



# Ontario

**PROVINCIAL NUCLEAR EMERGENCY RESPONSE PLAN**

**IMPLEMENTING PLAN  
FOR  
OTHER RADIOLOGICAL  
EMERGENCIES**

**May 2011**

*Prepared by Emergency Management Ontario  
Ministry of Community Safety and Correctional Services*



Ontario  
Executive Council  
Conseil exécutif

**Order in Council  
Décret**

On the recommendation of the undersigned, the Lieutenant Governor, by and with the advice and concurrence of the Executive Council, orders that:

Sur la recommandation de la personne soussignée, le lieutenant-gouverneur, sur l'avis et avec le consentement du Conseil exécutif, décrète ce qui suit :

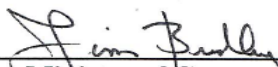
WHEREAS section 8 of the *Emergency Management and Civil Protection Act* R.S.O. 1990 c. E.9, as amended, requires the Lieutenant Governor in Council to formulate an emergency plan respecting emergencies arising in connection with nuclear facilities;

AND WHEREAS the Provincial Nuclear Emergency response Plan – Master Plan (the “Master Plan”) was approved by the Lieutenant Governor in Council by Order in Council 260/2009;

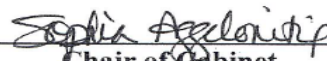
AND WHEREAS the Master Plan provides for the approval of a series of Implementing Plans to directly address emergencies in respect of specific nuclear facilities or radiological issues;

NOW THEREFORE the document entitled “Provincial Nuclear Emergency Response Plan – Implementing Plan for Other Radiological Emergencies” and dated May 2011, be approved as an emergency plan under section 8 of the *Emergency Management and Civil Protection Act*.

Recommended

  
Minister of Community  
Safety and Correctional  
Services

Concurred

  
Chair of Cabinet

Approved and Ordered

JUN 22 2011  
Date

  
Lieutenant Governor

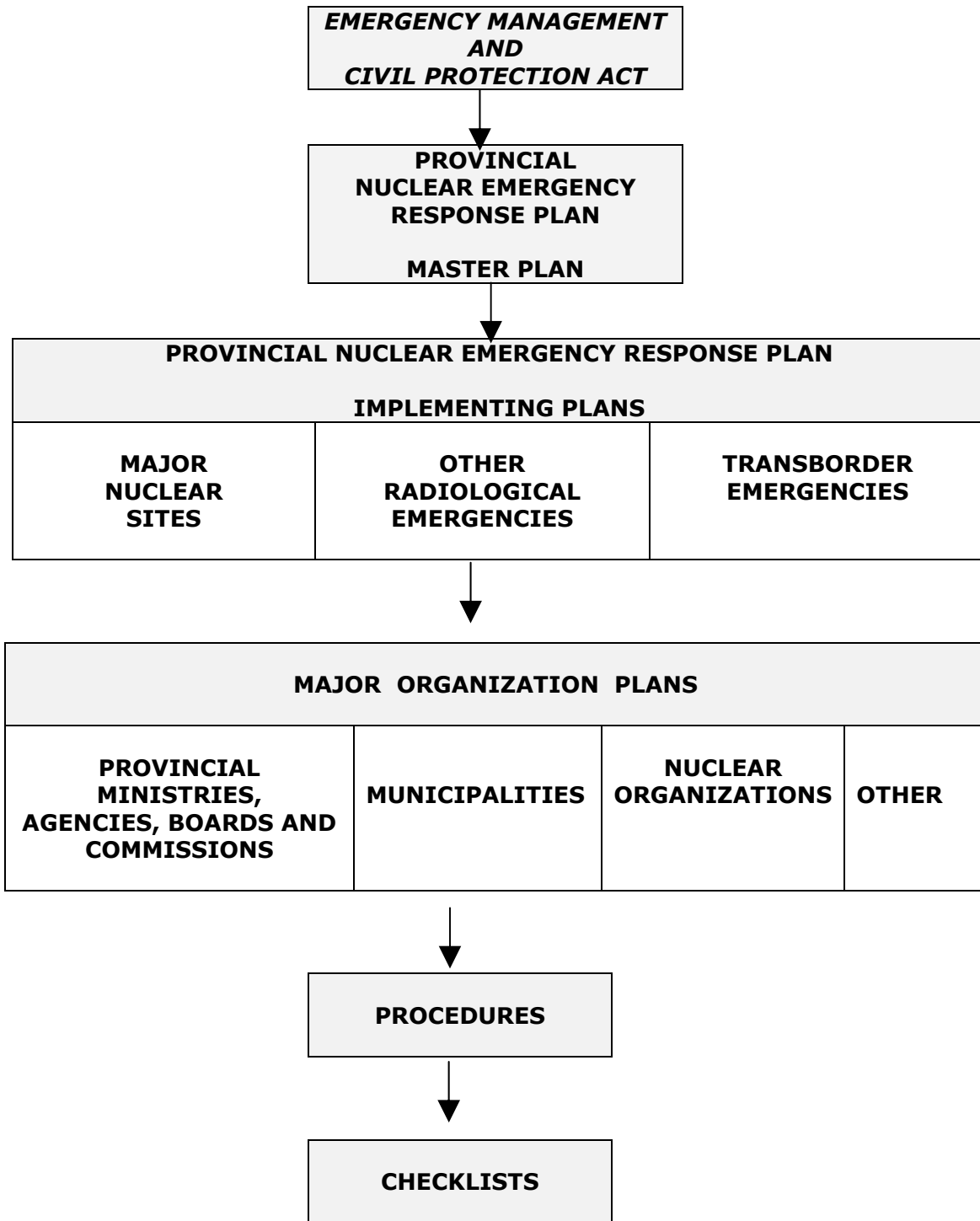
## FOREWORD

**The Province of Ontario's Nuclear Emergency Response Plan** has been developed pursuant to Section 8 of the ***Emergency Management and Civil Protection Act, R.S.O. 1990, c. E. 9*** (hereafter referred to as the ***Emergency Management and Civil Protection Act or EMCPA***). The current edition of this plan supersedes and replaces all older versions which should be destroyed.

Holders of the Provincial Nuclear Emergency Response Plan for Other Radiological Emergencies are responsible for keeping them updated by incorporating amendments, which may be issued from time to time.

This public document is administered by the **Minister of Community Safety and Correctional Services of Ontario**. All comments and suggestions relating to it should be directed to:

Program Manager,  
Planning and Exercises  
Emergency Management Ontario  
Ministry of Community Safety and Correctional Services  
77 Wellesley Street West, Box 222  
Toronto, Ontario, M7A 1N3  
Phone: (416) 314-3723  
Fax: (416) 314-3758  
Email: [askEMO@ontario.ca](mailto:askEMO@ontario.ca)  
Website: <http://www.ontario.ca/emo> (English Version)  
<http://www.ontario.ca/gdu> (French Version)



**FIGURE I : PROVINCE OF ONTARIO NUCLEAR AND RADIOLOGICAL EMERGENCY RESPONSE PLANNING STRUCTURE**

## PROVINCE OF ONTARIO NUCLEAR AND RADIOLOGICAL EMERGENCY RESPONSE PLANNING STRUCTURE

The structure for nuclear and radiological emergency response planning in Ontario, which is illustrated in **Figure I (page ii)**, consists of the following components:

- **The *Emergency Management and Civil Protection Act* (EMCPA)** requires and authorizes the formulation of the plan.
- **The Provincial Nuclear Emergency Response Plan (PNERP):**  
Developed pursuant to Section 8 of the EMCPA and subject to Cabinet approval:
  - **The Master Plan:** sets out the overall principles, policies, basic concepts, organizational structures and responsibilities.
  - **The Implementing Plans:** the elements of the Master Plan are applied to each major nuclear site, transborder emergencies and other types of radiological emergencies, and detailed provincial implementing plans developed.
  - **Major Organization Plans:** Each major organization involved (provincial ministries, agencies, boards and commissions, municipalities, and nuclear organizations, etc.) develops its own plan to carry out the relevant roles, responsibilities and tasks agreed to by them and consistent with their mandate. These plans are based on, and should be consistent with the PNERP and with the Provincial Implementing Plans.
- **Procedures:** Based on all of the above plans, procedures are developed for the various emergency centres to be set up and for the various operational functions required.
- **Checklists:** The culmination of the planning process is the development of checklists based on the requirements of the procedures, e.g., individual position or function-specific checklists.

It is necessary that everyone involved in the preparation and implementation of the Provincial Nuclear Emergency Response Plan employ common terminology. The terminology contained in the **Glossary, Annex F**, should be used for this purpose by all concerned. Further reference information can be found in the Incident Management System doctrine, which is available at [www.ontario.ca/ims](http://www.ontario.ca/ims).

# PROVINCIAL NUCLEAR EMERGENCY RESPONSE PLAN FOR OTHER RADIOLOGICAL EMERGENCY RESPONSE

## TABLE OF CONTENTS

		<u>Page</u>
	Foreword	i
	Province of Ontario Nuclear and Radiological Emergency Response Planning Structure	iii
	Acronyms & Abbreviations	vi
<b>CHAPTER 1</b>	<b>GENERAL AND LEGAL</b>	<b>1</b>
	1.1 Aim of Plan	1
	1.2 Scope of Plan	1
	1.3 The Potential Hazard	2
	1.4 Protective Measures	2
	1.5 Applicability of Plan	2
	1.6 General Responsibilities	2
<b>CHAPTER 2</b>	<b>ROLES AND RESPONSIBILITIES</b>	<b>6</b>
	2.1 Incident Management System	6
	2.2 Lieutenant Governor In Council and Premier	6
	2.3 Cabinet Committee on Emergency Management and Cabinet Office	6
	2.4 Deputy Minister of Community Safety	7
	2.5 Commissioner of Emergency Management	7
	2.6 Emergency Information	7
	2.7 The Provincial Emergency Operations Centre	8
	2.8 Provincial Liaison	12
	2.9 Response Organizations – Federal	14
	2.10 Response Organizations – Communities	14
	2.11 Contingency Provisions	15
	2.12 Declaration or Termination of an Emergency	16
	2.13 Response Level Determination	16
	2.14 PEOC Concept of Operations	16
	2.15 Main PEOC Operations	17
<b>CHAPTER 3</b>	<b>NOTIFICATION AND RESPONSE</b>	<b>20</b>
	3.1 Notification	20
	3.2 Response Phases	21
	3.3 Initial Response Phase	22
	3.4 Intermediate Response Phase	23
	3.5 Recovery Phase	33
	3.6 Termination of Offsite Response	33

## FIGURES AND TABLES

Fig I	Province of Ontario Nuclear and Radiological Emergency Response Planning Structure	ii
1.1	Protective Measures	5
2.1	Provincial Nuclear/Radiological Emergency Response Organization	18
2.2	Environmental Radiation Monitoring Group	19
3.1	Initial and Intermediate Response Phases	27
3.2	Radiation Contamination Zones	28
3.3	Emergency Dose Limits for Emergency Workers/ Nuclear Energy Workers	29
3.4	Protective Actions Considerations	34

## ANNEXES

ANNEX A	Radiological Incidents Described	36
ANNEX B	Nuclear Establishments in Ontario	42
ANNEX C	Protective Action Levels	46
ANNEX D	Guidance for Recovery Phase Operations	49
ANNEX E	Nuclear / Radiological Glossary	51

## ACRONYMS AND ABBREVIATIONS

<b>ADM</b>	- Assistant Deputy Minister
<b>AECL</b>	- Atomic Energy of Canada Limited
<b>AIM</b>	- Abnormal Incident Manual
<b>ALARA</b>	- 'As low as reasonably achievable'
<b>AMG</b>	- Assurance Monitoring Group
<b>AGPWMGP</b>	- Assurance/General Province-Wide Monitoring Group Plan
<b>BWR</b>	- Boiling Water (nuclear) Reactor
<b>CANDU</b>	- The name of the Canadian developed nuclear power reactor system (from <u>C</u> anada <u>D</u> euterium <u>U</u> ranium)
<b>CCEM</b>	- Cabinet Committee on Emergency Management
<b>CEMC</b>	- Community Emergency Management Coordinator
<b>CEM</b>	- Commissioner of Emergency Management
<b>CESC</b>	- Corporate Emergency Support Centre
<b>CEOC</b>	- Community Emergency Operations Centre
<b>CEOF</b>	- Corporate Emergency Operations Facility
<b>CNSC</b>	- Canadian Nuclear Safety Commission
<b>CRC</b>	- Corporate Response Centre
<b>CRL</b>	- Chalk River Laboratories
<b>CZ</b>	- Contiguous Zone
<b>DNGS</b>	- Darlington Nuclear Generating Station
<b>EB</b>	- Emergency Bulletin
<b>ECI</b>	- Emergency Coolant Injection
<b>EFADS</b>	- Emergency Filtered Air Discharge System
<b>EMCPA</b>	- <i>Emergency Management and Civil Protection Act</i>
<b>EIC</b>	- Emergency Information Centre
<b>EI</b>	- Emergency Information
<b>EIS</b>	- Emergency Information Section
<b>EMO</b>	- Emergency Management Ontario
<b>ENERGY</b>	- Ministry of Energy
<b>EOC</b>	- Emergency Operations Centre
<b>EPZ</b>	- Emergency Planning Zone



