologies in Saanichton on Vancouver Island. Accelerators have no impact on the environment. Although highly unlikely, road accidents involving vehicles transporting nuclear or radioactive material across B.C. should be considered in the emergency plan. Such accidents, if they do occur, would have limited radiological consequences as the containers are designed to sustain the most extreme mechanical thermal shocks.	➤ Most accidents in this category in B.C. have only localized impact and are handled by on-site or on-scene emergency personnel or local first responders. ➤ A worst-case accident in this category could result in a release of radioactive material that could cause injuries and deaths to those nearby if protective actions are not taken. Several jurisdictions would be involved in managing the response, and the BCNEP would be activated with a focus on technical assessment, protective actions and risk communications.
	There are over 250 federal licenses in BC for nuclear substances and radioactive devices with, for example, universities, labs, hospitals, and mining companies. The Canadian Nuclear Safety Commission's Licensee Database is available at: www.nuclearsafety.gc.ca	
	The Vancouver Fraser Port Authority located in the Lower Mainland is the largest port by tonnage in Canada and the fourth largest in North America.	
	The Puget Sound Naval Shipyard in Bremerton, Washington, has been recycling nuclear-powered ships and submarines since 1990. It is about 100 km from Victoria.	
E: Outside North America	Small quantities of radioactive material, if any, would be expected to reach Canada and would likely not pose a risk to health, safety, property or the environment.	➤ The BCNEP would likely not be activated, but the technical assessment, risk communications and environmental monitoring components could be utilized.

4. PREPAREDNESS

Given the planning context described in the previous section, preparedness for nuclear accidents in B.C. relies heavily on existing plans, infrastructures and networks that support readiness for all hazards. This section describes preparedness activities and capabilities that are specific to nuclear threats.

4.1 DETECTION

The purpose of detection is to identify contamination in the air or on the ground in the event of an atmospheric release of radioactive material. Ongoing monitoring of the background radiation described in Section 2.1 - Nature of the Hazard and Response is a key aspect of preparedness. Health Canada's Fixed-Point Surveillance (FPS) network is a system of real-time radiation detection equipment located across Canada and a single Data Centre in Ottawa, which collects, analyses and reports the data measured at each of these monitoring stations (See Appendix G for more information).

As of 2020, there are five FPS stations at the following locations on Vancouver Island:

- Saanich
- Metchosin
- Victoria
- Nanaimo
- Sidney

There are also FPS stations in Vancouver, Haida Gwaii and Kelowna.

In addition to the FPS network, when a nuclear-powered submarine is berthed at an identified jetty the Department of National Defence and the Canadian Armed Forces (DND/CAF) will install a radiation monitoring system on the jetty and DND/CAF will conduct a survey off-base in case of an emergency. Data from these systems are available on a secure website.

4.2 TRAINING

Radiation emergencies do not occur frequently, however if they do, they can pose specific challenges for responders. As such, all agencies that could potentially be involved in responding to an incident should undertake training in the radiation, detection and appropriate use of personal protective equipment.

Section 4.2 of the B.C. CBRNE describes the capability development needed to support response capacity under the BCNEP. This includes local/regional training and exercise programs, and provincial interoperability training.

The Justice Institute of B.C. and Royal Roads University provide a wide range of training options in emergency management. DND/CAF provides training related to nuclear powered vessels. Health Canada can provide or recommend third-party training, that can be organized based on need and available resources, for the following courses:

Nuclear Emergency Response Management: A three-day course that provides the basic knowledge required to respond to a nuclear-powered vessel reactor and weapon emergency.

METER: Basic Concepts of Radiation and Protection Principles: an eLearning course designed to provide basic concepts of radiation for response to a radiological or nuclear emergency. Available publicly at <https://training-formation.phac-aspc.gc.ca/>

METER Course: a course that targets first responders and receivers, introducing the concepts of radiation, radiation biology and personal protective equipment.

Field Response Training: an intensive, week-long course that provides training in both radiation/radioactive decay theory and field techniques for detecting and removing radioactive material.

4.3 EXERCISES

The development of the BCNEP was informed by scenario-based planning sessions with key stakeholders, and all involved agencies share a strong commitment to exercising and continually updating and improving emergency plans. DND/CAF in Esquimalt regularly exercise their plans related to nuclear powered vessels and welcome the presence of provincial and local stakeholders as participants and observers.

Efforts should be undertaken to regularly exercise sections of the BCNEP. The Ministry of Health can lead the co-ordination of exercises with participants from local governments, First Nations, first responders, health authorities, provincial ministries, DND/CAF and federal departments, as appropriate.

4.4 CAPABILITIES

Section 4.2 of the B.C. CBRNE describes the capability development needed to support response capacity under the BCNEP.

Appendix C provides an overview of resources and capabilities in the health authorities concerning the management of radio-nuclear accidents in B.C.

4.5 RESOURCES

Preparedness for nuclear accidents is informed by an extensive international knowledge base, including numerous peer-reviewed journals and the following resources:

- A series of *Radiation Issue Notes* developed by the BC Centre for Disease Control (BCCDC);
- Information on clinical, analytical, and consumer radiation provided online by Health Canada;
- *Extensive educational resources* provided online by the Canadian Nuclear Safety Commission;
- Standards, guides, fact sheets and books available through the International Atomic Energy Agency (IAEA)²;
- Resources available through the Oak Ridge Institute for Science and Education's *Radiation Emergency Assistance Center/Training Site (REAC/TS)*;
- Canadian Nuclear Laboratories *Nuclear Review* publications; and
- Canada's *Radiation Research Journal*.

Agencies can use these and other resources to enhance their readiness to respond.

² *Preparedness and Response for a Nuclear or Radiological Emergency, General Safety Requirements. GSR Part 7*

5. KEY AGENCY ROLES AND RESPONSIBILITIES

5.1 SITE OPERATORS AND LICENSEES

Operators of nuclear generating stations, research reactors, licensed nuclear facilities and licensed activities in Canada are responsible for safe operations and for on-site or on-scene emergency management. This is performed within the regulatory framework overseen by the Canadian Nuclear Safety Commission (CNSC) for civilian nuclear activities and/or by the DND/CAF for activities within its authority.

Nuclear research facilities and licensees are required to set up and maintain the organization, equipment and response procedures necessary to meet the functions and responsibilities required by the CNSC pursuant to the *Nuclear Safety and Control Act* (1997) and its regulations for Class I and II nuclear facilities. Site operator/licensee emergency plans must include notification to CNSC, local authorities and first responders as appropriate. DND/CAF is excluded from the application of the act and its regulations. However, DND/CAF maintains the organization, equipment and response procedures necessary to respond to a nuclear emergency onboard a nuclear-powered vessel, including the requirement to notify local authorities, i.e. DND/CAF maintains requirements that are consistent with those established under the act and its regulations.

All persons who handle, offer to transport, transport or receive nuclear substances in B.C. must comply with the CNSC's *Packaging and Transport of Nuclear Substances Regulations and the Transportation of Dangerous Goods Regulations*. These regulations include the requirement to immediately notify CNSC and any licensee associated with the material in the event of an accident.

The site operator/licensee (for licensed facilities) or on-scene responders (for other events) will manage the on-site or on-scene response.

5.2 FIRST RESPONDERS

First responders work at the site level of an event and include police, fire and ambulance. B.C.'s *All-Hazard Plan* describes the general roles and responsibilities of first response organizations. The B.C. Emergency Health Services is part of the provincial health system and is also described in the *Public Health and Medical Services Annex* of the *All-Hazard Plan*.

The Royal Canadian Mounted Police (RCMP) is designated as the lead agency for terrorist CBRNE events and, if they are the police of jurisdiction, they are the lead agency for criminal CBRNE events. However, they can also assist other agencies during a non-terrorist or non-criminal CBRNE event. All requests for RCMP CBRNE assistance during a CBRNE event should be forwarded through the local police.

First responder organizations have their own radioactive material response protocols based on resources like those developed by the BCCDC, and/or the Canadian Nuclear Safety Commission.

First response to a potential nuclear accident is based on the protection principles of reducing exposure time, maintaining maximal practical distance from the source and shielding. Typical steps include:

- Reconnaissance and notification;
- Using radiation detection instruments;
- Establishing hot, warm and cold zones;
- Using personal protective equipment;
- Extraction and decontamination; and
- Transport to hospital.

5.3 LOCAL AUTHORITIES

Local authorities include municipalities, regional districts and First Nations communities with treaty agreements. Local authorities hold primary

responsibility for emergency planning, response and recovery within their jurisdictions. Although not required, some treaty First Nations communities have formal agreements with neighbouring jurisdictions regarding emergency services and programs.

Under Section 9(2) and 9(3) of B.C.'s *Emergency Program Act (1996)*, local authorities must develop emergency plans for response and recovery as well as establish an emergency management organization to develop and implement emergency plans and other preparedness, response and recovery measures. The *Local Authority Emergency Management Regulation (1995)* requires local authorities to prepare emergency plans which reflect and are based on the potential emergencies and disasters that could affect all or any part of their jurisdictional area.

5.3.1 Health Authorities

The health system in B.C. includes five regional health authorities, the First Nations Health Authority, and the Provincial Health Services Authority, which includes Health Emergency Management BC, BC Emergency Health Services (BCEHS) and the BCCDC. Health authorities are the operational arm of the provincial health system, delivering emergency, acute, public health, environmental health, community care and mental health services.

Hospitals, administered by the regional health authorities, operate a number of programs that could be used in response to a nuclear emergency. Hospitals may draw upon existing decontamination plans and protocols based on the nature of the situation and available resources. Hospitals may also be seen as a source of knowledge, screening and medical countermeasures, and will work closely with their nuclear medicine subject matter experts in the event of a nuclear accident. Regional health authorities will play a key role in communicating with the public with direction on specific health advice being led by medical health officers (MHOs)

in conjunction with the Provincial Health Officer (PHO). For larger scenarios, the PHO may take the lead in health communications in co-ordination with health authority MHOs. For a list of health authority resources that may be applicable in a nuclear emergency, refer to *Appendix C – Summary of Radiation Resources in the B.C. Health Authorities*.

5.4 PROVINCE OF B.C.

B.C.'s *All-Hazard Plan* provides a detailed description of the emergency management roles and responsibilities of provincial ministries and organizations. This section highlights key aspects of these roles with respect to management of accidental or unintentional nuclear emergencies. However, given the complexity of a nuclear event, enhanced integration and flexibility may be required to ensure co-ordinated decision-making and information sharing. The Ministry of Health will work closely with the appropriate stakeholders to ensure activation of the most appropriate command and coordination structure to achieve the required effect.

5.4.1 Ministry of Health and Other Health System Organizations

The *Public Health and Medical Services Annex* to the *All-Hazard Plan* provides a detailed description of emergency management in the provincial health system.

The Ministry of Health is designated as the key ministry for *radiation spills under Schedule 1 of B.C.'s Emergency Management Program Regulation*, and administers the BC Nuclear Emergency Plan (BCNEP).

Working together, the following actors play key roles in health-related planning with respect to accidental nuclear emergencies:

- The PHO is responsible for the planning, preparedness and response co-ordination for the public health aspects of emergencies or threats and is the primary provincial public health spokesperson.
- The BCCDC offers a wide range of support to the PHO, providing evidence based best practice knowledge on risk reduction, control of hazards and treatment regarding radiation, providing public information, and maintaining any provincial supplies of medical countermeasures. In some scenarios, the PHO may delegate lead response to the BCCDC.

- The Ministry of Health's emergency management unit ensures that the provincial health system is capable of planning for, responding to and recovering from the impacts of extreme events. The emergency management unit has a 24/7 Duty Officer program and is responsible for the Health Emergency Coordination Centre (HECC) described in Section 6.2.4.

The BCNEP is a fully scalable plan and the Ministry of Health may take the lead in situations where components are used to address potential or minor threats, with support from FNEP resources and services related to preparedness. The PHO, in co-operation with the emergency management unit or HECC, will assess the need to activate the provincial emergency management system. In the event of an accidental or unintentional nuclear emergency involving the activation of the provincial emergency management system, the Ministry of Health will:

- Co-chair the Central Coordination Group with EMBC to provide strategic direction and oversight;
- Work collaboratively with EMBC to identify and activate the most appropriate provincial emergency management response structure;
- Play a key role in decisions concerning protective actions (PHO/BCCDC);
- Provide the government's public health spokesperson;
- Act as a lead liaison and coordinator with the provincial health sector; and
- Maintain liaison and co-ordination with Health Canada and the Public Health Agency of Canada (PHAC).

5.4.2 Emergency Management BC (EMBC)

EMBC is housed within the Ministry of Public Office and Solicitor General and is the coordinating agency for all provincial emergency management activities. In response to a significant accidental nuclear emergency, EMBC will:

- Work collaboratively with the Ministry of Health to identify and activate the most appropriate provincial emergency management structure;
- Co-chair the Central Coordination Group (if convened) with the Ministry of Health to provide strategic direction and oversight;
- Co-ordinate the response with provincial ministries and agencies and local/regional authorities, including requirements for sheltering and/or evacuation of the public in affected areas – this may include the deployment of the provincial co-ordination team;
- Assist in distributing public information, advisories and warnings on behalf of the provincial health officer Ministry of Health;
- Provide notifications to all relevant stakeholders; and
- Through the BC Coroners Service:
 - Provide medical and legal direction with respect to the processing and disposition of any contaminated human remains;
 - Take possession of, transport, and secure storage for any human remains;
 - Direct and establish temporary mortuary services;
 - Mitigate gaps for the remediation of an event with radioactive contamination;
 - Provide security of contaminated worker(s).