<b>ERAP</b>	- Emergency Response Assistance Plan
<b>ER</b>	- Emergency Response
<b>ERMG</b>	- Environmental Radiation Monitoring Group
<b>FADS</b>	- Filtered Air Discharge System
<b>FDA</b>	- Food and Drug Administration
<b>FNEP</b>	- Federal Nuclear Emergency Plan
<b>GOC</b>	- Government Operations Centre
<b>Gy</b>	- Gray. See definition of Absorbed Dose in <b>Glossary, Annex F</b>
<b>HAZMAT</b>	- Hazardous Material
<b>HC</b>	- Health Canada
<b>IAEA</b>	- International Atomic Energy Agency
<b>INES</b>	- International Nuclear Event Scale
<b>JTCC</b>	- Joint Traffic Control Centre
<b>JTCP</b>	- Joint Traffic Control Plan
<b>KI</b>	- Potassium Iodide
<b>km</b>	- Kilometre
<b>LGIC</b>	- Lieutenant Governor In Council
<b>LHDR</b>	- Laurentian Hills Deep River
<b>LHDRRNEPC</b>	- Laurentian Hills Deep River Regional Nuclear Emergency Preparedness Committee
<b>LOCA</b>	- Loss-of-Coolant Accident
<b>LOECI</b>	- Loss of Emergency Coolant Injection
<b>MCSCS</b>	- Ministry of Community Safety and Correctional Services
<b>MCSS</b>	- Ministry of Community and Social Services
<b>MDU</b>	- Monitoring & Decontamination Unit
<b>MEMC</b>	- Ministry Emergency Management Coordinator
<b>MEOC</b>	- Ministry Emergency Operations Centre
<b>Met</b>	- Meteorology, meteorological
<b>MMAH</b>	- Ministry of Municipal Affairs and Housing
<b>MNDMF</b>	- Ministry of Northern Development Mines and Forestry
<b>MNR</b>	- Ministry of Natural Resources
<b>MOE</b>	- Ministry of the Environment

<b>MOHLTC</b>	- Ministry of Health and Long-Term Care
<b>MOL</b>	- Ministry of Labour
<b>mSv</b>	- Millisievert
<b>MTO</b>	- Ministry of Transportation
<b>NIG</b>	- Nuclear Incident Group
<b>NEMCC</b>	- Nuclear Emergency Management Coordinating Committee
<b>OMAFRA</b>	- Ontario Ministry of Agriculture, Food and Rural Affairs
<b>OPG</b>	- Ontario Power Generation
<b>OPP</b>	- Ontario Provincial Police
<b>PAL</b>	- Protective Action Level
<b>PNERP</b>	- Provincial Nuclear Emergency Response Plan
<b>PNGS</b>	- Pickering Nuclear Generating Station
<b>PWR</b>	- Pressurized Water (nuclear) Reactor
<b>PHWR</b>	- Pressurized Heavy Water (nuclear) Reactor
<b>PEOC</b>	- Provincial Emergency Operations Centre
<b>PZ</b>	- Primary Zone
<b>rad</b>	- See definition of Absorbed Dose in <b>Glossary, Annex F</b>
<b>RAG</b>	- Regional Action Group
<b>RD</b>	- Radiological Device
<b>RDD</b>	- Radiological Dispersal Device
<b>rem</b>	- See definition of Equivalent Dose in <b>Glossary, Annex F</b>
<b>RHRP</b>	- Radiation Health Response Plan
<b>RNEMCC</b>	- Regional Nuclear Emergency Management Coordinating Committee
<b>SRP</b>	- Site Reference Plan
<b>SMC</b>	- Site Management Centre
<b>Sv</b>	- Sievert. See definition of Equivalent Dose in <b>Glossary, Annex F</b>
<b>SZ</b>	- Secondary Zone
<b>TRF</b>	- Tritium Removal Facility
<b>TLD</b>	- Thermoluminescent Dosimeter
<b>UTM</b>	- Universal Transverse Mercator
<b>WHO</b>	- World Health Organization

# CHAPTER 1

## GENERAL

### 1.1 Aim of Plan

- 1.1.1 The aim of the Other Radiological Emergencies Response Plan is to describe the measures to be undertaken to protect public health and safety in the event of a radiological emergency caused by sources not covered under Ontario's other Implementing plans of the PNERP.
- 1.1.2 For the purposes of this plan, a radiological emergency would occur when there is an actual or potential hazard to public health, property and/or the environment from ionizing radiation resulting from sources other than a nuclear installation. Such a hazard will usually be caused by an accident, malfunction or loss of control involving radioactive material.
- 1.1.3 This plan covers events occurring either in or outside of Ontario (particularly in adjacent jurisdictions), which may be of concern to the health and safety of Ontario's residents.

### 1.2 Scope of Plan

- 1.2.1 This plan provides generic guidance on dealing with many different kinds of radiological emergencies not covered by the other implementing plans. As such, the guidance contained herein may be general in nature and should therefore be applied taking into consideration the unique aspects of the situation being dealt with.
- 1.2.2 This plan deals with radiological emergencies arising from:
- a) Accidents or occurrences at a Nuclear Establishment<sup>1</sup> not covered under other implementing plans of the Provincial Nuclear Emergency Response Plan (PNERP);
  - b) Accidents or occurrences during the transportation of radioactive material;
  - c) Satellite re-entry;
  - d) Radiological Dispersal Devices (RDD);
  - e) Radiological Devices (RD); and
  - f) Nuclear Weapon detonation.

---

<sup>1</sup> A *nuclear establishment* is a facility that uses, produces, processes, reprocesses, stores or disposes of a nuclear substance (as defined in the federal *Nuclear Safety and Control Act* - <http://www.cnscccsn.gc.ca/eng/lawsregs/>).

A description of each of these incidents is provided in **Annex A** to this Plan.

1.2.3 The above incidents may either be in the form of dispersed radiation or an intact source.

### **1.3 The Potential Hazard**

The hazard to the affected public would be from:

- a) Contamination:
  - External (skin & clothing); or
  - Internal (as a result of ingestion or inhalation of contaminants).
- b) Radiation Exposure

### **1.4 Protective Measures**

The protective measures available for minimizing or avoiding the radiation hazard are listed in **Table 1.1**.

### **1.5 Applicability of Plan**

Organizations that may be involved in the response to a radiological incident covered by this plan include:

- a) Nuclear Establishments in Ontario;
- b) Transporters of radioactive materials;
- c) Federal government department and agencies;
- d) Provincial ministries, agencies, boards and commissions; and
- e) Communities (upper and lower tier municipalities and First Nations).

### **1.6 General Responsibilities**

#### **1.6.1 Nuclear Establishments**

- a) Under the terms of the licence issued by the CNSC, nuclear establishments (**Annex B**) are required to:
  - Take appropriate measures to prevent radioactive material from being released offsite.
  - Promptly inform the offsite authorities and the CNSC should such a release occur.
- b) An accident in which the effects are expected to be confined within the boundaries of the nuclear facility shall be dealt

with by the establishment itself, under the regulatory control of the CNSC.

#### 1.6.2 Nuclear Transporters

Transporters of radioactive materials, as well as persons/organizations that are forwarding them, are required, under the CNSC's *Packaging and Transport of Nuclear Substance Regulations*<sup>2</sup>, to report any dangerous occurrences and, under the *Transportation of Dangerous Goods Act*<sup>3</sup>, are required to report any actual or anticipated releases.

In addition, any dangerous good that exceeds the specified value in column 7 of Schedule 1 of the *Transportation of Dangerous Good Regulations*<sup>4</sup>, must be shipped with an approved Emergency Response Assistance Plan (ERAP), issued by Transport Canada.

#### 1.6.3 Federal Government

In the event of a radiological emergency, federal government departments and agencies are responsible for overseeing/regulating the facility response, notification, the coordination of federal resources including those for aerial/ground monitoring and for providing guidance on dose limits for emergency workers (see **Annex C**).

#### 1.6.4 Government of Ontario

- a) The Government of Ontario has jurisdiction over public health and safety, property and the environment within its borders and, as such will be primarily responsible for managing the off-site consequences of a radiological emergency affecting any part of the province.
- b) In the event of a radiological emergency, the Province's role may vary from providing assistance/support to coordinating the provincial response. For example, in the case of an emergency with localized effects, or whenever it considers this to be appropriate, the province will simply monitor the situation and provide the support and assistance needed to the community dealing with the emergency.

---

<sup>2</sup> The CNSC's *Packaging and Transport of Nuclear Substance Regulations* are available at: <http://laws.justice.gc.ca/PDF/Regulation/s/sor-2000-208.pdf>

<sup>3</sup> The *Transportation of Dangerous Goods Act* is available at: <http://laws.justice.gc.ca/PDF/Statute/T/T-19.01.pdf>

<sup>4</sup> The *Transportation of Dangerous Goods Regulations* is available at: <http://www.tc.gc.ca/eng/tdg/clear-tofc-211.htm>

- c) The province will, however, coordinate the response operations in the following cases:
- If the affected community(ies) so request(s); or
  - If the province considers this to be the appropriate course in the interests of public health and safety.
- d) The provincial response to a radiological emergency will be coordinated through the Provincial Emergency Operations Centre (PEOC).

#### 1.6.5 Communities

- a) Local governments and agencies are responsible for taking appropriate measures to protect public health and safety within their jurisdictions. Municipalities in close proximity to, or with nuclear establishments within their boundaries, should include in their emergency response plans, the measures they may need to take to deal with the off-site consequences of a radiological accident.
- b) Other municipalities which have a radiological incident identified as one of their potential risks, within their Hazard Identification & Risk Assessment (pursuant to Section 2(3) of the *Emergency Management and Civil Protection Act*), should include, within their municipal emergency response plans, the measures they may need to undertake to deal with such an emergency.
- c) An accident whose effects are so localized that the impact can be satisfactorily dealt with by local emergency responders, with some outside technical assistance, shall be handled by the community affected, with provincial support, if so requested.
- d) If the consequences of the accident are beyond the capabilities of the community's response organization as well as the capabilities available through mutual aid agreements, the province will assume responsibility for coordinating the response.

EXPOSURE CONTROL MEASURES	INGESTION CONTROL MEASURES
Entry Control Sheltering Evacuation Thyroid Blocking Use of Protective Equipment Decontamination	Milk Control Water Control Pasture Control Produce and Crop Control Livestock Control Food Control Land Control* Environmental Decontamination*

**TABLE 1.1: PROTECTIVE MEASURES**

**Note:** The measures are defined in the Glossary in **Annex F** of this plan.

**Note:** \* Normally applicable only to Recovery Phase.

## **CHAPTER 2**

### **ROLES AND RESPONSIBILITIES**

#### **2.1 Incident Management System**

- 2.1.1 Ontario uses the Incident Management System (IMS), a standardized and coordinated approach to managing incidents that provides functional interoperability at all levels of emergency management.
- 2.1.2 IMS presents standardized organizational structure, functions, processes, and terminology:
  - (a) The organizational structure provides for the chain of command and control;
  - (b) The standard functions under IMS for a radiological incident include Command, Operations, Planning, Logistics, Science, and Finance & Administration;
  - (c) Processes allow those who respond to the same incident to formulate an Incident Action Plan to manage the incident;
  - (d) IMS uses plain-language terminology to reduce the risk of miscommunication among responders.
- 2.1.3 The basic IMS organizational structure used for a provincial emergency response is illustrated in **Figure 2.1**.

#### **2.2 Lieutenant Governor In Council and Premier**

The Lieutenant Governor In Council (LGIC) and the Premier of Ontario provide overall direction to the management of the emergency response.

#### **2.3 Cabinet Committee on Emergency Management and Cabinet Office**

- 2.3.1 The mandate of the Cabinet Committee on Emergency Management (CCEM) is to ensure that the Province is prepared to address emergency situations and assume other responsibilities, as Cabinet deems appropriate. Cabinet Office supports the CCEM and acts as a link to the Premier's Office. The CCEM is the only Cabinet Committee for which membership has been specified by portfolio.
- 2.3.2 The CCEM works in conjunction with the Premier's Office, Cabinet Office, other affected ministries and Emergency Management Ontario to develop detailed plans for continued operations and



constitutional governance in Ontario in the event of emergencies that could affect Ontario – regionally or provincially.

- 2.3.3 The Committee's main roles and responsibilities during an emergency can be summarized as follows:
- a) Develop the overall provincial emergency management response strategy for the Government of Ontario;
  - b) Conduct high-level briefings and discussions of strategic issues with appropriate ministries;
  - c) Ensure management of strategic issues; and
  - d) Ensure the continuity of critical government operations and services.

## **2.4 Deputy Minister of Community Safety**

The Deputy Minister of Community Safety is responsible for:

- a) Maintaining liaison between the Commissioner of Emergency Management (CEM) and Deputy Ministers involved in the emergency response;
- b) Leading the Ministry of Community Safety and Correctional Services Ministry Action Group (or doing so through a designate).

## **2.5 Commissioner of Emergency Management (CEM)**

- a) During an emergency or pending emergency situation, the CEM will serve as the direct link between the Cabinet Committee on Emergency Management (CCEM) and the PEOC (**Section 2.7** below);
- b) The CEM will ensure that strategic and operational information and decisions are relayed between the CCEM and PEOC in a timely and effective manner.

## **2.6 Emergency Information**

- 2.6.1 The Provincial Chief, Emergency Information is responsible for the development and implementation of the Provincial Emergency Information Plan (PEIP), in cooperation with Cabinet.
- 2.6.2 Information must flow in both directions to ensure that Command-identified emergency information issues are incorporated into the emergency information messaging and that the PEOC is made aware of the PEIP, its amendments, or issues that may affect the overall response.

2.6.3 Where a local Emergency Information Centre is set up, the Chief of the Emergency Information Section may provide liaison staff, if requested or deemed necessary to ensure an appropriate level of coordination and provision of emergency information.

2.6.4 The main functions of the Emergency Information Section include:

- Developing and issuing news releases and other public information products on behalf of the province regarding the emergency and the measure being taken by the province to deal with it;
- Coordinating news conferences on behalf of the province and providing supportive documents for provincial spokesperson(s).
- Monitoring the media and the public's perception of and reaction to the situation and keeping the Command Section and the local Emergency Information Centre informed;
- Answering media and public inquiries;
- Providing information on the emergency and the province's response to ministries and other stakeholders not directly involved in the response.
- Monitoring media and the Internet, correcting inaccuracies and dispelling rumours;
- Posting emergency information on the Internet and intranet;
- Providing notices and public service announcements to broadcasters;
- Providing key messages and information to activated call centres;
- Providing communications advice to the PEOC Command Section and the Commissioner of Emergency Management; and providing information to the Premier's Office via Cabinet Office.

2.6.5 The Provincial Emergency Information Plan provides detailed information regarding the roles, responsibilities and functions of the Emergency Information Section.

## **2.7 The Provincial Emergency Operations Centre (PEOC)**

2.7.1 The PEOC provides:

- a) Overall coordination of the provincial response, based on the strategic direction from the CEM and CCEM;
- b) Timely support, information and analysis to the CEM to coordinate the provincial emergency response;

- c) Assistance to communities in responding to a major radiological emergency by providing protective action direction, advice, assistance and support in coordinating the provision of additional resources;
- d) Deployed provincial staff to assist in coordinating provincial emergency response, as necessary.

### 2.7.2 Command Section

The role of the PEOC Command Section is to:

- a) Determine status of emergency declaration
- b) Approve and authorize implementation of the Incident Action Plan;
- c) Identify and resolve response issues;
- d) Identify unresolved issues to be addressed by the CEM and the CCEM;
- e) Provide advice, assistance and recommendations to the CEM;
- f) Implement decisions made by the CEM and the CCEM;
- g) Authorize and issue emergency information, operational directives and guidance including Emergency Bulletins;
- h) Establish and maintain liaison with the Command function of other supporting or assisting Emergency Operations Centres.

The Command Section may include technical experts and organizational representatives, as appropriate.

### 2.7.3 Command Staff

#### a) Safety

Safety staff is responsible for monitoring, tracking and ensuring the safety of all personnel working at the PEOC. Safety staff may also coordinate with other levels of response to ensure safe operations overall.

#### b) Liaison

Liaison staff acts as the link between the Command Section and other command elements involved in emergency response.

#### c) Information

Information Staff acts as the link between Command and the Emergency Information Section that is responsible for the development and implementation of the provincial

communications plan. Information must flow in both directions to ensure that Command-identified emergency information issues are incorporated into the emergency information messaging and that the PEOC is made aware of the communication plan, plan amendments, or issues that may affect the overall response.

#### 2.7.4 Operations Section

- a) Implement the Incident Action Plan.
- b) The Operations Section Chief coordinates the functions of the section and provides operations input to the Command Section.
- c) The Operations Section, will be made up of representation from the following organizations, as appropriate:
  - i. Provincial ministries;
  - ii. Nuclear facilities;
  - iii. Federal departments including Health Canada, Public Safety Canada, Department of National Defence and CNSC;
  - iv. Contiguous provinces and/or states;
  - v. Others as needed.
- d) Functions performed by Operations staff include:
  - i. Providing operational input to the decision-making process;
  - ii. Implementing Command Section operational decisions by issuing advice or direction, as appropriate;
  - iii. Monitoring and coordination of deployed provincial resources;
  - iv. Identifying and coordinating the operational requirements of the response operation;
  - v. Sharing information between all elements, as required.

#### 2.7.5 Planning Section

- a) The Planning Section, led by the Planning Section Chief, prepares and documents the Incident Action Plan, including the Protective Action Response Planning Procedure and oversees all incident-related data gathering and analysis regarding incident operations and assigned resources.
- b) The Planning Section includes representation from the following organizations, as appropriate:
  - (i) Provincial ministries, including Agriculture, Food and Rural Affairs, Community and Social Services, Community Safety and Correctional Services, Health and Long-Term Care, Labour and Transportation;

- (ii) Deployed Provincial resources;
- (iii) Traffic Control representative;
- (iv) Others as required (EI, Scientific staff, as appropriate);
- (v) Municipal Planning Team representative; and
- (vi) Others as needed.

#### 2.7.6 Logistics Section

Under the direction of the Logistics Section Chief, staff arranges for and coordinates all PEOC material, personnel services, equipment and resources required to manage and resolve the emergency.

#### 2.7.7 Finance and Administration Section

Under the direction of the Finance and Administration Section Chief, staff perform administrative, financial and staffing duties specific to the emergency. This may include the capture of incident-related costs, maintenance and scheduling of support personnel, maintenance of appropriate support records, and administering procurement contracts as necessary.

#### 2.7.8 Scientific Section

The Scientific Section of the PEOC is responsible for giving scientific direction, coordinating the environmental radiation monitoring efforts, utilizing the analysis results and solving problems. The Chief of the Scientific Section will oversee all the groups within the section, as follows:

##### a) Environmental Radiation Monitoring Group (ERMG)

The Environmental Radiation Monitoring Group (**Figure 2.2**), led by Health Canada, is responsible for planning/surveying fixed and aerial and ground monitoring activities, directing the radiation monitoring teams (Federal, nuclear facilities and private sectors), processing the data, analysis, and assuring the teams' worker safety.

This group includes representatives from:

- Canadian Food Inspection Agency;
- Health Canada;
- Ministry of Agriculture Food and Rural Affairs;
- Ministry of the Environment;

- Ministry of Health and Long-Term Care;
- Ministry of Labour;
- Representatives from the community health unit(s); and
- Others, as appropriate.

The Environmental Radiation Monitoring Group, in cooperation with its federal partners, directs Field Monitoring Teams composed of representatives from:

- Canadian Nuclear Safety Commission;
- Health Canada;
- Natural Resources Canada;
- Nuclear facilities; and
- Private sector (as appropriate).

A Health Canada representative shall ensure liaison with the Federal Technical Advisory Group (TAG) operating under the Federal Nuclear Emergency Plan (FNEP)<sup>5</sup>.

b) Assurance Monitoring Group

Headed by the Radiation Protection Service of the Ministry of Labour, this group implements monitoring programs in areas adjacent to a radioactive release which do not require protective measures against radiation. These programs are aimed at assuring the public that air, food and water are safe (refer to MOL Assurance/General Province-Wide Monitoring Group Plan).

c) General Province-Wide Monitoring Group

Headed by the Radiation Protection Services of the Ministry of Labour, this group monitors province-wide sampling to determine the extent of radionuclide dispositions and foodstuff contamination (refer to MOL Assurance/General Province-Wide Monitoring Group Plan).

## 2.8 Provincial Liaison

2.8.1 The provincial emergency response organization for dealing with a nuclear or radiological emergency is shown in **Figure 2.1**.

2.8.2 Liaison Arrangements: To ensure liaison and coordination between different elements of the emergency response organization, the following arrangements and agreements shall be implemented:

<sup>5</sup> The Federal Nuclear Emergency Plan is available at: <http://www.hc-sc.gc.ca/hc-ps/pubs/ed-ud/fnep-pfun-1/index-eng.php>

- a) Provincial staff may be deployed to join the Emergency Operations Centre (EOC) of the affected community, of another jurisdiction (e.g. state or province) or of an affected organization (e.g. Greater Toronto Airport Authority (GTAA), federal government).
- b) Provincial Ministry EOCs - The following ministries shall set up their EOCs and provide assistance to the PEOC through their Ministry Action Group therein:
- Agriculture, Food & Rural Affairs;
  - Attorney General;
  - Community and Social Services;
  - Community Safety and Correctional Services;
  - Ministry of Energy;
  - Environment;
  - Government Services;
  - Health and Long-Term Care;
  - Labour;
  - Municipal Affairs & Housing;
  - Natural Resources;
  - Northern Development, Mines and Forestry; and
  - Transportation.
- c) As required, elements of the provincial CBRNE system, as well as federal and private resources, may be activated.
- d) The Environmental Radiation Monitoring Group of the PEOC is set out above in **Paragraph 2.7.8 (a)**.
- e) The Radiation Health Response Plan (RHRP) has been developed by the Ministry of Health and Long-Term Care (MOHLTC) to deal with potentially exposed and/or contaminated persons following a nuclear or radiological event. The RHRP will be implemented, whenever this plan is activated, through the MOHLTC EOC, in coordination with the PEOC (See **Paragraph 3.4.10**).
- f) Provincial and Federal Counter-Terrorism Plan - In the event that the incident results from an act of malevolence, the provincial consequence management aspect will be dealt with under this plan while the law enforcement aspect will be handled under the Provincial and Federal Counter-Terrorism Plans.

Coordination of the response operations will be accomplished using Ontario's Incident Management System (**Section 2.1**).

## 2.9 Response Organizations – Federal

2.9.1 The main federal agencies/organizations that will be involved in a radiological response include:

- a) Canadian Nuclear Safety Commission;
- b) Health Canada;
- c) Public Safety Canada;
- d) Transport Canada (for transportation accidents); and
- e) Royal Canadian Mounted Police (for malevolent acts).

2.9.2 The Environmental Radiation Monitoring Group, led by Health Canada, is discussed above in **Paragraph 2.7.8 (a)**.

2.9.3 Other federal entities may be called in, as prescribed in federal plans.

2.9.4 The Government Operations Centre is operated by the federal government to coordinate federal activities in support of the Provincial Emergency Operations Centre or activities relating to areas of federal jurisdiction. This may include liaison with any other potentially affected provinces, with the United States, any other country, and international agencies.

## 2.10 Response Organizations – Communities

2.10.1 The organization assembled to respond to a radiological emergency shall be described in the community's Emergency Response Plan.

2.10.2 Mutual Assistance Arrangements/Agreements - Existing arrangements may be put into action in order to assist the affected community.

2.10.3 Support Communities - In the event of a declared emergency, the Premier or LGIC may order a community to provide support or assistance to the affected, communities at the time of the emergency (as authorized by sections 7.0.2 (4) or 7.0.3 of the EMCPA).

2.10.4 Community Emergency Operations Centres

- a) The municipal emergency response is under the direction and coordination of the Head of Council at the Community Emergency Operations Centre, which in turn receives information, support and direction from the Provincial Emergency Operations Centre.



- b) The structure of the municipal organization for undertaking emergency operations shall be laid down in municipal emergency response plans. This organization shall provide for the following centres, as required:
- Community Emergency Operation Centre(s)<sup>7</sup>;
  - Reception Centre(s);
  - Evacuee Centre(s);
  - Emergency Worker Centre(s); and
  - Emergency Information Centre(s).
- c) Where applicable, Community Emergency Operation Centres should also include representatives of appropriate upper-tier departments and local boards such as boards of health, social services departments, school boards and police services. Such departments and boards shall also provide staff as required for the various other emergency centres to be set up.
- d) The PEOC may deploy resources to the Community Emergency Operations Centre to act as a link between the two centres. Information, and in some cases direction, to the Community Emergency Operations Centre from the PEOC may be conveyed through the provincially deployed staff.
- e) Further guidance on the function and responsibilities of these centres are provided in the implementing plans to the PNERP.

## **2.11 Contingency Provisions**

- 2.11.1 The PEOC may issue operational directives to the emergency management and response organization through the centres in the tier below it. However, if for any reason any of these centres is not functioning or is not responsive, the PEOC may issue operational directives directly to any element of the emergency management and response organization.
- 2.11.2 Likewise, response organizations are responsible for taking appropriate actions, according to plans, procedures and the requirements of the situation.

---

<sup>7</sup> *Community Emergency Operation Centres* is used in this Plan as a generic term and includes a centre set up by an upper tier Municipality.

## **2.12 Declaration or Termination of an Emergency**

- 2.12.1 If circumstances are such that an emergency declaration or termination is necessary, such declarations shall be made by:
- a) The LGIC or the Premier, pursuant to section 7.0.1 of the EMCPA; and
  - b) The Head of Council(s), pursuant to section 4 of the EMCPA.