5.4.3 Ministry of Environment and Climate Change Strategy (MoE)

The MoE has legislated responsibilities relating to the generation of hazardous materials, their storage and their transportation. The ministry also has legislated responsibilities that include contaminated sites and land remediation activities. In the event of a significant, off-site nuclear accident, the ministry should be notified to ensure provincial legislation compliance. The Ministry of Environment will take an active role in unified command and provide subject matter expertise as it relates to their legislation.

5.4.4 Ministry of Agriculture

The Ministry of Agriculture is responsible for healthy and safe agri-food and seafood production and post-production processing. In the event of a significant nuclear accident, the ministry will:

- Liaise with the Canadian Food Inspection Agency, Health Canada, the Department of Fisheries and Oceans and the BCCDC to determine appropriate measures to be taken in the event of a nuclear emergency;
- Provide advice to farmers and aqua culturists on the protection of crops, livestock and provincially managed shellfish and marine plant stocks. Encourage adoption of agri-food and seafood practices that minimize nuclear related risks B.C. food products may pose to the public;
- Use the ministry's Farm Livestock Premise Identification System and other information to identify agri-food livestock producers potentially impacted by a nuclear incident;
- Co-ordinate the emergency relocation and care of poultry and livestock; and
- Assist the Ministry of Health with food safety.

5.4.5 Government Communications and Public Engagement (GCPE)

GCPE has the primary responsibility for the development of the provincial communications strategy. In the event of an accidental nuclear emergency involving the activation of the PECC, GCPE will:

- Assign a representative to the Central Coordination Group;
- Gather information from a variety of sources to inform public messages and provide briefing material;
- Liaise with colleagues in external agencies;
- Draft news releases, information bulletins, FAQs, etc. to update public; and
- Support social media channels.

5.5 FEDERAL GOVERNMENT

The roles and actions of the following federal agencies during a nuclear or radiological emergency will be coordinated through the Federal Nuclear Emergency Plan (FNEP).

5.5.1 Public Health Agency of Canada (PHAC)

Within the federal Health Portfolio, responsibilities for emergency management activities are shared by two organizations: Health Canada and PHAC. The Public Health Agency of Canada (PHAC) is part of the Health Portfolio and its activities focus on preventing chronic diseases, like cancer and heart disease, preventing injuries and responding to public health emergencies and infectious disease outbreaks. The Health Portfolio takes action to assist provinces and territories to protect and mitigate the risks to the health of Canadians. The Health Portfolio Operations Centre is the hub for these activities. The western regional office facilitates this interaction with the B.C. Ministry of Health, commonly through a regional liaison officer assigned to the B.C. Health Emergency Coordination Centre.

5.5.2 Health Canada

Health Canada administers FNEP, maintains the 24/7 FNEP Duty Officer program, and has the authority to modify the response level of the FNEP. In the event of a nuclear accident affecting B.C., through the leadership of Health Canada, the FNEP Technical Assessment Group (FNEP TAG) will:

- Monitor trigger criteria and make decisions about FNEP response levels as described in Section 9.1 of this plan;
- Upon request, collaborate with the province in technical assessment;
- Respond to provincial requests for FNEP resources and services as described in Appendix G; and
- Collaborate with the province in co-ordinated, proactive and transparent public communications.

5.5.3 Department of National Defence / Canadian Armed Forces (DND/CAF)

The Department of National Defence and the Canadian Armed Forces (DND/CAF) plays a major role in Category C events. In the event of a nuclear-powered vessel reactor emergency, DND/CAF will:

- Conduct off-site surveys;
- Assess risk to health; and
- Make recommendations on proactive measures.

5.5.4 Public Safety Canada

Public Safety Canada (PS) is responsible for the Government Operations Centre in Ottawa and the Federal Coordination Centre in B.C. and is responsible for overall federal co-ordination under the FERP when an emergency requires a coordinated Government of Canada response. In the event of a significant nuclear accident affecting B.C., PS will:

- Activate the Government Operations Centre and link with the PECC as required and

Monitor the response of the licensee;

- Evaluate response actions;
- Provide technical advice and regulatory approval where required; and
- Provide field response to assist local authorities as needed.

described in the FERP and B.C. Emergency Response Management System; and

- Activate the Federal Coordination Centre and undertake the federal-regional co-ordination described in Section 5.

5.5.5 Canadian Nuclear Safety Commission (CNSC)

The CNSC regulates the use of nuclear energy and materials in Canada. In the event of a nuclear accident involving a licensee in B.C., CNSC will:

5.5.6 Federal Summary of Responsibilities

The *Federal Nuclear Emergency Plan (FNEP)* details the roles of the federal agencies listed above and other federal departments and FNEP groups. Refer to the FNEP link above for the most recent version of the list of Nuclear Emergency Functions.

These roles and responsibilities address the FNEP nuclear emergency functions and are co-ordinated through the FNEP TAG.

5.6 FEDERAL COMMUNICATIONS

In an emergency, as outlined in the FERP, PS's Communication Directorate assumes the lead for coordinating whole-of-government public communications among federal, provincial and local partners and stakeholders.

As indicated in the FERP, the primary whole-of-government communications objectives in an emergency are:

- To assist when possible to minimize the threat to Canadians affected by the event, and to disseminate clear, factual and consistent information about the event.
- To convene teleconferences, as needed, with implicated federal, provincial and local departments, agencies and stakeholders, in order to share situational awareness, provide strategic communications advice, and coordinate key messages and communications activities among partners, including facilitating the development of communications products, web and social media approaches, media relations protocols, media technical briefings and Ministerial announcements/events.
- To monitor the public environment, including media coverage and social media activity.

All federal, provincial and local organizations remain responsible for communicating about their respective mandates.

5.7 INTERNATIONAL

For nuclear emergencies in B.C. that may have trans-boundary impacts of radiological safety significance, the Province of B.C. is responsible for informing and coordinating with all its neighbouring jurisdictions, in accordance with its own plans and agreements. B.C. is a signatory of PNEMA, and an active partner in the Pacific Northwest Border Health Alliance.

The federal government notifies, informs and liaises with the international community, issues requests and manages offers of assistance under international conventions and agreements. Health Canada and the CNSC are the Canadian Competent Authorities for communications with the IAEA. Health Canada transmits the requests and offers of international assistance. PHAC is the Canadian focal point for communications with the World Health Organization and the *International Health Regulations*. Other federal authorities, including GAC, also have responsibilities to communicate with their stakeholders in the international community.

6. RESPONSE STRUCTURE

The following section provides an overview of how agencies will co-ordinate the response to a nuclear emergency. The structures outlined in this section will carry out the operational elements in Section 7.

6.1 ORGANIZATIONAL CHART

Figure 6 depicts the links between emergency management structures potentially activated under the British Columbia Nuclear Emergency Plan. The chart demonstrates that nuclear accidents potentially affecting B.C. range from more localized events requiring an on-site bottom-up response, to more distant and international events involving a broader top-down response

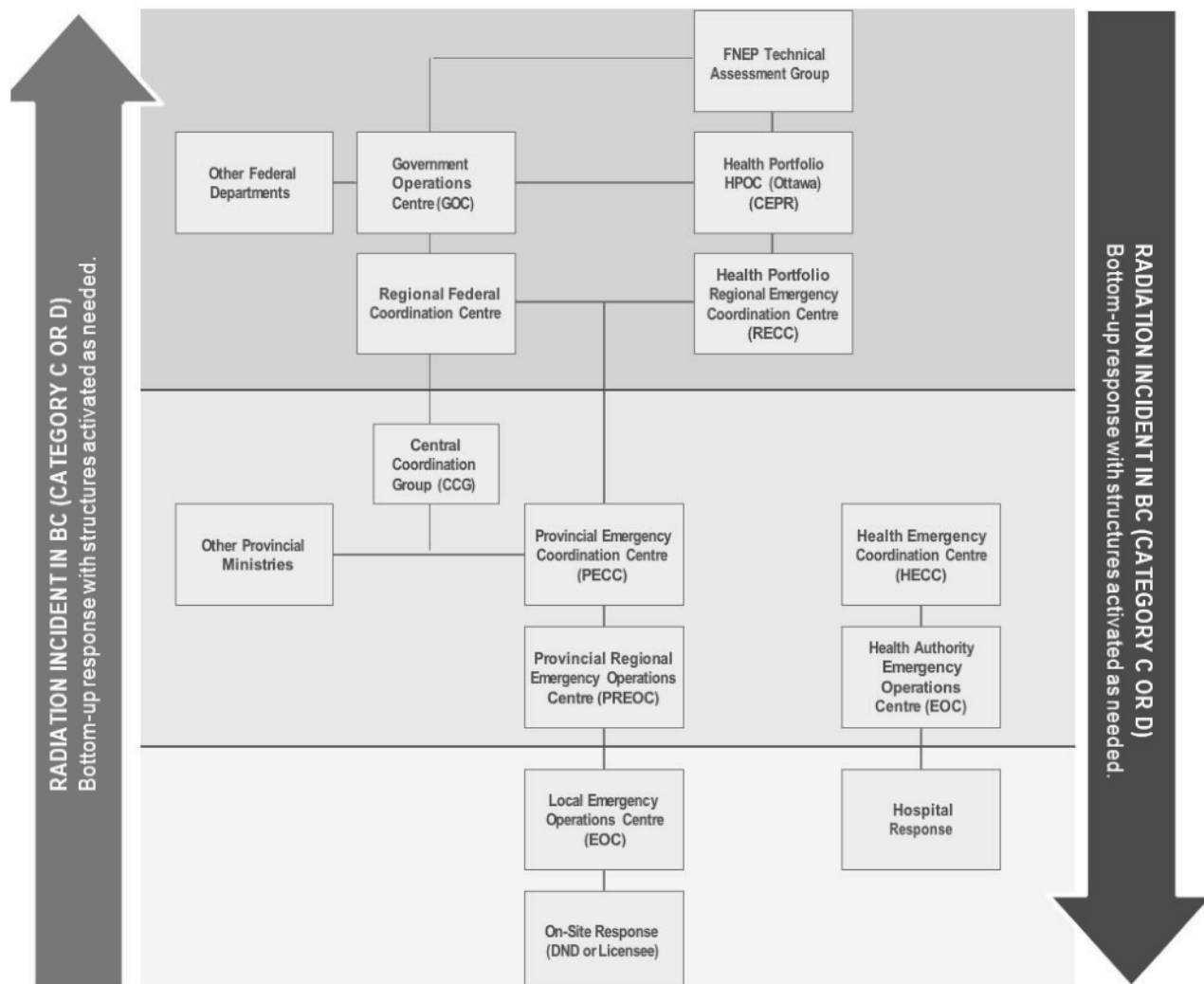


Figure 7: British Columbia Nuclear Emergency Organizational Chart

6.2 KEY RESPONSE STRUCTURES/ENTITIES

6.2.1 B.C. Emergency Management System

All provincial government ministries, agencies and government corporations with designated responsibilities under B.C.'s *Emergency Program Management Regulation* are required to apply the policies, guiding principles and standards set out in the B.C. Emergency Management System document.

Provincial emergency policy direction is provided by a Central Coordination Group, which is composed of senior government and non-government officials selected in accordance with the nature of the emergency. In the event of a major disaster, a Minister-Deputies Emergency Committee may be convened to provide high-level policy and resource decisions concerning the response.

6.2.2 Emergency Operations Centres

A nuclear accident will result in the activation of an Emergency Operations Centre (EOC) by one or more of a number of potential agencies in B.C. (e.g., site operator/licensee, fire services, BCEHS, local authority, regional health authority, provincial ministries, and/or DND/CAF in the case of an event involving a nuclear-powered vessel). The role of an EOC is to co-ordinate the agency's response.

B.C. Emergency Management System standards are recommended best practices for all agency EOCs in B.C., to provide for maximum inter-operability within the overall provincial emergency management system.

6.2.3 Provincial Regional Emergency Operations Centres (PREOC) / Provincial Emergency Coordination Centre (PECC)

EMBC incorporates six regional offices, each with a PREOC. PREOCs are responsible for the provision and co-ordination of provincial support for local authorities and First Nations within designated regional boundaries.

PREOCs receive situation reports and resource requests from local authority Emergency Operation Centres.

The PECC, located in Greater Victoria, is responsible for the overall co-ordination of an integrated provincial response. Upon activation, the PECC and HECC work closely, via liaison and regular communication, to ensure an integrated response.

6.2.4 Health Emergency Coordination Centre

The Ministry of Health's emergency management unit operates a 24/7 Duty Officer program and houses the HECC, which can be activated to provide policy direction and support to the health authorities and other health agencies. In a nuclear emergency, the HECC serves as the health system's co-ordination and communications link with Emergency Management BC and the rest of the provincial emergency management structure, including Health Canada and PHAC.

6.2.5 Federal Nuclear Emergency Plan – Technical Assessment Group

The Federal Nuclear Emergency Plan Technical Assessment Group (FNEP TAG) is a multi-departmental group composed of scientific technical experts from designated FNEP partner organizations and is chaired by the director of the Radiation Protection Bureau in Health Canada. The FNEP TAG is responsible for gathering data, conducting assessments and recommending and/or implementing appropriate actions for the management and mitigation of off-site radiological consequences.

Section 9.3 describes the FNEP TAG supports available to B.C., upon request, and the federal/provincial accountabilities and co-ordination involved in collaborative technical assessments under the FNEP.

Federal Radiological Task Teams of subject matter experts may be deployed to the site of a nuclear emergency when specialized equipment and/or expertise are required for radiological monitoring and assessment. For an event within the scope of FNEP, Federal Radiological Task Teams will operate under the authority of their home organizations, but under the overall direction of the official of the FNEP TAG and the provincial/territorial emergency management system. Activities may include environmental monitoring, sample collection, population screening and provision of resources for emergency workers.

6.2.6 Federal Nuclear Emergency Plan Designated Officials and Response Teams

In the case of a nuclear emergency under the scope of the FNEP, the *Federal Emergency Response Management System* (FERMS), established under the *Federal Emergency Response Plan* (FERP), will be augmented by designated officials from Health Canada (HC) senior management (as primary department), senior management from the federal on-site authority and specialized FNEP TAG Subject Matter Experts (SMEs), or task teams thereof, identified in the FNEP and supporting documents.

The full list of FNEP Designated Officials at the Senior and Executive Level that have roles in the FERMS and Public Safety Government Operations Centre (PS-GOC) Governance Structure can be obtained from the FNEP, 5th edition. Only the FNEP Designated Officials that have roles and responsibilities during nuclear emergency management in the Province of B.C. are listed below.

FNEP Duty Officer (DO):

The FNEP DO is a first point of contact for stakeholders on FNEP-related issues. The FNEP DO can be contacted on a 24/7 basis and serves to triage incoming information on incidents and events. The FNEP DO maintains a log of all calls, actions, decisions and events, and notifies HC management when there are events that could require a FNEP response. Any decision to take further action rests with HC and may be made in consultation with Provincial and other FNEP partner organizations including the CNSC and PS-GOC as appropriate. **The FNEP DO can be contacted 24/7 at: (613) 954-6651.**

FNEP TAG Liaison Officers (FTLOs):

The FNEP TAG links into the overall provincial, federal, and/or international responses through FNEP TAG Liaison Officers (FTLOs). The FTLOs are embedded, as required, in the respective host Emergency Operations Centres (EOCs) and provide the necessary interface between these bodies and the FNEP TAG.

One or more FTLO(s) may, upon request or as appropriate, be dispatched to a given EOC to manage the linkages between that EOC and the FNEP TAG for an effective response. The FTLO(s) will:

- Interface the FNEP TAG with the key Incident Management System (IMS) functions of the PECC;
- Facilitate information exchange between the FNEP TAG and the PECC;
- Provide scientific or technical support in coordination with the FNEP TAG Risk Assessment and Situational Awareness Group or reach back for support that requires a more comprehensive analysis or response;
- Provide guidance in the most appropriate/efficient method of formulating requests to and from the FNEP TAG;

- Deliver any requests or relevant information from the PECC; and
- Advise, or instruct, on the proper interpretation or use of FNEP TAG products and tools.

In the Emergency Management structure of the Province of British Columbia, FTLOs primarily link the scientific activities of the FNEP TAG with those of the PECC. FTLOs located in the PECC are responsible for liaising with internal and external stakeholders.

Until the FTLO physically arrives at the PECC, direct communication via phone or videoconference will be established with the PECC Health Physicist (or alternate) through FNEP TAG Risk Assessment and Situational Awareness Group.

At the PECC, FTLO(s) will interface directly with the FNEP TAG Risk Assessment and Situational Awareness Group to support technical assessments in both organizations. All FNEP FTLOs will have a direct link into this group in Ottawa to communicate and coordinate situational awareness and provincial requests for FNEP TAG capabilities (as described in Section 10: FNEP Resources and Services).

7. OPERATIONAL ELEMENTS

7.1 TECHNICAL ASSESSMENT

Technical assessment in this context refers to the collection and analysis of all available information to assess the risks resulting from a nuclear accident. The responsibility for the assessment will differ depending on the category of the event.

The PHO and the BCCDC will normally lead this process at the provincial level. If the PECC is activated, representatives from the PHO, the BCCDC, and FNEP TAG will form the Technical Specialists Team within the PECC Planning Section to undertake technical assessments. In the event of a nuclear incident involving a nuclear-powered vessel, a representative from Island Health will also join the Technical Specialists Team.

The Department of National Defence and the Canadian Armed Forces will lead the on-base technical assessment in the event of an accident involving a nuclear-powered vessel and collaborate with local authorities and the province in conducting off-base technical assessments.

Section 9.3 describes the FNEP TAG supports available to B.C., upon request, and the federal/provincial accountabilities and co-ordination involved in collaborative technical assessments under the FNEP.

7.2 RISK COMMUNICATIONS

The history and symbolism involved in the public's perception of radiation mean that perceived risk often exceeds scientific risk (Slovic, 2012). B.C.'s experience with low assessed risks but high levels of public concern following the 2011 incident at the Fukushima nuclear power plant in Japan, demonstrated the importance of risk communication. In the event of a significant nuclear accident in B.C., principled and sound risk communication will be critical in terms of managing

the implementation of protective actions like sheltering in place and minimizing psychological stress. There will be a need to keep the public informed with available, confirmed information and provide regular updates as data is being gathered and verified.

Appendix E provides a summary from the IAEA concerning the common communication errors made in the assessment of radiological health hazards following an incident.

7.2.4 Principles

The following principles of communication will guide the response to an accidental nuclear emergency affecting British Columbia. The principles apply to all components of communication, including data gathering and analysis and information sharing.

- Appetite for information is not directly proportional to the actual risk level but is related to the perceived level of risk;
- Data needs to be gathered as quickly as possible following notification of a nuclear emergency;
- Information needs to be translated into language appropriate for the lay person/general public;
- Raw data, wherever possible, should be made available to anyone asking for it, including the public. Data should be easily accessible in the interests of transparency and good faith; and
- Responsibilities to reassure, inform, and protect the public should be acknowledged and form the basis for open information sharing between all levels of government.

7.2.5 Informing the Public

Ensuring coordinated, proactive and transparent public communications is a key feature of the B.C. Nuclear Emergency Plan. All public communications from the B.C. Government will be coordinated through Government Communications and Public Engagement, which will develop the provincial communications strategy in cooperation with the PHO, BCCDC, federal communications officials, and subject matter experts from the FNEP TAG. If the PECC is activated, this group will operate as the Information Officer Team (likely virtual) in the B.C. Emergency Management System structure, supported by the Technical Specialists Team in the Planning Section. The PHO is the primary public health spokesperson.

In the event of an accident involving a nuclear-powered vessel, the Department of National Defence/Canadian Armed Forces in conjunction with the PECC will activate a Joint Information Bureau to co-ordinate public communication.

7.3 ENVIRONMENTAL MONITORING

As described in Section 3, environmental monitoring would be a key response activity in a number of scenarios potentially affecting British Columbia. Section 4.1 describes the capabilities that exist in B.C. to support ongoing environmental monitoring. In the event of a nuclear accident, it will be important to augment these capabilities by drawing on other resources that might be accessed through the B.C. Centre for Disease Control, Ministry of Environment and/or the private sector in B.C.

Monitoring following an incident would involve testing of:

- Air and soil to track any radioactive plumes and identify hot spots; and
- Drinking water, milk, seafood and other foods and beverages, to support the implementation of restrictions as a protective action.

Section 9.4 describes the federal field resources that could be requested to support environmental monitoring.

7.4 WORKER PROTECTION

In the event that licensees and/or first responders are deployed to respond at the site of a nuclear emergency, radiation exposure to all emergency workers should be kept as low as reasonably achievable. Employers should ensure that emergency workers have and are trained in the use of appropriate personal protective equipment (PPE). B.C.'s *Occupational Health and Safety Regulation* contains legal requirements that must be met by all workplaces in the province. *Part 7, Division 3* of the regulation and the accompanying guidelines define requirements concerning radiation exposure including standards concerning control measures and the use of PPE. Refer to Appendix F for Canadian Nuclear Safety Commission recommended turn-back and permissible doses.

7.5 COUNTERMEASURES / PROTECTIVE ACTIONS

Urgent decisions regarding off-site countermeasures or protective actions will be made by first responders and local authorities and must be in consultation with the health sector as per the *Public Health Act* (e.g., local MHOs, PHO, BCCDC). British Columbia follows the current Health Canada recommendations concerning countermeasures described in **Table 2**.

Table 2: Health Canada recommended countermeasures

PROTECTIVE ACTION DEFINITION		GENERIC CRITERIA
SHELTERING	A directive to remain indoors with closed doors and windows, with ventilations systems shut off, for a few hours to two days.	10 mSv in 2 days
EVACUATION	In this context, the displacement of the population, or part of the population, from an area which has been, or may become contaminated with radioactive substances.	100 mSv in 7 days
TEMPORARY RELOCATION	Displacement of the population from a contaminated area for a period of several weeks, months or even over a year.	100 mSv/year
STABLE IODINE THYROID BLOCKING	Taking potassium iodide orally when outdoor air is expected to contain significant amounts of radioactive iodine, to block the absorption of radioactive iodine by the thyroid gland.	50 mSv in the first 7 days
INGESTION CONTROL	Restrictions of distribution and ingestion of potentially contaminated drinking water, milk, and other foods.	3 mSv/year
For additional information on Operational Intervention Levels see Table 3 in the <i>Health Canada Generic Criteria and Operational Intervention Levels for Nuclear Emergency Planning and Response</i> (2018)		

7.6 MEDICAL RESPONSE

Health emergency plans address the need to treat patients needing urgent care. Treatment of life-threatening illness and injury take precedence over decontamination and radiological assessment.

Each health authority in B.C. has a Patient Decontamination program that can be activated to provide patient triage and care. Information sources such as the Oak Ridge Institute for Science and Education's [*Radiation Emergency Assistance Center/ Training Site \(REAC/TS\)*](#) are available online to support medical teams in planning and preparing to respond to a radiation casualty.

During a radiation emergency, a significant number of emergency responders and the public may become externally exposed to radiation, contaminated with radioactive materials, or both.

Timely screening and treatment of the affected population are important components of emergency response and consequence management. [*The Canadian Guide on Medical Management of Radiation Emergencies*](#) provides a common framework from which hospitals, public

health authorities and emergency management organizations can base their response plans.

7.7 DE-ESCALATION AND THE TRANSITION TO RECOVERY

Co-ordinated by the Ministry of Health, the transition to recovery will include:

- Establishing a recovery management plan with reference levels on residual dose from long-term contamination and strategies for restoration of normal socio-economic activities;
- Monitoring of contaminated areas, assessment of potential doses to public and workers;
- Assessment of medium and long-term health hazards;
- Environmental decontamination and radioactive waste disposal operations; and
- Maintenance of dose registries for emergency workers.

8. RESPONSE PROTOCOLS

The following tables provide an overview of initial notifications, lead agencies and key actions that would take place during the types of nuclear

accidents that could require a B.C. Nuclear Emergency Plan (BCNEP) activation. Section 5 provides more detail about organizational roles.

Table 3: Category B - A significant release of radioactive material from the nuclear power plant in Washington State

NOTIFICATION TO FEDERAL, PROVINCIAL, LOCAL AND REGIONAL AGENCIES	<pre> graph TD US[US] --> CNSC[GAC] WS[WASHINGTON STATE] --> EMBC[EMBC] WS --> HLTH[HLTH Duty Officer] WS --> BCCDC[BCCDC] CNSC --> FNEP1[FNEP Duty Officer] CNSC --> PS[PS-GOC] EMBC --> LA[Local Authorities] HLTH --> HEMBC[HEMBC RHAs /FNHA] HLTH --> PHO[PHO] BCCDC --> FNEP2[FNEP Duty Officer] PS --> FNEP1 LA --> FNEP1 HEMBC --> FNEP2 PHO --> FNEP2 FNEP1 --> FNEP2 </pre>
LEAD AGENCIES	GAC LEADS INTERNATIONAL RESPONSE EMBC AND MINISTRY OF HEALTH (HLTH) CO-ORDINATE PROVINCIAL RESPONSE
KEY ACTIONS	➤ BCNEP, provincial co-ordination activated ➤ EMBC and HLTH co-lead the Central Coordination Group (CCG) ➤ PHO, BCCDC and the FNEP TAG form the Technical Specialists Team in the PECC Planning Section and undertake rapid technical assessment and make recommendations concerning protective actions, e.g. food and water, restriction of contaminated items (see Section 5.4 Countermeasures/Protective Actions). A FNEP TAG Liaison Officer (LO) would be physically or virtually embedded in the PECC ➤ B.C./WA information sharing, and collaboration takes place between established PNEMA and Pacific Northwest Border Health Alliance partners ➤ Potential deployment of the Provincial Coordination Team ➤ EMBC supports local authorities and co-ordinates across multiple ministries ➤ HLTH co-ordinates the health response, supports health authorities ➤ GCPE leads the formation of the information officer function in the PECC and supports the PHO in risk communication ➤ Province undertakes longer-term monitoring of air, impacts to agriculture and drinking water, as necessary, supported by FNEP resources

Table 4: Category C - base alert, base emergency or general emergency involving a nuclear-powered vessel in B.C.