## **2.13 Response Level Determination**

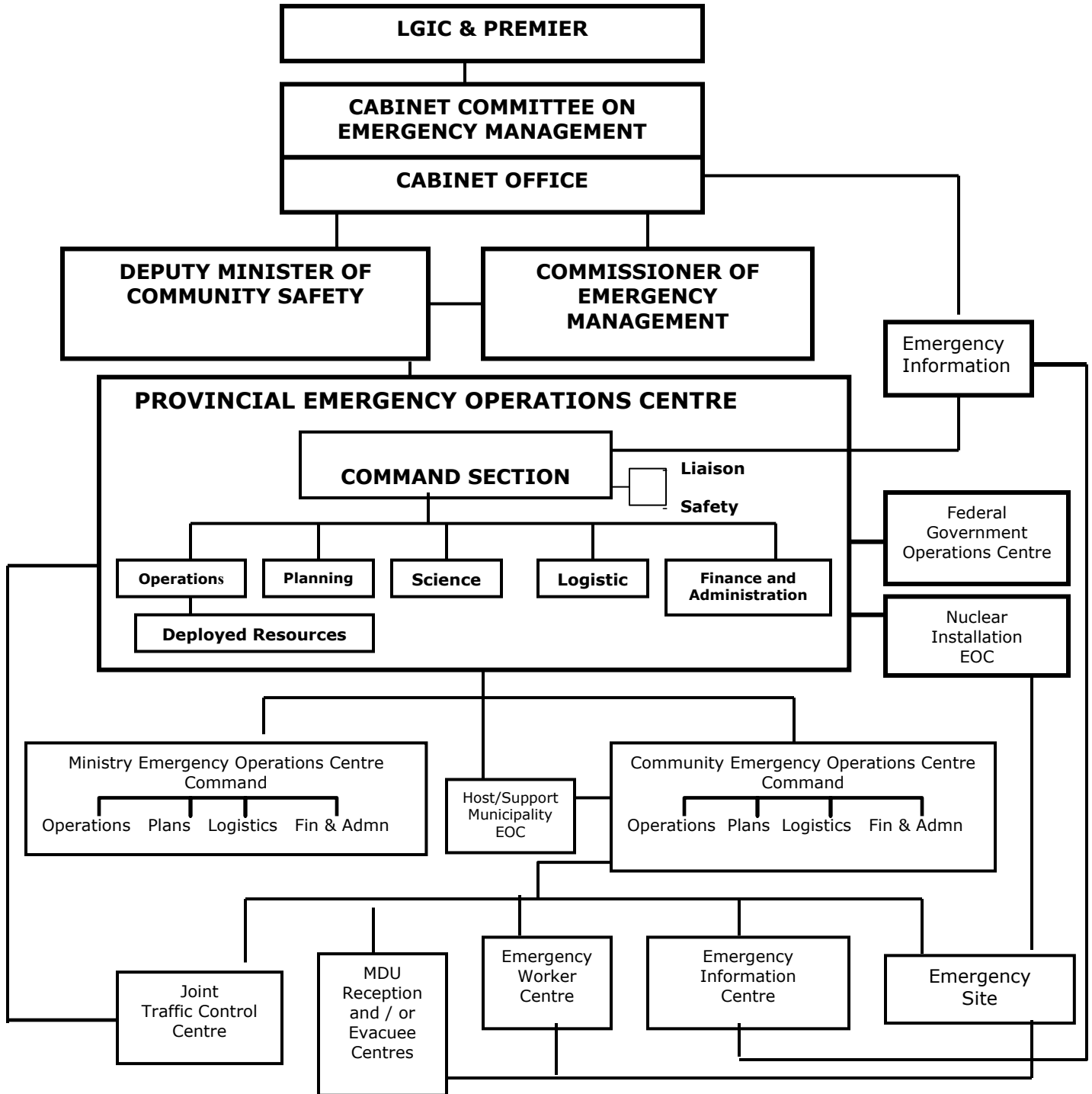
- 2.13.1 The response level adopted by the PEOC will be determined at the time of the incident and will depend on the extent of operations required to be undertaken as well as the associated staffing required at the PEOC.

## **2.14 PEOC Concept of Operations**

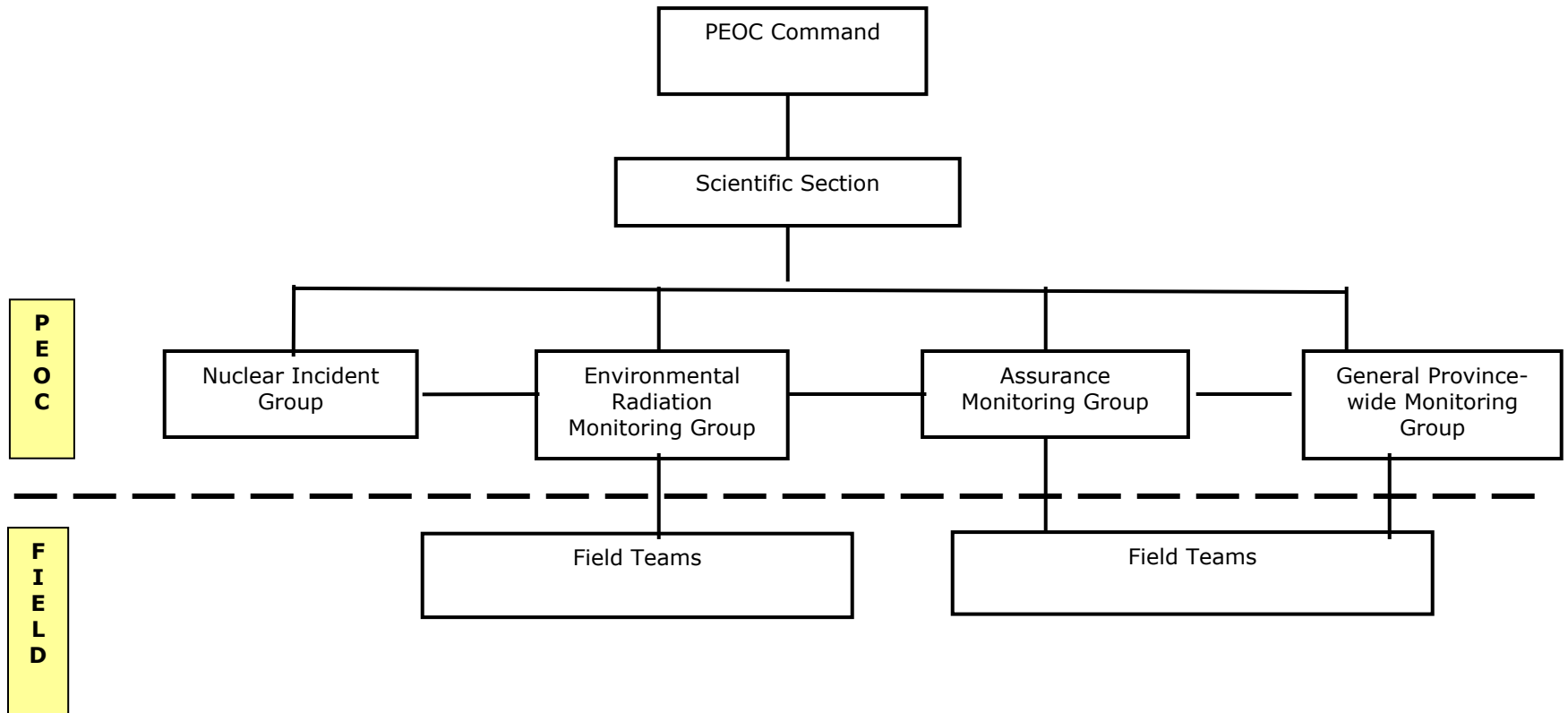
- 2.14.1 If the PEOC receives notification of a radiological incident from a community requesting assistance, some or all of the following operations will apply, in coordination with the actions already being undertaken by the community as detailed in **Chapter 3**:
- a) Locating the source, if missing. If the source has broken up, the various pieces would need to be located. This is the responsibility of the licensee, where the licensee is identifiable;
  - b) If any persons are suspected of having been exposed by the source, screening them and providing treatment to those who need it;
  - c) Fixing the source to prevent migration, ensuring shielding to prevent radiation exposure and applying appropriate access control zone boundaries;
  - d) Detecting areas of contamination;
  - e) Monitoring persons who may have been contaminated, and if necessary, decontaminating them;
  - f) Applying exposure control measures where considered appropriate;
  - g) Applying ingestion control measures where considered appropriate;
  - h) Decontamination of contaminated areas; and
  - i) Lifting of the protective measures applied.

## 2.15 Main PEOC Operations

- 2.15.1 PEOC Assembles: The PEOC organization is notified and begins operations, under the direction of the Commander.
- 2.15.2 Liaison with the Federal Government: Communication shall be established and resource requirements shall be arranged.
- 2.15.3 Liaison with Communities: Communication shall be established with the affected community for regular information sharing. If appropriate, a provincial staff shall be deployed. See **Paragraph 3.4.11** below.
- 2.15.4 Emergency Information: An initial provincial release of information should be issued. See **Section 2.6**. If appropriate, provincial emergency information staff shall be deployed to the affected community(ies).
- 2.15.5 Provincial Emergency Declaration: The LGIC or, if appropriate, the Premier may declare an emergency if the criteria under section 7.0.1 of the EMCPA is met (see **section 1.3 of the PNERP Master Plan**).
- 2.15.6 Environmental Radiation Monitoring: Under the direction of the Command Section, based on recommendations of and guidance from the Scientific Section, a request shall be made for federal monitoring teams to measure airborne radiation as well as radioactive material on the ground to determine the need for and extent of protective measures required.
- 2.15.7 Protective Measures: The PEOC will consider the advisability of issuing operational directives (or, in the event of declared emergency advising that such orders have been made) for precautionary measures and protective measures (**Paragraph 3.4.9** below), based on the assessments from the Scientific Section.



**FIGURE 2.1 : PROVINCIAL NUCLEAR AND RADIOLOGICAL EMERGENCY RESPONSE ORGANIZATION**



**FIGURE 2.2: ENVIRONMENTAL RADIATION MONITORING GROUP**

## CHAPTER 3

### NOTIFICATION AND RESPONSE

#### 3.1 Notification

- 3.1.1 In most incidents (malevolent or not), it is likely that the first indications of a radiological event will come from a local emergency response organization – police, fire, and emergency medical services. In such cases, notifications will likely proceed according to local plans/procedures.
- 3.1.2 Communities shall notify the PEOC where an emergency is declared or, whenever it activates its emergency response plan for such an incident (**Section 2.12**).
- 3.1.3 Pursuant to the *Nuclear Safety and Control Act*<sup>6</sup> and its associated regulations, any person/organization licensed by the Canadian Nuclear Safety Commission to hold, use or transport radioactive material is responsible for notifying the CNSC in the event of an occurrence resulting in the release or loss of control of radioactive materials.
- 3.1.4 The CNSC will notify the province (through the PEOC) of any report it receives from a licensee of an occurrence which has resulted, or has the potential to result in the receipt, by any member of the public, of a dose of ionizing radiation in excess of prescribed regulatory limits.
- 3.1.5 Upon receipt of a notification, from any source, of an occurrence of a radiological event whose effects have not been contained and/or which has the potential to affect public health and safety, the PEOC shall notify the following entities:
- a) The appropriate provincial ministries (**Paragraph 2.8.2(b)**);
  - b) The affected community(ies);
  - c) Federal departments and organizations with responsibilities under this plan, including:
    - Canadian Nuclear Safety Commission;
    - Health Canada; and
    - Public Safety Canada.

---

<sup>6</sup> The *Nuclear Safety and Control Act* is available at: <http://www.cnsccsn.gc.ca/eng/lawsregs/actsregulations/index.cfm>

The province shall transmit, in its notification to the above agencies, the response phase being adopted as per **Section 3.2** below.

- 3.1.6 Where the incident is as a result of a malevolent act, the Provincial Counter Terrorism Plan (PCTP) shall be activated to deal with the law enforcement aspect of protecting public safety. The purpose of the Other Radiological Emergencies Response Plan is to coordinate the consequence management aspect of the radiological incident. This plan can coexist with the PCTP and coordination of the emergency response operations under the two plans shall be undertaken through, and facilitated by, the Incident Management System structure.
- 3.1.7 Notification at the Community level:
- a) Where a community has persons or organizations licensed by the CNSC within its area, it should ensure that such licensees are aware of the appropriate community contact point to which the initial notification should be made.
  - b) Community Emergency Response Plans should detail the appropriate notifications as well as the response actions within the organization, in the event of a radiological emergency. This should include notification to the Provincial Emergency Operations Centre (PEOC).
  - c) If the community declares an emergency to deal with the radiological incident, it shall, as required under the *Emergency Management & Civil Protection Act*, notify the Minister of Community Safety and Correctional Services (through the PEOC).
  - d) Upon receipt of a notification from the province of a radiological incident resulting in the activation of this Plan, the community shall activate its emergency response plan and organization (pursuant to section 4 of the EMCPA).

## **3.2 Response Phases**

- 3.2.1 The response to a radiological emergency, for the purposes of this plan, is divided into three phases:
- Initial Response Phase;
  - Intermediate Response Phase; and
  - Recovery Phase.

### 3.3 Initial Response Phase

- 3.3.1 The Initial Phase is the period at the beginning of the incident when immediate decisions for effective use of protective actions are required and actual field measurement data is generally not available.
- 3.3.2 The response during this phase includes initial emergency response actions undertaken by first response organizations (Police, Fire, Emergency Medical Services) to protect public health and welfare in the short term.
- 3.3.3 Priority should be given to lifesaving and first-aid actions.
- 3.3.4 Zoning the event scene into Access Control Zones (*Hot, Warm and Cold*) **Table 3.1** will help reduce radiation exposures, aid in controlling the spread of radioactive contamination and minimize interference with emergency operations. Protective actions are taken very quickly and can be modified later as more information becomes available.
- 3.3.5 The immediate actions required include:
- a) Determining and providing dose limit guidance for first responders/ emergency workers (**Annex C** and CNSC Information Sheet INFO-0754-4 "Incident Control and Decontamination for First Responders"<sup>7</sup>).
  - b) Delineation of Access Control Zones:
    - Criteria for the delineation of access control zones (i.e. Hot, Warm and Cold Zones) are prescribed in the CNSC Information Sheet INFO-0754-4 "Incident Control and Decontamination for First Responders".
  - c) Immediate care of injured:
    - In most circumstances, life saving actions and actions to secure the area of a radiological terrorist event from further terrorist activities should take precedence over radiological considerations following a terrorist event. A possible exception pertains to the need to secure the area near ground zero soon after detonation of the radiological device.

<sup>7</sup> This document is available at: [http://www.cnsccsn.gc.ca/pubs\\_catalogue/uploads/0754\\_4.pdf](http://www.cnsccsn.gc.ca/pubs_catalogue/uploads/0754_4.pdf)



- All affected individuals must be attended to by medical personnel and stabilized for traumatic injuries before the consideration of radiation injury can be made.
- d) Radiation Triage: Once the affected individuals have been medically stabilized, radiation triage assessment must be undertaken.
- e) Protective Actions:
- First responders will have to decide whether sheltering or evacuation is most appropriate. Generally, except within a potential explosive blast zone from which people are likely to be evacuated, sheltering will normally be the preferred protective measure until such time that actual dose measurements can be made and their implications determined.
  - Evacuations should be directed if it is more protective than sheltering.
- f) Decontamination:
- The CNSC recommends that a decontamination area be set up at least 5 meters behind a point where the reading is twice background. Typical background levels are approximately  $0.25\mu\text{Sv/h}$  for a gamma dose rate meter.
  - Monitoring for contamination and applying decontamination techniques should be performed prior to releasing people.
  - Decontamination must be undertaken (i.e. clothes removed and bagged and skin cleared) at levels of twice background or higher, when measured by sweeping with a pancake meter. Typical background is 50 cpm for a  $15\text{ cm}^2$  pancake contamination meter.

### 3.4 Intermediate Response Phase

- 3.4.1 The Intermediate Phase (or environmental radiation monitoring phase) **Table 3.1** may occur simultaneously with, or shortly after the initial phase with activation of the provincial response

organization. Provincial decision-making, however, will be based on environmental monitoring which may take longer to activate.

- 3.4.2 Environmental monitoring activities will be carried out to identify and quantify the contents of the radiological contaminants.
- 3.4.3 Appropriately trained nuclear energy workers (as defined by the *Nuclear Safety and Control Act*) will carry out these activities.
- 3.4.4 Protective action measures are likely to be needed based on results of ground monitoring.
- 3.4.5 Measurements of exposure and ground depositions will enable protective action decisions to be modified.
- 3.4.6 Initial Provincial Response: The initial provincial response in the event of a radiological emergency is contingent on the characteristics of the incident:
  - a) If the radiological source remains intact or confined, with no impact on public safety, the responsibility remains that of the licensee under the regulatory control of the CNSC. The province will continue normal **Routine Monitoring**.
  - b) If the radiological source has the potential to affect offsite public health and safety, provincial assistance will be provided. The response level adopted by the province will be determined by the level of assistance required as well as the level of staffing undertaken by the PEOC.
  - c) Notwithstanding the above, where any incident is as a result of a malevolent act (terrorism) the PEOC shall adopt the **Activation** response.
  - d) The following are the key operations undertaken at the provincial level for response to a radiological incident.
- 3.4.7 Overview of Environmental Radiation Monitoring Operations:
  - a) Radiation monitoring will be directed for both the area where the radiological incident occurred and, in the event of a widely dispersed event, for selected sites around the province as well, in order to gather radiological information about the contamination, e.g. plume and deposition, air and ground concentrations, exposure rates, etc.

- b) Hybrid teams comprising members from federal, Ontario's nuclear facilities and private sector organizations may be assembled to jointly carry out the radiation monitoring activities. The PEOC shall have the overall responsibility of organizing and coordinating the radiation monitoring resources and utilization of findings according to the Environmental Radiation Monitoring procedures.
- c) Initially, fixed monitoring resources shall be surveyed and **aerial** field-monitoring teams will be deployed to:
  - i. Identify the type of radioactive contaminants;
  - ii. Determine how far they have spread and in what direction; and
  - iii. Determine if additional resources are needed.

The information can then be used to direct **ground** monitoring resources to carry out more detailed field surveys in areas of concern in order to develop a more refined contamination picture.

- d) If emergency responders are first at the scene, they would have already established access control zones (**Paragraph 3.3.5 (b)**). Based on the new, radiological monitoring information, the PEOC may revise/adjust the initial zone boundaries, creating response zones (**Paragraph 3.4.8**) within which appropriate protective measures can be ordered/adjusted.
- e) The radiological picture of the contaminated area will continue to change over time due to radioactive decay, natural processes of weathering, dispersion, dilution, etc. as well as human activities and intervention. It will therefore be necessary to continue a monitoring program to keep track of the changing radiological situation. As more accurate data accumulates, the boundaries of the zones and therefore the requirement for, and extent of, protective measures will be appropriately adjusted.

#### 3.4.8 Delineation of Zones

- a) Field monitoring carried out under the direction of the Scientific Section shall result in the delineation of zones, as outlined below and shown in **Figure 3.2**.
- b) Protective Measures will be directed, based on the delineation of these zones.

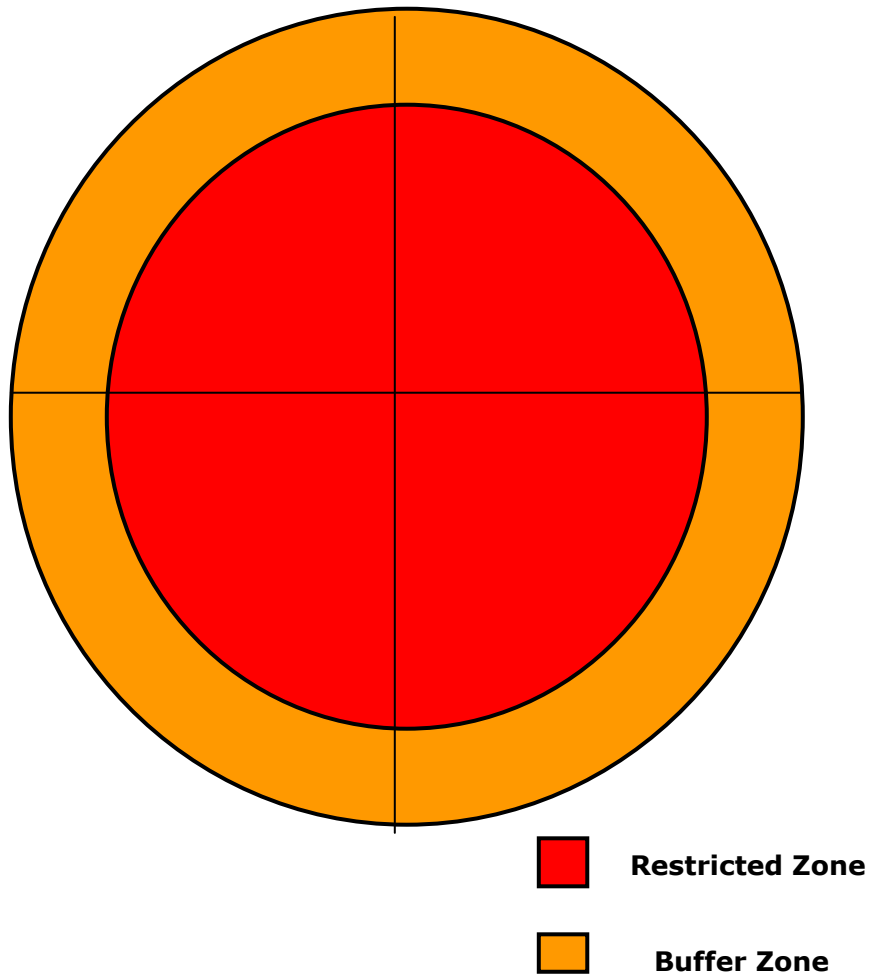
- Restricted Zone - The area within which exposure control measures are likely to be needed, based on the results of field monitoring. These measures would be applied within this Restricted Zone as per the Protective Action Levels (**Annex C**).
- Buffer Zone - This zone provides a buffer area beyond the Restricted Zone, where limited measures of radioactivity are detected. The buffer zone is initially delineated based on the results of preliminary field monitoring. Ingestion control measures may be applied within this zone based on guidance provided by the Protective Action Levels (**Annex C**), and in accordance with direction provided by Health Canada and the Canadian Food Inspection Agency.

#### 3.4.9 Protective Actions

- a) Protective actions include precautionary measures and protective measures.
- b) In principle, protective actions should be applied so as to prevent any increased exposure of people to radiation due to the emergency. In practice, this may not always be justified since protective actions also entail some risk and/or cost. It is therefore necessary to optimize the application of protective actions so as to minimize the total risk or detriment involved.
- c) A range of precautionary and protective measures are available to deal with radiological emergencies. They are complementary to each other, and should be applied in combination as appropriate to the situation, and taking into account their respective efficacies and limitations.
- d) The PEOC will decide on appropriate precautionary and protective measures based on the Scientific Section's technical assessments, and on operational and public policy considerations. Where a protective measure is warranted, the PEOC shall consider the advisability of issuing Operational Directives (or, in the event of a declared emergency, advising that such orders have been made).

INITIAL RESPONSE PHASE		INTERMEDIATE RESPONSE PHASE	
Response Organizations	Delineation of Access Control Zones	Response Organizations	Delineation of Zones
<ul style="list-style-type: none"> <li>- Police</li> <li>- Fire</li> <li>- Emergency Medical Services</li> </ul>	<ul style="list-style-type: none"> <li>- Hot</li> <li>- Warm</li> <li>- Cold</li> </ul>	<ul style="list-style-type: none"> <li>- Ministries</li> <li>- Federal Organizations</li> <li>- Communities</li> </ul>	<ul style="list-style-type: none"> <li>- Restricted</li> <li>- Buffer</li> </ul>
<p><i>Criteria for the delineation of access control zones: prescribed in the Canadian Nuclear Safety Commission Information Sheet INGO-0754-4 'Incident Control and Decontamination for First Responders'.</i></p>		<p><i>Definition of delineation of zones: prescribed in the Nuclear/Radiological Glossary <b>Annex F</b>.</i></p>	

**TABLE 3.1: INITIAL AND INTERMEDIATE RESPONSE PHASES**



**FIGURE 3.2: RADIATION CONTAMINATION ZONES**

<b>WORKERS</b>	<b>NON-EMERGENCY</b>	<b>EMERGENCY</b>
Member of the Public (including Emergency Workers)	1 mSv / year (0.1 rem / year)	500 mSv** (50 rem)
Nuclear Energy Worker	50 mSv / year (5 rem / year)	500 mSv** (50 rem)
	100 mSv / 5 years (10 rem / 5 years)	

**TABLE 3.3 : EMERGENCY DOSE LIMITS FOR  
EMERGENCY WORKERS /  
NUCLEAR ENERGY WORKERS**

**REGULATED EFFECTIVE DOSES\***

\* *Nuclear Safety & Control Act, Radiation Protection Regulations, CNSC, May 2000.*

\*\* Maximum Dose allowed; Note: there is no limit for a person who acts voluntarily to save or protect human life (such response actions should only be taken with an understanding of the potential acute effects of radiation to the exposed responder and based on the determination that the benefits of the action clearly exceed the associated risks).

- e) In the first instance, before reliable radiological information is available, protective action decisions will have been taken by emergency responders. Once the environmental monitoring teams are activated and data is received and analyzed, these protective measures can be adjusted, based on operational, technical and public policy considerations.
- f) The PEOC shall consider the advisability of issuing operational directives for any precautionary and protective measures in the Restricted and Buffer Zones and shall issue the necessary directions for their implementation.
- g) Guidance for levels at which protective actions are undertaken are provided in **Annex C** are detailed in **Table 3.4**.
- h) The measures (set out in **Table 1.1** of this plan and further defined in the glossary in **Annex F**).