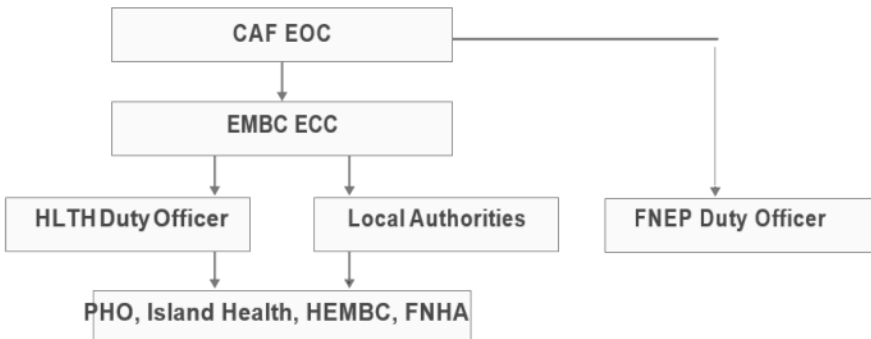
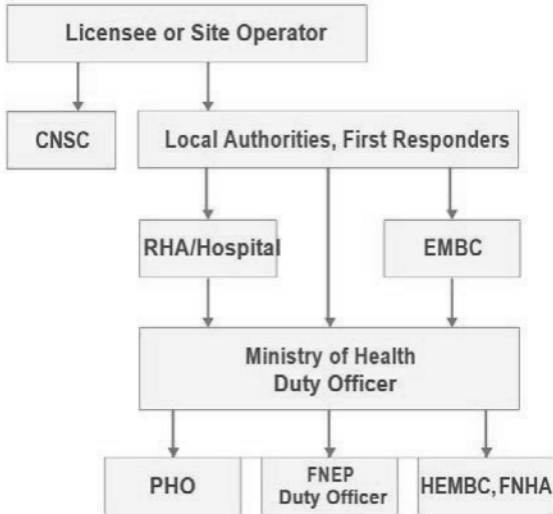
NOTIFICATION TO PROVINCIAL, LOCAL AND REGIONAL AGENCIES	 <pre> graph TD CAFEOC[CAF EOC] --> EMBC[EMBC ECC] CAFEOC --> FNEP[FNEP Duty Officer] EMBC --> HLTH[HLTH Duty Officer] EMBC --> LA[Local Authorities] HLTH --> PHO[PHO, Island Health, HEMBC, FNHA] LA --> PHO </pre>
LEAD AGENCIES	DND/CAF LEADS ALL ON-BASE ACTIVITIES LOCAL AUTHORITIES LEAD OFF-BASE RESPONSE
KEY ACTIONS	➤ DND/CAF undertakes all on-base technical assessments, response and decontamination activities ➤ Local fire and BCEHS conduct off-base first response ➤ PHO/BCCDC, Island Health and FNEP TAG form the Technical Specialists Team in the PECC Planning Section to undertake technical assessment and recommend protective actions to local authorities. DND/CAF would be virtual for the first 24-48 hours. A FNEP TAG Liaison Officer would be physically or virtually embedded in the PECC ➤ DND/CAF would conduct off-site ambient gamma radiation survey ➤ Local authorities undertake protective actions, supported by EMBC and HLTH ➤ Island Health undertakes health and medical response, supported by HLTH PHO ➤ DND/CAF, PHO/BCCDC, EMBC, GCPE, local authorities and Island Health co-ordinate public communications through the Joint Information Bureau and the Information Officer Team in the PECC ➤ EMBC supports local authorities and co-ordinates across multiple ministries ➤ HLTH co-ordinates the health response, supports Island Health ➤ Province undertakes longer-term environmental monitoring as necessary, supported by federal resources

Table 5: Category D - Nuclear accident involving a research reactor, other licensee or transportation of radioactive material in B.C.

NOTIFICATION TO PROVINCIAL, LOCAL AND REGIONAL AGENCIES	 <pre> graph TD LSO[Licensee or Site Operator] --> CNSC[CNSC] LSO --> LA[Local Authorities, First Responders] LA --> RHA[RHA/Hospital] LA --> EMBC[EMBC] RHA --> MOH[Ministry of Health Duty Officer] LA --> MOH EMBC --> MOH MOH --> PHO[PHO] MOH --> FNEP[FNEP Duty Officer] MOH --> HEMBC[HEMBC, FNHA] </pre>
LEAD AGENCIES	LICENSEE LEADS ON-SITE RESPONSE FIRST RESPONDERS AND LOCAL AUTHORITY LEAD OFF-SITE RESPONSE
KEY ACTIONS	➤ If limited to on-site, licensee notifies, responds and monitors ➤ If there are off-site implications, fire and ambulance undertake decontamination and transport ➤ Local authority activates its emergency response plan ➤ Health authority/designated hospital activate emergency plans and receive any casualties ➤ EMBC supports local authority and co-ordinates across multiple ministries ➤ HLTH supports health authority and co-ordinates health system response ➤ BCNEP, PECC and/or PREOC and HECC are activated, EMBC and HLTH co-lead the CCG ➤ PHO, BCCDC and the FNEP TAG form the Technical Specialists Team in the PECC Planning Section and undertake rapid technical assessment and make recommendations concerning protective actions, e.g. food and water, restriction of contaminated items (see Section 7.5 Countermeasures/Protective Actions). A FNEP TAG Liaison Officer (LO) would be physically or virtually embedded in the PECC ➤ GCPE leads the formation of the information officer function in the PECC and supports the PHO in risk communication ➤ Province undertakes longer-term environmental monitoring as necessary, supported by federal resources

9. FEDERAL / PROVINCIAL ACCOUNTABILITIES AND CO-ORDINATION

This section describes key aspects of federal/provincial accountabilities and co-ordination concerning the management of nuclear accidents in British Columbia.

9.1 BCNEP/FNEP RESPONSE LEVELS AND TRIGGER CRITERIA

The British Columbia Emergency Management System (BCEMS) and the B.C. Nuclear Emergency Plan (BCNEP) have three response levels:

1. Minimum;
2. Mid-Level; and
3. Full.

The *Federal Nuclear Emergency Plan* (FNEP) also has three heightened response levels, ranging from enhanced monitoring activities through to a Full-scale technical response. A complete description of the FNEP response levels can be found in the FNEP.

Subject to the specific circumstances of the emergency, the trigger to raise the response level of the FNEP and establish the FNEP TAG may be made prior to, concurrently with or following decisions under the BCNEP or Federal Emergency Response Plan response level (for example, in the case of concurrent emergencies, emergencies abroad, or situations that have started as a non-nuclear emergency). The table below describes BCNEP and FNEP response levels and trigger criteria.

Table 6: BCNEP/FNEP Response Level 1

BCEMS / BCNEP RESPONSE LEVELS	BCEMS / BCNEP ACTIVATION DETAILS	FNEP RESPONSE
ROUTINE MONITORING		FNEP REMAINS AT ROUTINE MONITORING
LEVEL 1: MINIMUM <i>Single event which is over quickly and requires only post event response and recovery activities.</i>	➤ Most accidents are handled by on- site, on-scene or first responders, and may involve a hospital response by a regional health authority ➤ HLTH/PHO may lead provincial co-ordination/response if a potential or minor threat does not reach the threshold of an emergency ➤ May involve limited activation of PREOC(s) or the PECC	➤ FNEP Response raised to Enhanced Monitoring (Level 1) ➤ FNEP TAG chair convenes FNEP Escalation discussion (along with PS, PHAC, PECC, CNSC or DND/CAF if relevant) to determine if current FNEP Response Levels is appropriate ➤ FNEP TAG minimally stood up; continual monitoring of situation ➤ Reach out to PECC and GOC for situational awareness ➤ Reach out to PECC, the CNSC or DND/CAF (as appropriate) for technical information ➤ FPS Network data continually shared with partners through agreed upon mechanisms. ➤ FNEP TAG to provide weather information and other technical information to the PECC, if requested ➤ Notification to IAEA and United States of America, if relevant

Table 7: BCNEP/FNEP Response Level 2

BCEMS / BCNEP RESPONSE LEVELS	BCEMS / BCNEP ACTIVATION DETAILS	FNEP RESPONSE
ROUTINE MONITORING		FNEP REMAINS AT ROUTINE MONITORING
LEVEL 2: MID-LEVEL <i>Major or multiple events. Two or more community, ministry or agency Emergency Operation Centres activated.</i>	➤ Provincial emergency management structure is activated, and functional positions are staffed as required ➤ CCG activated ➤ M-DEC activated if deemed necessary	➤ FNEP Response raised to Assessment and Planning (Level 2) ➤ FNEP TAG chair convenes FNEP Escalation discussion (along with PS, PHAC, PECC, CNSC or DND/CAF (if relevant)) to determine if current FNEP Response Levels is appropriate ➤ FNEP TAG partially stood up (e.g., Risk Assessment and Situational Awareness); other FNEP resources (e.g. dosimetry, field teams) placed on stand-by (as appropriate to the situation) ➤ Reach out to PECC, GOC and other FNEP partners for situational awareness ➤ Reach out to PECC, the CNSC or DND/ CAF (as appropriate) for technical information ➤ FPS Network data continually shared among partners ➤ Establish FNEP TAG virtual link with PECC, followed by deployment of FTLO(s) to the PECC, if needed ➤ FNEP TAG to provide assessments appropriate to the situation (e.g. short and long-range dose projections, etc.) to support situational awareness, risk assessment and other functions. ➤ Federal field-based radiological task teams (ground, aerial and others) placed on stand-by/mobilized or deployed (at request of the PECC) ➤ Notification to IAEA and USA

Table 8: BCNEP/FNEP Response Level 38

BCEMS/BCNEP RESPONSE LEVELS	BCEMS/BCNEP ACTIVATION DETAILS	FNEP RESPONSE
ROUTINE MONITORING		FNEP REMAINS AT ROUTINE MONITORING
<i>LEVEL 3: FULL</i> <i>A major emergency or multiple events that impact a number of regions and multiple jurisdictions.</i>	➤ Provincial emergency management structure is activated and fully staffed ➤ CCG and M-DEC activated	➤ FNEP Response raised to Coordinated Federal Scientific and Technical Response (Level 3) ➤ FNEP TAG chair convenes FNEP Escalation discussion along with PS, PHAC, PECC, CNSC or DND/CAF (if relevant) to determine if current FNEP Response Levels is appropriate ➤ FNEP TAG fully stood up ➤ Reach out to PECC, GOC and other FNEP partners for situational awareness ➤ Reach out to PECC, the CNSC or DND/CAF for technical information ➤ FPS Network data continually shared among partners ➤ Establish FNEP TAG virtual link with PECC, followed by deployment of FTLO(s) to the PECC, if needed ➤ Federal field-based radiological task teams (ground, aerial and others) placed on stand-by/mobilized or deployed (at request of the PECC) ➤ Other FNEP resources (as requested) placed on stand-by/ mobilized or deployed ➤ FNEP TAG to provide assessments appropriate to the situation (e.g. short and long-range dose projections, etc.) to support situational awareness, risk assessment and other functions within the GOC and PECC ➤ Notification to IAEA and USA

9.2 FEDERAL / PROVINCIAL NOTIFICATIONS

9.2.4 Initial Notifications

Early information about emergencies can come from multiple sources, including official channels or the media. The following describes formal federal/provincial notifications.

- **CATEGORY A: An emergency at a nuclear power plant in Canada:** B.C. does not have a nuclear power plant. EMBC will be included when the Government Operations Centre notify provinces/territories.
- **CATEGORY B: An emergency at a nuclear power plant or research reactor in the U.S. or Mexico:** GAC, Health Canada, Canadian Nuclear Safety Commission or Public Safety Canada/Government Operations Centre will normally be the first government agencies to receive the initial report. They, in turn, will notify the provinces and territories.
- **CATEGORY C: An emergency involving a nuclear-powered vessel in B.C.:** The Department of National Defence and the Canadian Armed Forces will notify Public Safety Canada, Federal Nuclear Emergency Plan (FNEP) Duty Officer and EMBC.
- **CATEGORY D: Other nuclear emergencies or potential threats in North America:** For nuclear accidents in B.C. with off-site implications, EMBC or Ministry of Health designated official will be notified by first responders and/or local or regional authorities and will notify the FNEP Duty Officer. If the emergency is in another province or elsewhere in North America, Health Canada will receive direct notification from the PS-GOC, the International Atomic Energy Agency (IAEA) or other partners and will notify other provinces/territories.
- **CATEGORY E: A nuclear emergency outside North America:** Health Canada will receive formal notification from IAEA and will notify federal FNEP partners and provinces/territories.