#### 3.4.10 Radiation Health Response Plan

- a) The MOHLTC has developed a Radiation Health Response Plan (RHRP) to deal with potentially exposed and/or contaminated persons following a nuclear or radiological event.
- b) The RHRP provides a framework for the overall health response to a radiological event and an overview of general principles for the public health response.
- c) This Radiation Health Response Plan will be activated as soon as the Other Radiological Emergencies Response Plan has been activated for a radiological emergency. The RHRP will be implemented through the MOHLTC Emergency Operations Centre.
- d) The health response actions, as detailed in the RHRP, that may be required for both the public and emergency workers (including medical personnel) include:
  - Preventing the contamination of medical workers and the medical facilities;
  - Monitoring for external contamination;
  - Decontamination;
  - Internal contamination monitoring;
  - Dose estimations;
  - Screen for acute radiation exposure;



- Maintaining a database for medical follow-up
- Reduction of internal contamination, where possible;
- Administration of KI Pills (Potassium Iodine);
- Provide treatment for acute radiation exposure;
- Counselling;
- Public communication; and
- Public health information program.

#### 3.4.11 Deployment of Provincial Staff

- a) Per **Paragraphs 2.8.2 (a) and 2.15.3**, provincial staff may be deployed, if considered appropriate, to the community(ies) affected by the incident as well as to other jurisdictions involved in the operational response to the incident, e.g. federal government, state or provincial EOCs.
- b) The role of deployed staff will be to:
  - Maintain close liaison with the jurisdiction(s) dealing with the emergency;
  - Provide direction/guidance to the community(ies) on actions they may need to take;
  - Obtain and transmit to the PEOC all relevant information on the situation; and
  - Provide information to those jurisdictions on the actions taken by the province.

#### 3.4.12 Emergency Information

- a) The PEOC will arrange for emergency information to be regularly issued to the media and the public and ensure coordination of releases of information with the affected municipalities and the federal government.
- b) If it is deemed appropriate, provincial emergency information staff may be deployed to the local area's emergency information centre.

#### 3.4.13 Ongoing Assessment of the Situation

- a) The PEOC will carry out an ongoing assessment of the situation based on information received from the community emergency response organization(s)/CNSC/licensee (as applicable), as well as from the results of radiation monitoring carried out within Ontario.

- b) The main aims of this ongoing assessment are:
- To develop, modify as necessary, and implement a radiation monitoring plan;
  - To decide on the imposition/lifting of protective measures;
  - To modify the protective measures implemented based on the results of the ongoing field monitoring; and
  - To adjust the response level and/or staffing level, as required.

#### 3.4.14 Emergency Worker Safety

- a) It is the responsibility of the Minister of Labour to oversee the system of Emergency Worker Safety to ensure that employers meet their obligations concerning health and safety of workers during a radiological emergency.
- b) Emergency Worker Organizations should ensure the provision of equipment and training to their personnel, as appropriate, to enable them to respond to radiological emergencies. The equipment should include personal dosimeters, and other personal protective equipment as required, for the protection of emergency workers.
- c) In addition, emergency worker organizations should ensure the provision of radiation detection and assessment equipment in vehicles, or should have access to such equipment through mutual aid agreements, as appropriate.
- d) Emergency Workers includes police, firefighters, emergency medical services, personnel from the Canadian Forces, and other individuals that may be providing support to the response.
- e) Emergency Worker organizations should ensure that their staff adheres to the guidance set out by the CNSC for limiting their effective doses when working in the area.
- f) Guidance for limiting the effective dose for first responders and emergency workers is provided in **Table 3.3**.

3.4.15 Compensation: Where applicable, compensation for losses will be made according to the terms and conditions of the Nuclear Liability Act.

### 3.5 Recovery Phase

3.5.1 The Recovery Phase begins with recovery and cleanup actions designed to reduce radiation levels in the environment to acceptable levels and ends when all the recovery actions have been completed.

3.5.2 Transition from Response Phase to Recovery Phase:

- a) At a suitable stage the PEOC will consult with the major organizations involved in the emergency response regarding their transition to the Recovery Phase, and what lead time they would need to make a smooth transition.
- b) Based on these consultations, the PEOC will set a time for the ending of the Response Phase (and the commencement of Recovery Phase) and inform all concerned in advance.
- c) At the transition point, the Response Phase will end, the Recovery Phase will commence, and the required organizational and other changes will be made by all those affected as prescribed in recovery plans and procedures, and as directed by the PEOC.
- d) Guidance on the issues to be dealt with during the Recovery Phase is provided in **Annex E**.

### 3.6 Termination of Offsite Response

3.6.1 Response to a nuclear or radiological emergency will be terminated in one of the following ways:

- a) A decision by the Chief, Emergency Management Ontario or designate, that the event that caused the initial notification shall not be dealt with under this Plan;
- b) A formal termination of the provincial response by the Chief, Emergency Management Ontario, or designate;
- c) A formal termination of the offsite response by the Provincial Emergency Operations Centre;
- d) Following an emergency declaration, termination of the emergency pursuant to Section 7.0.7 of the EMCPA.

Measure	Considerations
<b><i>Precautionary Measures</i></b>	
Restricting access to potentially affected areas	<ul style="list-style-type: none"> <li>• The PEOC should consider the advisability of applying any or all of the following precautionary measures in the Restricted or Buffer Zones and issue the necessary directions for their implementation:               <ul style="list-style-type: none"> <li>○ Closure of beaches and recreation areas;</li> <li>○ Closure of workplaces and schools.</li> </ul> </li> </ul>
<b><i>Protective Measures - Exposure Control</i></b>	
Entry Control	<ul style="list-style-type: none"> <li>• Consideration should be given to suspending the following transportation routes in the affected area. The appropriate representative in the PEOC, as shown below, will coordinate management of the main traffic routes in cooperation and coordination with the appropriate municipal EOC(s).               <ul style="list-style-type: none"> <li>○ Road (MTO);</li> <li>○ Rail (MTO and federal representatives);</li> <li>○ Marine (federal and provincial representative); and</li> <li>○ Air (federal representative).</li> </ul> </li> <li>• If main traffic routes are likely to remain closed for an extended period, alternative routing arrangements should be made under the guidance of the PEOC.</li> <li>• The Ministry of Transportation and the OPP representatives in the PEOC will ensure control of traffic and any diversions that may be required in the affected area, in cooperation with the local police services and public works' departments of the affected municipalities.</li> </ul>
Sheltering	<ul style="list-style-type: none"> <li>• If the results of radiation monitoring indicate that sheltering is required, Emergency Bulletins will be issued.</li> </ul>
Evacuation	<ul style="list-style-type: none"> <li>• Evacuations will be directed by the PEOC based on the results of the radiation monitoring and according to the delineation of the Restricted Zone.</li> <li>• The PEOC may, in conjunction with the community EOC, issue Emergency Bulletins to the affected public when evacuations are necessary. Alternatively, the community EOC may make arrangements to issue Emergency Bulletins directly.</li> </ul>

**TABLE 3.4 : PROTECTIVE ACTION CONSIDERATIONS**

<b>Measure</b>	<b>Considerations</b>
	<ul style="list-style-type: none"> <li>• Monitoring &amp; Decontamination of evacuees will be undertaken according to the arrangements of the Radiation Health Response Plan.</li> <li>• Food and lodging will be provided according to arrangements under the affected communities Emergency Response Plan, with assistance provided by the Ministry of Community and Social Services, as necessary.</li> </ul>
Thyroid Blocking/KI (Potassium Iodine)	<ul style="list-style-type: none"> <li>• If thyroid blocking is necessary, it will be implemented under the authority of the Chief Medical Officer of Health, and according to the Radiation Health Response Plan.</li> </ul>
Use of Protective Equipment	<ul style="list-style-type: none"> <li>• See <b>Section 3.4.14</b> below on Emergency Worker Safety.</li> </ul>
Decontamination and Dose Reduction	<ul style="list-style-type: none"> <li>• Personal Decontamination will be implemented under the authority of, and according to the Radiation Health Response Plan.</li> <li>• Decontamination and other dose reduction techniques should be directed if the projected annual effective dose exceeds 5 mSv (0.5 rem) for any year following the first year (Health Physics Society, January 2004).</li> </ul>
<b><i>Protective Measures - Ingestion Control</i></b>	
Food Restrictions	<ul style="list-style-type: none"> <li>• The federal government may impose restrictions on the export of food items, which may have been contaminated. The Ministry of Agriculture, Food and Rural Affairs may be required to assist in this implementation. <ul style="list-style-type: none"> <li>○ The consumption of exposed food or water could be banned.</li> <li>○ Milk and meat producing animals (livestock) to be removed from outside pasture and open water sources.</li> <li>○ Pasture control, produce and crop control, livestock control, land control and environmental decontamination measures would also be undertaken as required.</li> </ul> </li> </ul>

**TABLE 3.4 : PROTECTIVE ACTION CONSIDERATIONS**

## **RADIOLOGICAL INCIDENTS DESCRIBED**

### **1.0 Nuclear Establishments**

#### 1.1 Nuclear Establishments described:

- A nuclear establishment is a facility that uses, produces, processes, reprocesses, stores or disposes of a nuclear substance (as defined in the federal *Nuclear Safety and Control Act*), but does not include a nuclear installation.
- The following types of facilities may be nuclear establishments under the above definition:
  - a) Academic and research laboratories;
  - b) Hospitals and medical institutes;
  - c) Industrial plants;
  - d) Uranium mines;
  - e) Processing, reprocessing or separation plants for nuclear substances;
  - f) Nuclear fuel fabrication plants;
  - g) Nuclear waste disposal and storage sites; and
  - h) Construction companies.

#### 1.2 Accidents at Nuclear Establishments:

The following are some of the types of accidents that could occur at a nuclear establishment, and would be covered by this plan:

- a) Missing radioactive source;
- b) Dispersion of radioactive material;
- c) Natural, flammable, destructive or other phenomena that have or could have affected the control over and/or the integrity of a radioactive source (e.g., fire, explosion, earthquake, tornado, flood, etc.);
- d) Discovery of significant radioactive contamination within the facility; and
- e) Discovery of high radiation fields within the facility.

#### 1.3 Types of Hazards:

The following are the main types of offsite hazard that could arise from the accidents listed above:

- a) Direct radiation exposure to persons who handle a radioactive source or come in its vicinity could occur if the radioactive source leaves the premises of the establishment. An accident at a nuclear establishment could also be the source for the spread of contamination.
- b) The spread of radioactive contamination offsite from the establishment, even though the radioactive source remains onsite.

## **2.0 Transportation Accidents**

### 2.1 Transportation Regulatory Controls and Guidance:

- The Canadian Nuclear Safety Commission (CNSC) is responsible for regulating the packaging of radioactive material for transport under the Packaging and Transport of Nuclear Substances Regulations.
- Transport Canada is responsible for regulating the transport of dangerous goods under the Transportation of Dangerous Goods Regulations.
- Transport Canada, in conjunction with its counterparts in the USA, Mexico and Argentina, has published the 2008 Emergency Response Guidebook (ERG2008)<sup>8</sup>. This is a guide to aid first responders (fire, police, EMS) in the immediate measures to be taken to deal with a transportation accident involving hazardous material. Guide No. 161 - 166 deal with transportation emergencies involving radioactive substances.
- Transport Canada also operates the Canadian Transport Emergency Centre (CANUTEC), which is a facility that operates on a 7-day/24-hour basis, and can provide technical advice, information and assistance (by telecommunication) on dealing with transportation accidents involving hazardous goods. Transporters are required to inform CANUTEC whenever an accident involving radioactive material occurs.

### 2.2 Types of Accidents and Hazards:

- If the package containing the radioactive material remains intact, then the hazard is minimal. The only

---

<sup>8</sup> This document is available at: <http://www.tc.gc.ca/eng/canutec/guide-menu-227.htm>

response required is to control access to the site of the accident until qualified personnel retrieve the package.

- If the package is damaged in the accident, the following hazards may arise:
  - a) There may be radiation fields in the vicinity of the source or parts of it;
  - b) Radioactive contamination may have spread, or may start to spread;
  - c) Early responders to the accident may have been exposed to high radiation fields.
- Early responders to the accident may have been contaminated, and they and their equipment may spread the contamination further.

### 3.0 Satellite Re-entry

#### 3.1 Typical Accidents:

- Some satellites carry nuclear reactors (using highly enriched uranium-235) to provide internal power. Some others carry radioisotope thermoelectric generators, generally using plutonium-238.
- If one of these satellites were to malfunction and make an unplanned re-entry into the earth's atmosphere, it could result in the deposition of radioactive material on earth. This deposition would be along the re-entry path of the vehicle, forming what is called a *footprint*. This footprint can be very long, its length and width depending on the conditions of the re-entry\*.
- Another complication is that the expected location of the footprint is difficult to determine until the re-entry into the atmosphere actually takes place. Even then, there will be considerable uncertainty as to the beginning and end of the debris path along the ground-projected trajectory of the space vehicle or its parts.

---

\* Cosmos 954, weighing about 5000 kg, produced a footprint about 600 km long with radioactive debris covering an area of more than 100,000 km<sup>2</sup>. Skylab, weighing about 75,000 kg (but which did not contain any radioactive material) produced a footprint more than 1000 km long and over 150 km wide.



### 3.2 Typical Hazards:

The crash of a space vehicle carrying radioactive material could create one or more of the following hazards:

- External radiation from deposited debris. This would vary depending on the degree of radioactivity emitted by the item, and exposure conditions (distance, period of exposure, etc.). The deposition of small particles from the atmosphere may continue for some hours after re-entry.
- Internal radiation from inhaled material. The most dangerous would be plutonium or other alpha emitters, usually contained in radioisotope thermoelectric generators.
- Internal radiation from ingested material. Contamination of foodstuffs and water may cause this.

## **4.0 Radiological Dispersal Devices (RDD)**

### 4.1 RDD Described:

- Radiological Dispersal Devices (RDDs) can be constructed by combining a conventional bomb with radioactive material thereby causing radiological materials to be dispersed upon explosion. These devices are not as destructive as a nuclear explosion involving the fission or fusion processes and, therefore, can only scatter a limited quantity of harmful radioactive material over a very limited area.
- A RDD will initially appear as a conventional bomb attack by terrorists, until such time as it is verified through radiation monitoring carried out by the first responders.
- Although the most likely dispersal of radioactive material is thought to be through an explosive device, the same effect could also be achieved by other means, such as liquid-spraying aircrafts or via ventilation systems of large complexes. In the worst case scenario, terrorists may use multiple devices or a combination of real and hoax incidents.

### 4.2 Hazards and Consequences:

- The immediate hazard of an RDD is the physical damage to property and human life caused by the conventional component of the device coupled with the radiation exposure of victims due to scattered radioactive material. The explosion

from an RDD will contain a large amount of dust and debris and a relatively small amount of very fine particles. Only these fine particles can travel beyond the blast zone of an explosive and may carry some radioactivity with them.

- The physical damage caused to human life and property will be primarily due to the conventional explosive component of RDD. The short term physical effects caused by the radioactive material will be less significant but the psychological effects will be considerable.
- Residual hazards may be caused due to downwind fallout of radioactive material, inadvertent cross contamination and the use of affected infrastructure prior to proper decontamination.

## **5.0 Radiological Devices (RDs)**

### 5.1 RDs Described:

- Radiological Devices (RDs) could be lost or stolen radioactive sources which may be in locations resulting in radiation exposure and/or contamination of the public, contamination of a site and/or contamination of food and water supplies.
- Depending on the size, location and intensity of the RD, it could be detected either through periodic monitoring of likely locations or, ultimately, once members of the public in its proximity begin to fall ill.

### 5.2 Hazards and Consequences:

- Symptoms may include reddening of the skin or a burn-like injury. In some cases nausea, vomiting or diarrhea could occur.
- The socio-economic and psychological disruptions caused by such incidents may linger on for quite some time and may require a very concerted recovery effort.

## **6.0 Nuclear Weapon Detonation**

### 6.1 Nuclear Weapon Detonation Described:

- Detonation of a nuclear weapon would most likely result from a terrorist or malevolent attack using a low yield nuclear weapon or suitcase bomb.

## 6.2 Hazards and Consequences:

- A high radioactive burst as well as a bomb blast would result in widespread death, injury and destruction as well as contamination.
- The injuries would include burns, blast injury and trauma, contamination, radiation exposure, and psychological trauma.
- Major economic consequences would result from disruptions to communications, electricity supply, transportation systems, etc.

## NUCLEAR ESTABLISHMENTS IN ONTARIO

#	FACILITY & LOCATION	LICENSEE	STATUS
<b>Uranium Mine/Mill Facilities</b>			
<b>Elliot Lake Area Rio Algom Limited</b> <b>(Note: All of these facilities fall under <u>one</u> single license)</b>			
1.0	Spanish America Mine Site and TMA	Rio Algom Ltd.	Decommissioning substantively complete. On-going operations for water treatment and environmental monitoring.
1.1	Stanleigh Mine Site and TMA	Rio Algom Ltd.	Decommissioning substantively complete. On-going operations for water treatment and environmental monitoring.
1.2	Lacnor Mine Site and TMA	Rio Algom Ltd.	Decommissioning substantively complete. On-going operations for water treatment and environmental monitoring.
1.3	Panel Mine Site and TMA	Rio Algom Ltd.	Decommissioning substantively complete. On-going operations for water treatment and environmental monitoring.
1.4	Quirke Mine and TMA	Rio Algom Ltd.	Decommissioning substantively complete. On-going operations for water treatment and environmental monitoring.
1.5	Nordic Mine Site and TMA	Rio Algom Ltd.	Decommissioning substantively complete. On-going operations for water treatment and environmental monitoring.
1.6	Buckles Mine Site	Rio Algom Ltd.	Decommissioning substantively complete. On-going operations for water treatment and environmental monitoring.
1.7	Milliken Mine Site	Rio Algom Ltd.	Decommissioning substantively complete. On-going operations for water treatment and environmental monitoring.
1.8	Sheriff Creek Sanctuary	Rio Algom Ltd.	Decommissioning substantively complete. On-going operations for water treatment and environmental monitoring.
1.9	Pronto Mine Site and TMA	Rio Algom Ltd.	Decommissioning substantively complete. On-going operations for water treatment and environmental monitoring.

#	FACILITY & LOCATION	LICENSEE	STATUS
<b>Elliot Lake Area Denison Mine Inc.</b>			
2.0	Denison Mine and TMA	Denison Mines	Decommissioning substantively complete. On-going operations for water treatment and environmental monitoring.
2.1	Stanrock Mine and TMA	Denison Mines	Decommissioning substantively complete. On-going operations for water treatment and environmental monitoring.
<b>Province of Ontario</b>			
2.2	Agnew Lake Mine	Ministry of Northern Development	Decommissioning Environmental monitoring.
2.3	Deloro Waste Management Area, Deloro	Ministry of Environment	Decommissioning Environmental monitoring.
<b>Bancroft Area Madawaska Mine Inc</b>			
3.0	Madawaska Mine Bancroft	Encana West Ltd. (Note: No active license. Encana is currently acting as the responsible party)	Decommissioning substantively complete. Environmental monitoring.
3.1	Dyno Mine	Encana West Ltd.	Decommissioning substantively complete. Environmental monitoring.
3.2	Bicroft Tailings Site	Barrick Gold Corporation	Decommissioning substantively complete. Environmental monitoring.
<b>Uranium Refining, Conversion and Fuel Fabrication Plants</b>			
4.0	General Electric Canada Inc. Toronto	GEC Inc.	Operating
4.1	General Electric Canada Inc. Peterborough	GEC Inc.	Operating
4.2	Cameco Corporation Blind River	Cameco Corporation	Operating

#	FACILITY & LOCATION	LICENSEE	STATUS
4.3	Cameco Conversion Facility Port Hope	Cameco Corporation	Operating
4.4	Cameco Fuel Manufacturing Inc. Port Hope	Cameco Fuel Manufacturing Inc.	Operating
<b>Waste Management Facilities</b>			
5.0	Cameco Corporation Port Granby	Cameco Corporation	On-going operations for water treatment and environmental monitoring.
5.1	University of Toronto Waste Management Facility	University of Toronto	Operating
5.2	Welcome Waste Management Facility	Atomic Energy of Canada Ltd.	Operating
5.3	Monserco Limited Mississauga	Monserco Limited	Operating
5.4	Douglas Point	Atomic Energy of Canada Ltd.	Partially Decommissioned On-going operations for environmental monitoring.
5.5	NPD Waste Management Facility Rolphton	Atomic Energy of Canada Ltd.	Partially Decommissioned On-going operations for environmental monitoring.

#	FACILITY & LOCATION	LICENSEE	STATUS
5.6	Atomic Energy of Canada Ltd. Port Hope	Low-Level Radioactive Waste Management Office, Pine St Extension	Operating
5.7	Mississauga Metals and Alloys, Brantford	Mississauga Metals and Alloys	Operating
5.8	Richmond Metals, Stoney Creek	Richmond Metal Service	Operating
<b>Processing and Tritium Facilities</b>			
6.0	MDS Nordion Kanata	MDS Nordion	Operating
6.1	Shield Source Inc. Peterborough	Shield Source Inc.	Operating
6.2	SRB Technologies Pembroke	SRB Technologies (Canada) Inc.	Operating
<b>Research Reactors</b>			
7.0	Royal Military College, Kingston	Department of National Defence Canada	Operating
7.1	MacMaster University, Hamilton	MacMaster University	Operating
8.0	<b>Radioisotope Licensees</b> All Licensees (approximately 1,425)		

(Source : Canadian Nuclear Safety Commission – 2010 [www.nuclearsafety.gc.ca/eng](http://www.nuclearsafety.gc.ca/eng))

#### **NOTES**

1. Nuclear establishments within the AECL Chalk River Laboratories (less Maple Reactors) are not included here as they are covered by the Provincial Nuclear Emergency Response Plan, Implementing Plan, Chalk River.
2. Nuclear establishments within Ontario Power Generation's nuclear stations are not included here as they are covered by the site-specific parts of the Provincial Nuclear Emergency Response Plan for these stations.

**ANNEX C**

(Ref: Paragraphs 1.6.3, 3.3.5 (g), 3.4.8 (b) &amp; 3.4.9)

**PROTECTIVE ACTION LEVELS**

Protective Action Levels (PALs) are used as guidance for decision-makers in determining the protective and ingestion control measures that should be undertaken to protect public health and safety.

**EXPOSURE CONTROL MEASURES**

<b>PROTECTIVE MEASURE</b>	<b>LOWER LEVEL</b>		<b>UPPER LEVEL</b>	
	<b>Effective Dose</b>	<b>Thyroid Dose</b>	<b>Effective Dose</b>	<b>Thyroid Dose</b>
Sheltering	1 mSv (0.1 rem)	10 mSv (1 rem)	10 mSv (1 rem)	100 mSv (10 rem)
Evacuation	10 mSv (1 rem)	100 mSv (10 rem)	100 mSv (10 rem)	1 Sv (100 rem)
Thyroid Blocking	-	100 mSv (10 rem)	-	1 Sv (100 rem)

**INGESTION CONTROL MEASURES**

<b>BANNING FOOD/WATER CONSUMPTION</b>	<b>RADIONUCLIDE CONCENTRATION LEVEL</b>			
	Cs-134, Cs-137 Ru-103, Ru-106, Sr-89	I-131	Sr-90	Am-241, Pu-238 Pu-239, Pu-240 Pu-242
Foods for General Consumption	1 kBq (27 nCi) per kg		100 Bq (2.7 nCi) per kg	10 Bq (270 pCi) per kg
Milk, Infant Foods, Drinking Water	1 kBq (27 nCi) per kg		100 Bq (2.7 nCi) per kg	1 Bq (27 pCi) per kg

**For Application and Notes, see next page.**



## **APPLICATION**

1. The PALs for exposure control measures are expressed in terms of, and shall be related to, the highest projected dose likely to be received by the most exposed individual in the relevant critical group (see Glossary in **Annex F**, for definitions of these terms).
2. PALs are expressed over the duration of significant releases.
3. The PALs for ingestion control measures should be applied to food prepared for consumption. The PALs are to be applied to the **sum** of the activity levels for each radionuclide within a group. However, they are applied independently to each group. For example, if in a foodstuff the radiocesium is 50% of the permitted concentration while the quantity of rubidium (which is in the same group as cesium) is 60% of the permitted concentration, the item should be banned. However, an item containing 50% of the permitted concentration of radiocesium and 60% of the permitted concentration of Sr-90 (which is in a different group) would be acceptable.

(**Note:** I-131 is grouped with radiocesium, etc. in the case of foods for general consumption, but is grouped with Sr-90 for infant food and water).

## **NOTES**

1. The effective dose PALs above were adopted by the Government of Ontario in 1984 upon the recommendation of Provincial Working Group # 3 and are generally consistent with Health Canada Intervention levels as published in Canadian Guidelines for Intervention During a Nuclear Emergency (2003). The latest authoritative international guidance on the subject confirms their continuing validity. (Cf. *International Basic Safety Standards for Protection Against Ionizing Radiation and for Safety of Radiation Sources*, International Atomic Energy Agency. Safety Series No.115, 2004).
2. The intervention levels recommended in the International Basic Safety Standards (IBSS) are in terms of *avertable dose*, whereas the Ontario PALs are in the form of *projected dose*. This difference is essentially academic since the PALs are used most often in decisions on protective measures taken **prior to any radiation exposure**, and hence are being compared to avertable dose. In most cases where radiation exposure is already occurring, it would neither be possible nor desirable to base protective action decisions on calculations involving PALs; instead, they would be based on pre-planned responses and conservative estimates. (See Operational Response Strategy, **PNERP Master Plan Chapter 6**).