9.2.5 Subsequent Federal Notifications and Fan-out

Based on its assessment of the information, Health Canada, in consultation with appropriate Federal Nuclear Emergency Plan (FNEP) partners, will adopt a FNEP response level commensurate with the risk assessment and B.C.'s response level (see *Tables 6, 7 and 8*) and notify federal FNEP partners accordingly. Public Safety Canada /Government Operations Centre will handle all other federal notifications and activations under the *Federal Emergency Response Plan*.

9.2.6 International Notifications

The Government of Canada is expected, by international conventions, to notify international partners in the event of a nuclear emergency that affects public health or that may have radiological impacts beyond Canadian borders. Details concerning these notifications can be found in the *Federal Nuclear Emergency Plan*.

9.3 COLLABORATIVE TECHNICAL ASSESSMENT

Federal support to B.C. under the *Federal Nuclear Emergency Plan* (FNEP) for technical assessment of radiological impacts may include monitoring and assessing the nuclear emergency situation, providing information on its possible evolution and potential impacts, preparing specialized decision-support and geomatic products, formulating protective action recommendations for the radiological protection of emergency workers, public and environment as required, undertaking lab-based and field monitoring and assessment activities at the request of the province, supporting human monitoring activities and ensuring technical liaison with relevant counterparts. These support activities will be coordinated through the Federal Nuclear Emergency Plan Technical Assessment Group (FNEP TAG).

The FNEP TAG will obtain information from all relevant sources, including: pre-existing data-sharing arrangements with provinces; FNEP partners; radiological monitoring networks; any deployed federal assets; federal government institutions with specialized expertise in areas relevant to the technical assessment; other countries; and/or the IAEA and other international organizations. In addition to providing this information in support of B.C., the FNEP TAG will also assess the impacts of the emergency on Canadian jurisdictions outside of B.C.

B.C. will in turn provide the FNEP TAG with all relevant on-site and off-site information it has available and results of its modeling and technical assessments. Any discrepancies will only be communicated to the technical authorities involved for joint resolution.

9.4 FEDERAL FIELD OPERATIONS IN SUPPORT OF B.C.

For nuclear emergencies in B.C., or those having direct impact on B.C., monitoring of radiation in the environment and sampling of agricultural products, food, soil, water, etc. will normally be coordinated

by the Province, with federal resources and support as appropriate.

Provincial and federal radiological monitoring networks and real-time radiation detection systems, including the Canadian Radiological Monitoring Network and the Fixed Point Surveillance Network, will be used to monitor the environment for radiological contamination in order to provide information about the radioactive source, assess the risk to health and formulate protective action recommendations. In areas of federal jurisdiction or at the request of the Province, additional federal field capabilities may be deployed to assist and support B.C. field operations and radiological monitoring and sampling.

The main asset to obtain information about the radioactive source will be the DND Nuclear Emergency Response survey vehicles and boats, which would conduct surveys off-site. The team will assess the risk to health and make recommendations on protective actions. Federal support to B.C. for monitoring the environment will be co-ordinated by the Federal Nuclear Emergency Plan Technical Assessment Group (FNEP TAG) in collaboration with the Government Operations Centre operations, planning and logistics functions. International deployment of personnel and/or equipment will be undertaken through bi-lateral or multi-lateral arrangements and coordinated primarily through GAC and Health Canada.

All processed data collected by federal monitoring and sampling capabilities will be provided directly to the FNEP TAG and shared with the Ministry of Health or PECC (if activated) through a secure electronic platform.

9.5 INTERNATIONAL CO-ORDINATION

Communications with the international community and requests and/or offers of technical/scientific assistance coordinated through IAEA will be conducted by Health Canada, the CNSC, the Government Operations Centre (GOC) and GAC as the Canadian focal points in accordance with the *Convention on Early Notification of a Nuclear Accident* (IAEA, 1989), *Operations Manual for*

Incident and Emergency Communications (IAEA, 2012), *Convention on Assistance in Case of a Nuclear Accident or Radiological Emergency* (IAEA, 1999a) and the *IAEA Response and Assistance Network – RANET* (IAEA 2018).

Communications with the World Health Organization will be conducted by the Public Health Agency of Canada in accordance with the provisions of the *International Health Regulations* and relevant supporting documents.

Communications with the World Meteorological Organization will be managed by Environment and Climate Change Canada in accordance with the relevant technical communications procedures.

Technical communications with the international community will be coordinated through the GOC and the Federal Nuclear Emergency Plan Technical Assessment Group (FNEP TAG), and will be in accordance with the advice, procedures and assistance of GAC. Any co-ordination between international organizations in support of B.C. will be undertaken within the framework of the *Joint Radiation Emergency Management Plan of the International Organizations* (IAEA, 2017).

In co-ordination with the IAEA, technical liaison and assessment teams may also be dispatched from the IAEA to assist with the assessment of an event in British Columbia. Such teams will be coordinated through GAC and Health Canada, and work in collaboration with the FNEP TAG and PECC.

The PECC and the FNEP TAG will be informed of technical/scientific information exchanged with United States and international authorities. B.C. is a signatory of the PNEMA, and an active partner in the Pacific Northwest Border Health Alliance. During a nuclear emergency, the Ministry of Health or PECC (if activated) will inform the GOC and GAC of consultations with their United States counterparts. Consultations, commitments, or decisions taken among organizations in direct contact will not exceed the scope of the relevant agreement(s) and will be coordinated with the appropriate Canadian authorities.

9.6 FEDERAL / PROVINCIAL LIAISON AND CO-ORDINATION

9.6.1 National Co-ordination

In accordance with the *Federal Emergency Response Plan* (FERP), Public Safety Canada/Government Operations Centre, with the support of federal organizations involved in the *Federal Nuclear Emergency Plan*, develops the overall inter-departmental strategy for federal operations and co-ordinates the overall federal response including the provision of federal resources to provinces and territories. The Federal Nuclear Emergency Plan Technical Assessment Group (FNEP TAG) is responsible for coordinating and mobilizing the federal scientific/technical support to the Province in accordance with pre-established arrangements described herein and/or deliberations between the FNEP TAG and the PECC during the emergency.

9.6.2 Federal-Regional Co-ordination

When an emergency in B.C. requires an integrated Government of Canada response, the Public Safety Canada regional director co-ordinates the response on behalf of federal departments and agencies in the region. The regional director acts as the interface between the federal government and the Province of B.C. emergency management organizations, and co-ordinates requests and responses for emergency management assistance. The regional director provides appropriate representation in the PECC as required, at the request of the Province of British Columbia.

9.6.2.1 REGIONAL HEALTH PORTFOLIO

The Health Portfolio is represented by the PHAC in B.C. through the Regional Director (RD) during an emergency.

The B.C. RD promotes national consistency in the Health Portfolio's emergency management activities in B.C. and facilitates co-ordination, co-operation and partnering among federal departments, provincial and territorial levels of government, non-governmental organizations and the private sector. They also provide advice and direction to line managers and co-ordinate the interests of the Health Portfolio during a major regional emergency involving the health sector. When federal support is needed for B.C. response activities, the Health Portfolio regional offices may activate their Regional Emergency Coordination Centre (RECC) in support of the response and to facilitate communication, and coordination with the Health Portfolio Operations Centre in Ottawa as required. Health Portfolio liaison staff deployed to the PECC and/or one of the Provincial Regional Emergency Operations Centres (PREOC) in support of an activation under the *B.C. Nuclear Emergency Plan* (BCNEP) will report their activities through the RECC.

9.6.2.2 HEALTH PORTFOLIO EMERGENCY PREPAREDNESS AND RESPONSE CO-ORDINATOR

The Health Portfolio regional emergency preparedness and response (EPR) co-ordinator leads and co-ordinates the overall emergency

preparedness and response activities across the regional Health Portfolio. The EPR co-ordinator fosters collaboration between Health Canada and the Public Health Agency of Canada to enhance regional EPR capacity through the development of response plans, policies procedures and interdepartmental collaborations.

9.6.2.3 FEDERAL-REGIONAL EMERGENCY MANAGEMENT STRUCTURE

The Federal Coordination Steering Committee (FCSC) is a committee composed of senior regional federal government institution representatives that is co-chaired by the Public Safety Canada regional director and the senior representative of the primary federal department in the region. The committee provides direction on emergency management planning and preparedness activities in the region and oversees the co-ordination of the federal- regional response through the Federal Coordination Centre. The B.C. Health Canada regional director general and the PHAC regional director are standing members of the FCSC.

9.6.4 Federal-Provincial Co-ordination – Other Provinces and Territories

Some nuclear emergencies may have trans-boundary consequences. For those events that occur inside the Province of B.C., but are likely to affect populations outside of B.C., designated Federal Nuclear Emergency Plan Technical Assessment Group (FNEP TAG) representatives will liaise with the province/territory that is directly affected and also with the Province of British Columbia. Co-ordination between the federal-provincial emergency response organizations for other provinces and territories will be conducted according to the arrangements described in the Federal Emergency Response Plan and National Emergency Response System, augmented by provisions in the FNEP and its annexes, and in accordance with respective provincial/territorial nuclear emergency response plans. Requests for federal assistance and resources from the province or territory that is most directly affected by the emergency shall be given priority consideration over requests from more distant jurisdictions.

9.7 FEDERAL COMMUNICATIONS

At the federal level, the Federal Public Communications Coordination Group, led by Public Safety Canada's Communications Directorate, will co-ordinate the federal government's communications response to the public, media and affected stakeholders in collaboration with Government Communications and Public Engagement and private sector stakeholders as required. For Category C emergencies involving a nuclear-powered vessel, the Department of National Defence and the Canadian Armed Forces will be the lead agency for public information regarding the initial military response on-base. For emergencies occurring at licensed facilities, the facility operator and the CNSC will provide information about on-site conditions. The operator and the CNSC will likely appoint their own spokespersons.

To support the activities of the federal communications group in informing the public, media, workers, etc., a Federal Nuclear Emergency Plan Technical Assessment Group (FNEP TAG) task team will be established to develop or provide technical input into communications products.

9.8 FEDERAL SUPPORT CONCERNING COUNTERMEASURES

Upon request, federal authorities will support B.C. actions through the rapid exchange of technical assessment information and will develop its recommendations based on provincial, federal and international guidance.

As required and requested, the FNEP TAG may provide recommendations and co-ordinate the provision and use of specialized equipment (such as radiation dosimeters) to help protect federal and other emergency workers where potential exposure to radiation may occur. Where dose limits and other response criteria do not already exist, the FNEP TAG may provide radiation protection advice in accordance with relevant regulations or guidelines.

In the event that federal decisions on protective actions are required for areas under federal jurisdiction (e.g., on a DND/CAF base), their implementation will be carried out in a manner consistent with local and provincial response activities.

The Health Portfolio maintains limited supplies of medical countermeasures for internal radiological contamination in the National Emergency Strategic Stockpile.³ Upon request, these supplies can be made available; in most cases within a 24-hour period, to provincial authorities for use in their

response to a nuclear emergency. The federal government may also assist the Province of B.C. by providing training and guidelines in support of their preparedness activities. Details on training programs and session can be found in Appendix G.

For emergencies occurring outside of Canada, the FNEP TAG will monitor the advice given by authorities in the country of the emergency. Based on this information, as well as its own technical assessments, the FNEP TAG will formulate recommendations for appropriate protective action for Canadians in affected countries, as well as for travel and trade. Such recommendations will be shared with Province of B.C. authorities through established federal, provincial-and territorial mechanisms.

9.9 FEDERAL SUPPORT FOR DE-ESCALATION AND RECOVERY

Federal authorities, including the Federal Nuclear Emergency Plan Technical Assessment Group, may have a role to play in supporting B.C. in the activities described in 7.7. If applicable, this could include implementation and administration of federal post-disaster financial assistance programs under the Nuclear Liability Act (1985).

³ Examples of medical countermeasures in PHAC's National Emergency Strategic Stockpile include limited quantities of Prussian Blue, Ca- and Zn-DTPA, and potassium iodide (KI).

10. FNEP RESOURCES AND SERVICES

In accordance with the Federal Emergency Management Act, Article 6, the B.C. Nuclear Emergency Plan (BCNEP) as the Federal Nuclear Emergency Plan B.C. Annex (FNEP B.C. Annex) constitutes a pre-existing arrangement with the Province of B.C. to provide specific assistance (technical/scientific or operational) during an emergency. As such, it may be enacted to provide the technical/scientific and operational resources described in the BCNEP and the FNEP to support the Province of B.C. including resources and assets to aid in the overall preparedness and response phases of a nuclear emergency. Appendix F provides details

of FNEP resources and services. The scope and nature of the emergency will dictate the level of resources available in keeping with priorities established by the BCNEP, Federal Emergency Response Plan and the FNEP.

10.1 REQUESTING FNEP RESOURCES

Requests for FNEP resources should be directed to the FNEP designated official or the Technical Assessment Group chair if the PECC is activated.

APPENDIX A: Bibliography

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APPENDIX B: Glossary

Access control: The process of restricting access into the affected zone to emergency workers and other permitted individuals only.

As Low as Reasonably Achievable: An optimization tool in radiation protection used to keep individual, workplace and public dose limits as low as reasonably achievable (ALARA), social and economic factors being taken into account. ALARA is not a dose limit. It is a practice that aims to keep dose levels as far as possible below regulatory limits.

Base Alert: Emergency level adopted when an abnormal situation, with no immediate radiological threat, could deteriorate into a nuclear emergency.

Base Emergency: Emergency response level adopted when there is a confined nuclear emergency or a significant risk of a confined nuclear emergency with no imminent threat or radiological release to the environment.

Ca- and Zn-DTPA (diethylenetriamine pentaacetate acid): Drugs used to increase elimination of radioactive plutonium, americium, californium, curium, cobalt, zirconium, nickel and chromium, in individuals that have been internally contaminated.

Consequence Management: Measures and activities undertaken to alleviate the damage, loss, hardship and suffering caused by an emergency. It also includes measures to restore essential services, protect public health, and provide emergency relief to affected governments, businesses and populations.

De-escalation: The process of returning the response level of an emergency plan back to “routine” or pre-emergency conditions and indicating the start of transition to the recovery phase.

(FNEP) Designated Official: Federal personnel, including subject matter experts, designated by their department or agency to fill specific position to either represent their organization or to serve in a leading or supporting role within the Federal

Emergency Response Management structure, as defined in the *Federal Nuclear Emergency Plan*.

Deterministic Effects or Deterministic radiological health effects: Changes in cells and tissues that are certain to occur after an acute dose of radiation (in excess of a threshold value), below which the radiation effect is not detected. The severity of health effects – such as skin reddening, burns, and hair loss – increase with the radiation dose received.

Dosimeter: A device that is worn or carried by an individual for measuring his or her exposure to radiation.

Emergency: An abnormal situation which, to limit damage to persons, property or the environment, requires prompt action beyond normal procedures.

Emergency Management Organization: An organization put in place when a nuclear plan or “all-hazards” emergency plan is implemented, which is responsible for coordinating the response to a nuclear emergency.

Emergency Planning Zone: A defined zone around a nuclear facility for which detailed planning and preparations are made in advance to ensure that appropriate protective measures can be applied in a timely and accurate manner.

Emergency Support Function: General subject area described in the Federal Emergency Response Plan, which groups actions that may be taken by a primary department or agency and where the focus is exclusively on providing support in a sector to provinces in the response phase of an emergency.

Emergency Worker: Persons performing emergency services who are required to remain in, or to enter areas affected or likely to be affected by radiation from an accident, and for whom special safety arrangements are required. These may include police, firefighters, ambulance and emergency social services workers, and other essential services.

Evacuation: The rapid removal of people from an area to avoid or reduce high-level, short-term exposure to a hazard.

Federal Coordination Centre: As defined in the Federal Emergency Response Plan, it is the focal point for federal and federal-provincial/territorial co-ordination during response.

Federal Nuclear Emergency Plan Technical Assessment Group: A multi-departmental group composed of technical experts from designated FNEP departments and agencies, chaired by a senior technical expert.

Food Control: Measures taken to prevent the consumption of foodstuffs that have been radioactively contaminated above acceptable levels as a result of a nuclear emergency, including the supply of uncontaminated foodstuffs.

General Emergency: Emergency level adopted when there is a nuclear emergency with a radiological release or a significant risk of a radiological release to the environment.

Government Operations Centre (GOC or PS-GOC): The federal government operations centre, administered by Public Safety Canada, which is intended to host designated officials required to fill positions in the Federal Emergency Response Management System groups located in the National Capital Region. It is activated to co-ordinate national support to the affected provinces and activities under federal jurisdiction.

Health Portfolio: A term referring to both Health Canada and the Public Health Agency of Canada.

Intervention: Any action or provision beyond normal procedures undertaken to manage the emergency and mitigate its impacts, including all emergency organization structures, response actions, communications and public information and directives.

Lead Federal Minister/Department: The federal minister and department designated by the Prime Minister of Canada, or as indicated in the Federal Policy for Emergencies, to prepare arrangements and co-ordinate national activities to provide

support to a province, and to co-ordinate the activities of the federal departments and agencies involved. For nuclear emergencies, the designated lead federal department is Health Canada.

Liaison Officers: Federal officials who are assigned and responsible for ensuring liaison between two or more groups either in the Federal Emergency Response Management System, the corresponding provincial or regional structures.

Medical Countermeasures: Drugs used to treat people exposed to radiation to reduce the absorbed radiation dose and hence the risk of possible future biological effects. Examples of radiological medical countermeasures: Prussian Blue, Potassium Iodide (KI), Ca-DTPA and Zn-DTPA (diethylenetriamine pentaacetate acid). They can reduce the body's uptake by blocking organs with the non-radioactive element or they can increase the elimination of the radioactive element from the body.

Notification: A punctual action by which a specific individual or an organization is formally informed of a critical event, decision or action. An example would be a notification that the Federal Nuclear Emergency Plan has been activated. It should not be confused with reporting, which has specific and separate meaning.

Nuclear Emergency: An event that has led or could lead to the uncontrolled release of radioactive material, or exposures to uncontrolled sources of radiation, which pose or could pose a threat to public health and safety, property and/or the environment. This includes emergencies involving nuclear substances as defined in the Nuclear Safety and Control Act. Other plans may refer to these as radiological or nuclear accidents or emergencies.

Nuclear Emergency Function: Subject area defined in the Federal Nuclear Emergency Plan which groups actions specifically related to a nuclear emergency that may be taken by primary and/or supporting departments or agencies in the response phase of a nuclear emergency.

Nuclear Facility: A nuclear reactor, sub-critical nuclear reactor, research reactor, or plant for the separation, processing, reprocessing or fabrication

of fissionable substances from irradiated fuel. It also includes all land, buildings and equipment that are connected or associated with these reactors or plants.

Nuclear Powered Vessel: A marine vessel whose main propulsion system is driven by a nuclear reactor.

Off-site: The area outside the boundary of a nuclear facility or of Department of National Defence (DND) Category C emergency. The municipal, provincial and federal levels of government are responsible for off-site emergency planning, preparedness and response.

On-site: The area inside the boundary, or fence line, of a nuclear facility, or of DND land for a Category C emergency. For nuclear facilities, this area is also called the exclusion area. The operators of nuclear facilities and DND and the Canadian Armed Forces for Category C emergencies are responsible for on-site emergency planning, preparedness and response.

Potassium Iodide (KI): Substance used to prevent or reduce the uptake of radioactive iodine (radioiodine) by the thyroid. Potassium iodide is also known as a thyroid blocking agent.

Personal Protective Equipment: Protective clothing and respirator or other equipment designed to protect the wearer's body from injury.

Protective Action: Measure taken to reduce radiation doses which could be incurred by the population during a nuclear emergency. It is sometimes called countermeasure or protective measure.

Provincial/Territorial Emergency Measures

Organization: The organization responsible for off-site emergency planning, preparedness and response in a specific province.

Prussian Blue: Drug used to increase the elimination of radioactive cesium, thallium or rubidium in individuals that have been internally contaminated.

Radiological Consequence Management: Measures and activities undertaken to minimize or alleviate the damage, loss, hardship and suffering due to the radiation hazard arising from a nuclear emergency.

Radiological Emergency: See Nuclear Emergency.

Recovery Phase: The phase during which activities focus on restoration of quality of life, social systems, economies, community infrastructures, and the environment. This phase may last up to several years after the emergency.

Reporting: Term referring to the act of informing a specific authority of a given event or situation in accordance with specific regulatory requirements or equivalent criteria.

Response Phase: The phase during which activities focus on saving human life, on treating the injured, contaminated and overexposed persons, and on preventing and minimizing further health effects and other forms of impacts. This phase may last from a few hours to several weeks after the commencement of the emergency and would be followed by a recovery phase, as necessary.

Safety Significance: The off-site impact, on-site impact and Defence in depth degradation resulting from an emergency.

Sheltering: The use of a structure for protection from an airborne plume and/or deposited materials. The structure can attenuate radiation from radioactive materials deposited on the ground and reduce exposure to airborne plumes.

Site Area Emergency or Base Emergency: Events resulting in a major decrease in the level of protection for those on the site and near the facility, but not sufficient to meet criteria for a general emergency.

Stochastic Effects or Stochastic Radiological Health

Effects: A term used to group radiation-induced health effects (such as cancer or inheritable diseases), which have a statistical risk. For these diseases, the probability of their occurrence increases proportionally to the radiation dose received: the higher the dose, the higher the probability of occurrence. However, at no time,

even for high doses, is it certain that cancer or genetic damage will result.

Supporting Department or Agency: A federal institution assigned responsibility to support one or more emergency functions.

Task Team or Response team: A group of specialists and equipment, which may come from more than one department/agency, who work closely together during the response phase in order to carry out a very specific task e.g., dose prediction). A task team reports to a specific group of the emergency management structure.

Thyroid Blocking agent: See Potassium Iodide (KI).

Urgent Protective Actions: Actions that must be taken promptly in order to be effective, and the effectiveness of which will be markedly reduced if delayed. They include evacuation, sheltering, and administration of thyroid blocking agent.

APPENDIX C: Summary of Radiation Resources in B.C. Health Authorities

Table C-1: Summary of radiation resources in B.C. health authorities

SITE	MEDICAL COUNTERMEASURES
INTERIOR HEALTH	
East Kootenay Regional Hospital (Cranbrook)	No
Kootenay Boundary Regional Hospital (Trail)	No
Kelowna General Hospital	No
Vernon Jubilee Hospital	No
Royal Inland Hospital (Kamloops)	Yes – KI
ISLAND HEALTH	
Royal Jubilee Hospital (Victoria)	Yes – KI
Nanaimo Regional General Hospital	No
Victoria General Hospital	No
LOWER MAINLAND (FRASER HEALTH, PROVINCIAL HEALTH SERVICES AUTHORITY, VANCOUVER COASTAL HEALTH, PROVIDENCE HEALTH CARE)	
Abbotsford Regional Hospital	No
BC Children & Women’s Hospital	No
Burnaby Hospital	No
Jim Pattison Outpatient Centre (Surrey)	No
Lions Gate Hospital (North Vancouver)	No
Richmond Hospital	No
Royal Columbian Hospital (New Westminster)	No
Saint Paul’s Hospital (Vancouver)	No
Surrey Memorial Hospital	No
Peace Arch Hospital	No
UBC Hospital	No
Vancouver General Hospital	Yes – KI

NOTE: For all health care sites listed above, there is monitoring and radiation detection of gamma, alpha and beta radiation and decontamination capability. The specific equipment or radiation detection and radiation monitoring varies between sites, with Geiger-Muller (G-M) tubes and scintillation detectors being the most common. Some ion chambers are also available.

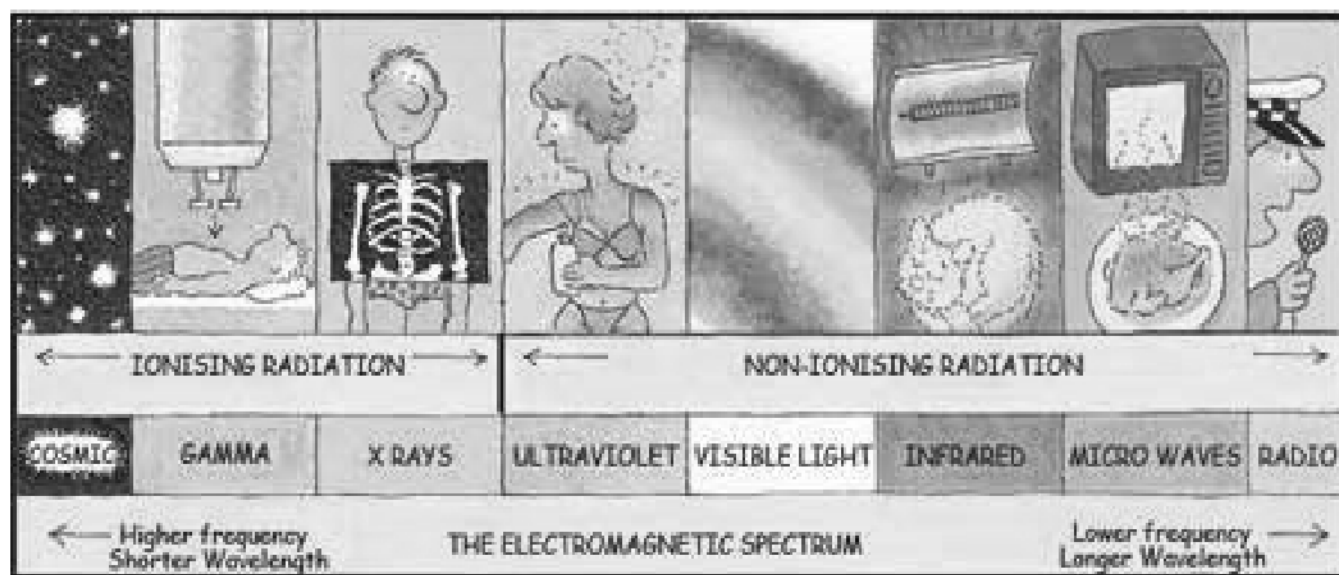
Resources are as of June 2014 – for real time summary of resources consult with the radiation safety officers and/or medical physicists at each health authority.

APPENDIX D: Radiation in General

Radiation is energy that comes from a source and travels through material or space. Every day, Canadians come in contact with radiation in both their living and work environments. Radiation can be classified as ionizing or non-ionizing. The

ionization of molecules can lead to radiolysis, i.e., breaking chemical bonds, and formation of highly reactive free radicals which in turn may react chemically with neighbouring materials even after the original radiation has stopped.

The Electromagnetic Spectrum



Sources of naturally occurring radiation include:

- radioactive material found in rocks and soils
- radon
- cosmic radiation
- ultraviolet radiation from the sun

Radiation can also be generated by artificial sources, including:

- Medical or clinical devices such as X-ray machines and ultrasound devices.
- Household or personal products such as microwave ovens and cell phones.
- Industrial or commercial equipment such as telecommunication towers and nuclear power generating stations.

- Nuclear fallout resulting from past military experimentation and weapons development.
- Wounds contaminated by radioactive material can also be a source of exposure.

Ionizing radiation is a part of Canada's environment. It can occur as electromagnetic rays (i.e., X-rays and gamma rays) or particles (i.e., alpha and beta particles) and originates from either natural (e.g., from the radioactive decay of natural radioactive substances such as radon gas and its decay products) or artificial sources. People can be exposed externally (e.g., X-rays), or internally if a radioactive substance is inhaled or ingested or absorbed through intact skin. Thus, all Canadians are continually exposed to radiation from these sources.

Appendix E: Common Communication Errors Made in Assessment of Radiological Health Hazards

Table E-1: Common communication errors made in assessment of radiological health hazards

COMMON ERRORS	EXPLANATION AND POSSIBLE CONSEQUENCES
NOT ANSWERING the public's principle question: 'Am I safe?'	➤ Assessments that do not answer the public's principle question: 'Am I safe?' may result in unjustified actions being taken by the public and/or decision makers that do more harm than good in the belief that they are making themselves and others safe.
NOT CLEARLY STATING that all members of the public, including children and pregnant women (and the fetus), have been considered, as well as the ways they have been exposed	➤ Assessments that do not consider the members of the public most sensitive to radiation (i.e. children and pregnant women) and/or all the ways they can be exposed (or not clearly explained that this was considered), may result in unjustified actions by the public and/or decision makers that do more harm than good in the belief they are protecting all members of the public to include the most sensitive to radiation.
NOT PROVIDING a consistent assessment of the health hazard (e.g. having several sources of official information) and/or using undefined or ambiguous terms	➤ Assessments that are inconsistent and/or ambiguous will result in confusion and undermine public confidence in official statements.
USING EARLY, INCOMPLETE OR UNCERTAIN data without clearly indicating the possible health hazard	➤ Assessments that use incomplete and/or uncertain data could result in an over or underestimation of the health hazard and lead to changing assessments as the data improves, which could undermine public confidence. If early data is used it needs to be made clear that these are preliminary assessments expected to change as new and/or improved data becomes available.
USING SIEVERT (Sv) without clearly stating what quantity it represents	➤ Assessments that do not clearly state the type of Sievert being used are not useful. Several different dosimetric quantities (e.g. equivalent dose to an organ or tissue, effective dose, ambient dose equivalent or personal dose equivalent) are given in sieverts and although the units are the same, these are different quantities that cannot be compared [24, 36]. Only equivalent dose, which is the dose to a particular person's organ or tissue (e.g. thyroid), can be used to assess the possible health effects, but only if it has been calculated correctly.
PROJECTING EXCESS CANCER DEATHS	➤ Assessments that project excess cancer deaths are unreliable. This is because it is impossible to predict the possible number of cancers resulting from an emergency within the first months to years after the emergency. The only way that excess cancers can be detected with certainty is by studying cancer statistics for the population affected by high doses over a period of many years. At low doses (doses below the international generic criteria calling for protective or other response actions), there will not be an observable increase in the incidence of cancer, even in a very large exposed group.

PROJECTING EXCESS CANCER DEATHS (continued)	➤ Projections of excess deaths are often based on inappropriate use of the fatal risk coefficient (a “deaths per sievert of collective effective dose”) given by the International Commission on Radiation Protection (ICRP) and others. This coefficient was intended to be used for the purposes of radiological protection only, and its use for projecting health consequences was never intended, as stated by ICRP, for the following reasons: ➤ Because of the uncertainty of health effects at low doses, the ICRP judges that it is not appropriate, for the purposes of public health planning, to calculate the hypothetical number of cases of cancer or heritable disease that might be associated with very small radiation doses received by large numbers of people over very long periods of time. ➤ Collective effective dose is not intended as a tool for epidemiological risk assessment, and it is inappropriate to use it in risk projections. The aggregation of very low individual doses over extended time periods is inappropriate and, in particular, the calculation of the number of cancer deaths based on collective effective doses from trivial individual doses should be avoided.
COMPARING DOSES with ‘safety’ limits implying health effects are possible if the limits are exceeded.	➤ Assessments that compare doses with ‘safety’ limits are unreliable because these limits are typically established as part of the license requirements for the nuclear power plant and exceeding these limits does not mean that the situation is unsafe. These limits are established to ensure the safe operation of the nuclear power plant by limiting releases to levels well below those at which health effects will occur.
USING TERMS such as ‘high dose rates’ or ‘highly contaminated’, Bq/m ² , and ‘100 times above normal levels’ without making it clear how this is related to the possible health hazard	➤ Assessments that use these terms are meaningless and could imply an exaggerated or understated health hazard.
MAKING IRRELEVANT COMPARISONS with other exposure situations, for example comparing the calculated dose with a dose received from an X-ray or an intercontinental flight	➤ Assessments that compare the calculated dose with other exposure situations can lead to underestimations of the health hazard. These doses cannot be compared due to the different types of radiation and the different exposure pathways that are possible in the context of a reactor core or spent fuel release (e.g. the dose from inhalation of radioiodine and the possible health effects to the thyroid gland).
USING ONLY EXTERNAL DOSE RATE	➤ Assessments that only use external dose rate are unreliable because this only considers external exposure, which can greatly underrepresent the health hazard. This is because other important exposure pathways such as inhalation from the passing plume or inadvertent ingestion of radioactive material have not been considered.
NOT CONSIDERING the fact that the dose is a calculated quantity that must be calculated in a very specific way to correctly place its health hazard into prescriptive, as described in	➤ Assessments that do not explain in detail how the calculations were performed are unreliable. Dose is a calculated quantity that must be determined in a very specific way to correctly place its health hazard into perspective.

Section 7.5. Any dose calculation needs to clearly state steps and assumptions used in the calculations	
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International Atomic Energy Agency (2013).
Actions to Protect the Public in an Emergency due to Severe Conditions at a Light Water Reactor

APPENDIX F: Canadian Nuclear Safety Commission Recommended Turn-Back Dose Rates and Maximum Permissible Dose

The Canadian Nuclear Safety Commission recommends the following Turn-Back Dose Rates and Maximum Permissible Dose (MPD):

- Routine situation (non-emergency):
MPD: 0.5 mSv (500 μ Sv)
Turn-back dose rate: 1 mSv/h*
- Emergency situation:
MPD: 250 mSv (250,000 μ Sv)
Turn-back dose rate: 1000 mSv/h* (1 Sv/h)
- Life Saving: **Unlimited (volunteer basis)**

*If any meter you are using goes off scale, turn back

APPENDIX G: Details of Federal Nuclear Emergency Plan Resources and Services

Requests for *Federal Nuclear Emergency Plan* (FNEP) resources should be directed to the FNEP designated official or the FNEP Technical Assessment Group (FNEP TAG) chair if the Provincial Emergency Coordination Centre (PECC) is activated. Requests for emergency medical countermeasures, medical units or other items from the National Emergency Strategic Stockpile (NESS) are to be made directly to the NESS, or via the Health Portfolio Operations Centre (if during off-hours) by the Ministry of Health.

Federal scientific/technical support to the Province of British Columbia including resources and assets to aid in the overall preparedness and response phases of a nuclear emergency can be provided by Health Canada and other FNEP partners. The scope and nature of the emergency will dictate the level of resources available in keeping with priorities established in the British Columbia Nuclear Emergency Plan, Federal Emergency Response Plan (FERP) and the FNEP.

PREPAREDNESS

Coordination Committees

As part of its preparedness activities, the Assistant Deputy Ministers' Emergency Management Committee (ADM EMC) provides a forum to discuss the Government of Canada's emergency management processes and readiness. Working groups and committees may be established under the ADM EMC to support interdepartmental collaboration on specific nuclear emergency preparedness and response topics.

The federal government also collaborates with provinces and territories to develop and maintain the national emergency preparedness and response framework.

As elaborated in *An Emergency Management Framework for Canada, the Senior Officials Responsible for Emergency Management* (SOREM)

provides a forum for federal, provincial, and territorial (FPT) discussions and emergency response integration. Working groups are established to support intergovernmental collaboration on issue-specific multi-stakeholder aspects.

Within this governance structure, the planning organization for the FNEP is supported by two standing committees, namely the:

- Federal Nuclear Emergency Management Committee (NEMC), and
- Federal/Provincial/Territorial NEMC.

Health Canada provides the chair (or co-chair) and secretariat for these committees. Federal departments/agencies and provincial/territorial emergency management organizations will participate as required in the relevant committees to ensure that:

- All interdepartmental and inter-jurisdictional planning and preparedness issues and activities relevant to nuclear emergencies are adequately coordinated, and
- Any concerns raised are considered and resolved.

An outline of the mandate for both committees is provided on the following page.

Coordination and Committee Meetings with BC

Other ad-hoc preparedness committees may be established as required to address specific areas of nuclear emergency preparedness such as capacity building, exercise planning or inter-jurisdictional cooperation.

Table G-1: Federal/provincial/territorial nuclear emergency management committees and their mandates

COMMITTEES	MANDATE
FEDERAL NUCLEAR EMERGENCY MANAGEMENT COMMITTEE , chaired by Health Canada	➤ To facilitate co-ordination of federal nuclear emergency preparedness and response arrangements, maintenance of the FNEP, information exchange and joint projects in the areas of nuclear emergency preparedness programs, response standards, emergency assistance, exercises and other related issues
FEDERAL/PROVINCIAL/TERRITORIAL NUCLEAR EMERGENCY MANAGEMENT COMMITTEE , chaired by Health Canada with a provincial co-chair	➤ To facilitate co-ordination of federal nuclear emergency preparedness and response arrangements with the provinces and territories and provide a forum for information exchanges and development of plans and joint projects to improve nuclear emergency management, including the co-ordination, development and implementation of a long-term exercise program.

Training

Health Canada Radiation Protection Bureau (RPB) offers training that is designed to meet the needs of specific stakeholders. These training sessions range from basic awareness sessions (Radiation Basics) to more comprehensive and operational-level training (Medical Emergency Treatment for Exposure to Radiation [METER], Field Response Training). Requests or inquiries for courses should be directed to HC/RPB and will be considered based on operational feasibility. It should be noted that not all training can be delivered on-demand (see individual notes).

Medical Emergency Treatment for Exposures to Radiation (METER)

The objective of the METER course is to enhance the Canadian medical community's preparedness in responding to a radiological/nuclear event. This course raises awareness and knowledge of participants regarding radiation safety and improves the ability of participants to respond to, manage, and treat casualties from a radiological or nuclear event. The topics covered in METER include:

- Deterministic effects of radiation exposure;
- Stochastic effects of radiation exposure;
- The basics of radiation biology;
- Decorporation agents and how to manage internal contamination;

- How to manage potentially contaminated patients in an emergency department;
- The procedures necessary to triage, transport and manage patients during and after a radiological or nuclear event;
- Wound decontamination and patient decontamination; and
- Protection of emergency personnel.

The target audience for the course includes first responders (paramedics, fire, HAZMAT, and police), first receivers (emergency room physicians, triage nurses, emergency room nurses, radiation safety officers, nuclear medicine personnel), and emergency management coordinators, planners and trainers.

Medical Emergency Treatment for Exposures to Radiation (METER) eLearning Module: Basic concepts of Radiation and Protection Principles; an eLearning course designed to provide basic concepts of radiation for response to a radiological or nuclear emergency.

Available publicly at
<https://training-formation.phac-aspc.gc.ca/>

Field Response

Health Canada's Field Response Training is an intensive week-long course that provides training in both radiation/radioactive decay theory and field techniques to operate in a simulated radiologically contaminated environment in preparation of assurance monitoring activities. During the classroom portion of the training, participants learn the principles and concepts involved in radiation, radioactive decay and ionizing radiation, how radiation is measured, the concepts of dose and dosimetry, and common exposure pathways. Participants will also learn the theory behind, and standard operating procedures to be used with, personal protective equipment (donning/doffing), personal dosimeters (passive and alarming), and the use of specialized radiation detection equipment. Practical experience will be gained in the set-up, operation and take-down of a field command post, decontamination tents and population monitoring stations.

The target audience for this training is individuals who may participate in the field-based environmental monitoring.

Exercises

Following the endorsement of the FNEP by the Deputy Ministers' Emergency Management Committee (DM EMC) in October 2012, an exercise program designed to validate all of the nuclear emergency functions contained within the FNEP was developed. The FNEP and FNEP Exercise Plan recognize that radiological/nuclear expertise and responsibility is not centralized in one department but spans over all FNEP departments and agencies across the federal government.

The scope of the FNEP Exercise Plan includes all federal FNEP partners and is used to prioritize and coordinate exercises with other provincial, national and international partners. The FNEP Exercise Plan details the types of exercises (workshops/seminars, drills, tabletop exercises, functional/command post exercises and full-scale exercises) that will be utilized to validate and test the FNEP and FNEP Annexes.

After Action Reports and Improvement Plans may be developed at the completion of the exercises, allowing for continuous refinement of plans, procedures, and performances.

The FNEP Exercise Plan will be implemented over a long-term cycle (approximately 5 to 10 years) and is informed by the exercise strategy. The strategy is developed in consultation with the FNEP coordination committees and is submitted to the Public Safety Canada Federal Exercise Working Group for consideration into the national exercise program.

RESPONSE

In the event of an actual or potential nuclear emergency, federal support to the Province of British Columbia for managing the radiological consequences could be provided in the form of surge capabilities involving some or all of the capabilities described below. The actual capabilities required will depend on the specific circumstances of the emergency and will be identified either as default measures or will be decided on the basis of joint discussions between the Chair of the FNEP TAG and a senior scientific official in the PECC. These specific arrangements supplement the all-hazards support provided through the Government Operations Centre (GOC) and the FERP.

Technical Assessments

As previously described in Section 6.2.5, during a nuclear emergency, the FNEP TAG will obtain information from any and all relevant and credible sources, and exchange and coordinate data with the PECC in order to provide the best possible assessment and prognosis products to all decision making authorities to implement all protective and corrective actions that may be required as part of the radiological consequence management to a nuclear emergency, and to facilitate strategic planning. These products are defined under supporting documents to the British Columbia Nuclear Emergency Plan and the FNEP (e.g. FNEP TAG Manual). Modelling and monitoring capabilities are described below.

Radiological Risk Assessment and Modelling Capabilities

Health Canada maintains the infrastructure to support a nuclear emergency response and a set of tools for the consolidation of scientific and technical information in support of hazard and risk identification.

These include:

- The Operations Center Interconnectivity Portal accessible to FNEP partners for viewing, sharing and collaborating on scientific and technical aspects of the emergency;

- The Accident Reporting and Guidance Operational System (ARGOS), a decision support system for handling and integrating large quantities of dynamic multi-disciplinary, multi-sourced assessment information, such as:
 - Radiological source term information from the PECC, CNSC, or DND/CAF; Meteorological modelling, monitoring and forecasting capabilities provided by Environment and Climate Change Canada's Canadian Centre for Meteorological and Environmental Prediction;
 - Radiological monitoring data from Health Canada and others; and
 - Radiation dose assessments.
- ARGOS has several important functionalities, including:
 - Importation of source terms;
 - Exportation of these source terms to the Canadian Centre for Meteorological and Environmental Prediction state of the art atmospheric dispersion modelling tools;
 - Calculation of doses for various radiological exposure pathways;
 - Exportation of results to Health Canada's GIS-based application mapping for further spatial and contextual analysis.

Surveillance and Environmental Monitoring Assets

Multiple federal agencies (Health Canada, Natural Resources Canada [NRCAN], and Canadian Nuclear Laboratories [CNL]) maintain environmental radiation monitoring capabilities. Information and data gathered from these capabilities will be shared with the Province prior to, during and following a nuclear emergency to support protective actions and consequence management decision-making and recovery operations.

Fixed-Point Surveillance Network

The Fixed Point Surveillance (FPS) Network is a network of real-time radiation detection equipment operated by Health Canada and located across Canada and a single data centre that collects, analyses and stores the data measured at each of these monitoring stations. This data centre is located at HC/RPB in Ottawa and communicates with the stations on a daily or as-needed basis. The network includes monitoring stations operated by Health Canada plus several stations that are owned and operated by the nuclear operators who share their data with Health Canada. The network provides ambient gamma dose rates and can be used in the event of a nuclear emergency to identify radioactive contamination in the air or deposited on the ground as a result of an atmospheric release of radioactive material.

Canadian Radiological Monitoring Network

The Canadian Radiological Monitoring Network (CRMN) is a national network of monitoring stations operated by Health Canada that routinely collect air, precipitation, external gamma dose, drinking water, atmospheric water vapour, and milk for radioactivity analysis. The network provides a mechanism for measuring routine or accidental releases of radioactivity in environmental samples. There are 26 environmental monitoring stations, plus additional sites in the vicinity of nuclear reactor locations. Samples collected at these stations are analyzed at Health Canada's radio analytical laboratories in Ottawa.

Comprehensive Nuclear Test-Ban Treaty Network

Health Canada maintains a network of four radionuclide monitoring stations across the country and a radionuclide laboratory in Ottawa to perform detailed radionuclide analysis that are operated under the auspices of the Comprehensive Nuclear Test-Ban Treaty (CTBT). In a nuclear emergency, these highly sensitive, high throughput CTBT stations can offer valuable information to the FNEP TAG on actual releases from a nuclear facility. These can be used to characterize the nature and approximate quantity of radioactivity released to the atmosphere, assisting authorities to assess the hazards and risks.

Mobile Monitoring Systems (aerial, vehicle -borne and ground surveys)

Health Canada and FNEP partner organizations maintain capabilities to perform aerial and ground surveys for the detection, identification and characterization of contamination following a nuclear emergency. Aerial surveys conducted by NRCAN can be used to provide information on contamination over wide-range geographical areas while vehicle-borne surveys can be used to provide information on a mid-range scale. The teams involved in both the aerial and vehicle-borne surveys have the capacity for data exchange and scientific reach-back to subject matter experts in the FNEP TAG located in Ottawa or at the PECC. Near real-time aggregation of validated data from survey results is available through Health Canada's GIS mapping system viewable on OCIP. The ground survey teams, including personnel from Health Canada, CNL, Director Nuclear Safety (DNSafe) and NRCAN, are responsible for the identification and characterization of ground-based contamination, for sample preparation and analysis, and conducting sampling of air, food, feed and water as directed or requested by the federal or provincial authorities.

The Mobile Nuclear Laboratories (MNLs) are part of the Government of Canada's deployable capabilities in support of the FNEP.

Health Canada maintains MNLs, a Mobile Coordination Centre (satellite communications, high speed internet, generators, workspaces, and multimedia), inflatable tents and equipment trucks, which can provide the following capabilities:

- Radioisotope quantification and identification;
- Contamination control;
- Rapid field deployment (rapid response kit);
- Scientific reach-back to municipal, provincial and federal EOCs.

MNLs may be deployed, on request of the Province, in the post release phase of an emergency, with a suite of assets and scientific staff to support off-site or field radiological monitoring. These requests will be assessed and prioritized by FNEP TAG and the PECC depending on the nature of the situation and operational feasibility.

Fixed Radioanalytical Laboratory

HC/RPB's National Monitoring Section (NMS) operates a state-of-the-art laboratory for radionuclide detection and identification. The laboratory routinely analyzes environmental samples including air particulates, precipitation, drinking water, atmospheric water vapour, and milk samples. The NMS's lab maintains a wide array of emergency analysis procedures for radioactivity assessment of relevant sample matrices.

The NMS lab can also provide advanced gamma spectroscopy analysis, via access to specialized instruments such as a Compton suppression system, performance software analysis tools and highly trained and experienced scientists. In emergency situations, the NMS laboratory could analyze up to 100 samples per day (based on a 30-minute gamma count time per sample), and up to 250 samples per day when other FNEP partner laboratories are included.

Emergency Dosimetry Services

HC/RPB's National Dosimetry Services maintain multiple emergency dosimetry kits that can be deployed to the Province during an emergency. Each kit contains twenty (20) Electronic Personal Dosimeters and four hundred (400) passive

dosimeters, portable dosimeter readers, a laptop and requisite software to track and monitor dosimeter readings, power cords, extension cords, native user guides plus a dosimetry kit user guide. Upon request, Health Canada can provide dosimetry devices to deal with larger surge demands for emergency response.

Health Canada can deploy up to 60,000 passive dosimeters, 300 electronic personal dosimeters and 10 portable dosimeter readers (with laptop, software, and user guides). Expert advice and recommendations on doses and exposures can be requested from FNEP TAG via the FNEP TAG Liaison Officer (FTLO) in the PECC.

Bioassay and In Vivo

The Bioassay and In Vivo Laboratories within HC/RPB's National Internal Radiation Assessment Section (NIRAS) provide in vitro and in vivo radiobioassay services and programs. NIRAS conducts research in internal radionuclide measurement and detection and provides bioassay and internal dosimetry support to the FNEP. Services include:

- In Vivo bioassay measurements and internal dose assessment for suspected radionuclide intakes using whole body and organ counting and external counting at wound sites. Up to four portable whole body counters can be deployed in the field with each counter capable of measuring approximately 6-10 people per hour. In addition, one fixed whole body counting facility and one fixed lung counting facility is available in the NIRAS laboratory in Ottawa;
- Identification of the levels of specific radionuclides in body excreta, primarily urine. Approximately 150-200 samples per day can be screened for alpha, beta or gamma radiation. Length of time for specific radionuclide analysis will depend on the specific isotope to be measured;
- Determination of the committed effective dose; and
- Interpretation of effectiveness of decorporation treatments.

Biodosimetry

Health Canada's Consumer and Clinical Radiation Protection Bureau (Radiobiology Division) can provide emergency cytogenetic biodosimetry services for individuals or mass casualties exposed to ionizing radiation. Analysis of chromosomal aberrations in human peripheral blood lymphocytes is the present-day standard for the biological assessment of ionizing radiation exposure. For individual exposures, dose estimates in the range of 0.1 to 5 Gray (Gy) can be performed. Health Canada and partners of the Canadian Cytogenetic Emergency Network have the capacity to process larger quantities of samples for the cytogenetic triage of mass casualties. In mass casualty events, only doses above 1 Gy will be identified. During an emergency, Health Canada and partner labs are equipped to receive and analyze an initial influx of 100-300 samples, and every 5 days thereafter, as described in Health Canada's *Guidelines for Requesting the Analysis of Cytogenetic Damage Human Blood for Triage-Quality Emergency Radiation Biodosimetry* (HC Internal draft, 2013). Requests for analysis that exceed 300 samples may be accommodated with assistance from US partners.

Population Monitoring

Health Canada's RPB maintains a deployable capability to perform population monitoring for radionuclide contamination during an emergency. Depending on scope of the event, and as resources permit, specific FNEP TAG task teams and resources may be deployed to support the Province in the provision of these services. Screening services can be provided as surge capacity or in complement to population monitoring stations already set up by the province. Deployment requires integration into an existing provincial or municipal reception facility or emergency worker centre. Depending on availability, the number of portal monitors that can be deployed for population monitoring varies from 12-18 units.

Requests for population monitoring must be supported by appropriate and adequate facilities and services to be provided by the Province of

British Columbia, including but not limited to crowd control, security, health services, registration and demographic information capturing etc. Requests should be directed through the FTLO (if present in the PECC, or at the FNEP TAG).

National Emergency Strategic Stockpile

As previously mentioned under Section 9.8, PHAC maintains the National Emergency Strategic Stockpile (NESS) to provide health and social service supplies quickly to provinces and territories when their own resources are not enough during an emergency. A 24-hour response capability is maintained, and assets can be deployed within 24 hours depending on circumstances of the event. The system consists of a central depot in Ottawa, as well as a number of other warehouses and pre-positioned supply centers (under the combined management of the provinces and federal government) strategically located across Canada.

The NESS contains various assets, from beds and blankets to a supply of pharmaceuticals, including a range of antibiotics and medical countermeasures for internal radiological contamination (Prussian Blue, Ca and Zn-DPTA, KI). As well, it maintains medical units that can be deployed on short notice (within 24 hours) to be set up in existing buildings such as schools and community centers. Additional capacities include supplies to set up first aid and triage stations. Pre-positioned supply centers have a mix of supplies depending on their location and anticipated emergencies that might occur. Requests for emergency countermeasures, medical units or other items from the NESS may be made by individuals identified as Health Emergency Management Directors in the Province of British Columbia, directly to the NESS Duty Supervisor or via the Health Portfolio Operations Centre (HPOC) and/or Health Portfolio Liaison Officers in the PECC. If the request includes medical countermeasures, the FTLO in the PECC should also be notified.

RECOVERY

The *Federal Nuclear Emergency Plan* (FNEP) addresses the immediate off-site response actions to a nuclear emergency. Once the situation has stabilized and immediate actions for the protection of public health and safety have been completed, emergency management of the radiological hazard will shift from the response phase to recovery phase and the FNEP response level will return to routine operations.

Responsibility for recovery from a nuclear emergency in B.C. is largely within the jurisdiction of the Province of British Columbia. The decision to

transition to recovery operations will be taken by the Province in the case of an emergency occurring in B.C., and by federal authorities in areas of federal jurisdiction or for a nuclear emergency outside North America. Some FNEP partners and FNEP designated officials may be involved in support of restoration efforts of the affected areas. Individual departments will engage in Government of Canada action planning and implementation of recovery activities in accordance with their primary and supporting responsibilities in the emergency support functions.

Notes



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