3. It is necessary to express PALs in terms of projected dose in order to conform to the Plan principle that protective measures should avert (or at least reduce) risk resulting from radiation exposure. Thus, expressed as projected doses, PALs in essence represent levels of risk from potential exposure, which justify the initiation of various protective measures. The risk commences when radiation exposure begins, and not when the emergency management organization starts to use PALs to assess the need for protective measures. If this assessment occurs in some circumstances after radiation exposure has commenced, the use of PALs in the prescribed manner will fulfill the above principle adopted in this Plan.
4. The PALs for exposure control measures are prescribed as a range for each protective measure because the decision on applying a protective measure is based not only on technical factors but also on operational and public policy considerations. To enable these considerations to be applied, it is appropriate to provide decision-makers with technical advice ranging between when a measure **should** be considered for application (on purely technical grounds) and when it becomes **necessary** on the same grounds. This span also allows for the fact that there are inherent uncertainties in the results of technical assessments.
5. The factor of 10 used to obtain the thyroid dose equivalent to the effective dose is based on the assumption that non-fatal or curable cancers of the thyroid carry the same socio-economic impact as fatal thyroid cancers. This assumption is presumed to be valid in the context of public safety and the low dose (or risk) levels used in the PALs.
6. The PALs for banning food and water consumption are consistent with International Atomic Energy Agency. Safety Series No. GS-R-2 'Preparedness and Response for a Nuclear and Radiological Emergency' (2002), and the Canadian Guidelines for the Restriction of Radioactively Contaminated Food and Water Following a Nuclear Emergency: Guidelines and Rationale, Health Canada (2000).

## **GUIDANCE FOR RECOVERY PHASE OPERATIONS**

### **1.0 General**

- 1.1 If a Restricted Zone is likely to be maintained for a period of time, it may become necessary for persons to enter the zone for such purposes as the operation of essential services, security patrols, restoration activities, retrieval of property from residences, workplaces, etc., possibly the care and feeding of farm and other animals, and, later, even the operation of commercial and industrial establishments.
- 1.2 The issue of the return of evacuees to the Restricted Zone should be subjected to a detailed assessment. The decision on when such evacuees can return to their homes should be based on the levels of contamination in various parts of the zone, the prospects and costs of decontamination, the anticipated reduction in dose over time, the benefits versus the risk involved in a return, etc.

### **2.0 Assessment and Implementation of Recovery Options**

- 2.1 The recovery process should be initiated during the response phase through the identification of stakeholder representatives whose function it is to consider the options for recovery operations and restoration of the situation back to "normal".
- 2.2 Because of the broad range of scenarios foreseen by this plan as well as the importance of the many factors existing at the time, which may play a crucial role for decision-makers, it is not advisable or practical to have specific quantitative guidance for recovery operations, including the return of evacuees.
- 2.3 A process shall be developed for "Optimization" – an internationally accepted term used to describe a flexible approach whereby a number of benchmarks (including dose and risk) are identified from national and international sources. These benchmarks are used in the analysis of recovery options and are adjusted based on site specific circumstances of such relevant factors as:

- Size and location of impacted area;
- Contaminants;
- Public health;
- Public welfare;
- Environment;
- Land uses;
- Wastes and disposal;
- Implementation costs; and
- Economic factors.

2.4 Optimization activities are both qualitative and quantitative, applied at each stage of recovery operations decision-making<sup>9</sup>.

---

<sup>9</sup> Department of Homeland Security, Preparedness Directorate; Protective Action Guides for RDD and IND Incidents; Federal Register, January 3, 2006.

## NUCLEAR/RADIOLOGICAL GLOSSARY

*(for other references see Provincial Glossary)*

**Absorbed Dose:** The amount of energy absorbed in the body, or in an organ or tissue of the body, due to exposure to ionizing radiation, divided by the respective mass of the body, organ or tissue. Expressed in terms of gray (rad).

**Acute Radiation Syndrome:** An acute illness caused by irradiation of the entire body (or most of the body) by a high dose of penetrating radiation in a very short period of time.

**Alerting:** Informing the population, by means of an appropriate signal, that a nuclear emergency has occurred or is about to occur.

**Buffer Zone:** This zone provides a buffer area beyond the Restricted Zone, where limited measures of radioactivity are detected. The buffer zone is initially delineated based on the results of preliminary field monitoring. Ingestion control measures may be applied within this zone based on guidance provided by the Protective Action Levels, and in accordance with direction provided by Health Canada and the Canadian Food Inspection Agency.

**Collective (Equivalent) Dose:** An expression for the total radiation dose incurred by a population, defined as the product of the average radiation dose to a group of exposed persons and the number of persons in the group. Generally expressed in terms of person-sievert (or person-rem).

**Committed (Equivalent) Dose:** The radiation dose that will be received over a period of 50 years (for adults) or 70 years (for children) after a person takes in a quantity of radioactive material (by ingestion, absorption or inhalation). The dose is expressed in terms of sievert (or rem).

**Containment (System):** A series of physical barriers that exist between radioactive material contained in a nuclear installation and the environment. Containment usually refers only to the reactor and vacuum buildings, and integral systems such as dousing.

**Contamination:** The unwanted presence of radioactive material in water or air, or on the surfaces of structures, areas, objects or people.

**Contiguous Zone:** The zone immediately surrounding a nuclear installation. An increased level of emergency planning and preparedness is undertaken within this area because of its proximity to the potential hazard. The actual Contiguous Zone for each designated nuclear installation is specified in the

relevant Implementing plans of the Provincial Nuclear Emergency Response Plan.

**Critical Group:** A particular group among the relevant population which, by virtue of age, sex or dietary habits, is expected to receive the highest dose from a stated radiation source or exposure pathway.

**Crop Control:** See **Produce and Crop Control**.

**Decontamination:** Reduction or removal of radioactive contamination in or on materials, persons or the environment.

**Derived Emission Limits:** Limits for radioactive emissions to air and water from a nuclear facility which ensure that, under normal operating conditions, Canadian Nuclear Safety Commission dose limits for members of the public are not exceeded by persons exposed to those emissions.

**Designated Municipality:** A municipality in the vicinity of a nuclear facility which has been designated under the *Emergency Management and Civil Protection Act*, as one that shall have a nuclear emergency plan (*for list see PNERP Master Plan, Annex A*).

**Designated Nuclear Installation:** A nuclear installation designated under the *Emergency Management and Civil Protection Act*, as one to which the specific and detailed provisions of the Provincial Nuclear Emergency Response Plan apply (*for list see PNERP Master Plan, Annex A*).

**Dose:** A measure of the radiation received or “absorbed” by a target. The quantities termed absorbed dose, organ dose, equivalent dose, effective dose, committed equivalent dose or committed effective dose are used, depending on the context. The modifying terms are often omitted when they are not necessary for defining the quantity of interest.

**Dose Projection:** The calculation of projected dose (*see Projected Dose*).

**Dose Rate:** The amount of radiation dose which an individual would receive in a unit of time. In the context of this Plan, the measurement units are multiples or submultiples of the sievert (or rem) per hour.

**Dosimeter:** An instrument for measuring and registering total accumulated exposure to ionizing radiation.

**Effective (Equivalent) Dose:** The sum of the weighted equivalent doses received by the organs and tissues of the body, where the weighted equivalent dose is the equivalent dose to an organ or tissue of the body multiplied by the appropriate weighting factor laid down in the Nuclear Safety and Control Act and Regulations promulgated by the Canadian Nuclear Safety Commission. Expressed in terms of sievert (or rem). See Weighted Dose.

**Emergency Bulletin:** Directions to the public on appropriate protective and other measures to be taken during a nuclear or radiological emergency, which are issued by the province and broadcast through the media.

**Emergency Workers:** A person who assists in connection with an emergency that has been declared by the Lieutenant Governor in Council or the Premier, under 5.7.0.1 of the EMPCA or by the head of council of a municipality under Section 4 of the EMCPA. This may include persons who are required to remain in, or to enter, offsite areas affected or likely to be affected by radiation from an accident, and for whom special safety arrangements are required. Examples of emergency workers include police, firefighters, ambulance and personnel from the Canadian Armed Forces, and other essential services. They shall not include nuclear energy workers (pursuant to the Nuclear Safety and Control Act) or assurance (ingestion) monitoring field staff.

**Emergency Worker Centre:** A facility set up to monitor and control radiation exposure to emergency workers.

**Emission:** In the context of this plan, emission refers to the release of radioactive material to the environment from a nuclear facility in the form of either an airborne or a liquid emission.

**Entry Control:** The prevention of non-essential persons from entering a potentially dangerous area.

**Equivalent Dose:** The absorbed dose multiplied by a weighting factor for the type of radiation giving the dose. Weighting factors for use in Canada are prescribed by the Canadian Nuclear Safety Commission. This term is also sometimes called *weighted dose*. Expressed in terms of Sievert (or rem).

**Evacuation:** The process of leaving a potentially dangerous area.

**Exposure:** The act or condition of being subject to irradiation. Exposure can be either **external exposure** (irradiation by sources outside the body) or **internal exposure** (irradiation by sources inside the body).

**Exposure Control:** See **Plume Exposure Control**.

**Exposure Pathways:** The routes by which radioactive material can reach or irradiate humans.

**External Notification:** The notification of organizations and agencies (not directly part of the emergency management organization) which may be affected by a nuclear emergency, or which may be required to assist in responding to it.

**Far Incident:** A transborder nuclear accident or event anywhere in the world which could affect Ontario, other than a Near Incident (see **Near Incident**).

**Field Monitoring:** The assessment of the magnitude, type and extent of radiation in the environment during an emergency by such means as field surveys and field sampling.

**Food Control:** Measures taken to prevent the consumption of contaminated foodstuffs and control of including the supply of uncontaminated foodstuffs. Where appropriate, such control may include food storage to permit radionuclide decay, diversion of food to non-human, non-food chain use or disposal of unusable stocks.

**Government Operations Centre:** The federal government organization located in the National Capital Region which directs the mobilization and delivery of national support to the affected province in the case of an event in or near Canada, or which coordinates federal actions in the case of an international event.

**Guaranteed Shutdown State:** A reactor is considered to be in this state when there is sufficient negative reactivity to ensure sub-criticality in the event of any process failure, and approved administrative safeguards are in place to prevent net removal of negative reactivity.

**Hostile Action:** Any deliberate action, or threat of action, which could cause a nuclear emergency.

**Host Municipality:** The municipality assigned responsibility in the Provincial Nuclear Emergency Response Plan for the reception and care of people evacuated from their homes in a nuclear emergency.

**Imminent Emission:** A radioactive emission that will occur in 12 hours or less.

**Ingestion Control:** Emergency response operations in which the main aim is to avoid or reduce the risk from ingestion of contaminated food and water.

**Initial Notification:** The notification made by a nuclear facility to Provincial and/or municipal authorities upon the occurrence of an event or condition which has implications for public safety, or could be of concern to these authorities. The criteria and channels for making such notification are usually prescribed in emergency plans.

**Internal Notification:** The notification by an organization to its personnel who are required to respond to an emergency.

**Land Control:** Control on the use of contaminated land for growing food products or animal feed.



**Livestock Control:** Quarantine of livestock in the affected area to prevent movement to other areas. Slaughter of such animals for food may be banned.

**Milk Control:** Preventing the consumption of locally produced milk in the area affected by a nuclear emergency, and its export outside the area until it has been monitored. Collection of contaminated milk, its diversion to other uses, or its destruction, may also be involved.

**Near Incident:** A transborder nuclear accident or event at a site within the states and provinces adjacent to Ontario.

**Notification:** Conveying to a person or an organization, by means of a message, warning of the occurrence or imminence of a nuclear emergency, usually includes some indication of the measures being taken or to be taken to respond to it.

**Nuclear Emergency:** An emergency caused by an actual or potential hazard to public health and property or the environment from ionizing radiation whose source is a nuclear installation.

**Nuclear Establishment:** A facility that uses, produces, processes, stores or disposes of a nuclear substance, but does not include a nuclear installation. It includes, where applicable, any land, building, structures or equipment located at or forming part of the facility, and, depending on the context, the management and staff of the facility.

**Nuclear Facility:** A generic term covering both nuclear establishments and nuclear installations.

**Nuclear Installation:** A facility or a vehicle (operating in any media) containing a nuclear fission or fusion reactor (including critical and sub-critical assemblies). It includes, where applicable, any land, buildings, structures or equipment located at or forming part of the facility, and, depending on the context, the management and staff of the facility.

**Nuclear Substance:** As defined in the (Federal) *Nuclear Safety and Control Act*.

**Offsite:** Offsite refers to the area outside the boundary (fence) of a nuclear facility.

**Onsite:** Onsite refers to the area inside the boundary (fence) of a nuclear facility.

**Operational Directives:** Direction given by the emergency response organization to implement operational measures.

**Operational Measures:** Measures undertaken by the emergency response organization to deal with the emergency, including measures to enable or facilitate protective action for the public, e.g., public alerting, public direction, activation of plans, traffic control, emergency information, etc.

**Operator:** Holder of a subsisting licence issued pursuant to the Nuclear Safety and Control Act for the operation of a nuclear installation.

**Pasture Control:** Removing milk- and meat-producing animals from pasture and from access to open water sources, and supplying them with uncontaminated feed and water.

**Personal Monitoring:** The use of radiation monitoring devices to assess whether persons, and their belongings, including vehicles, are contaminated or not, and, if contaminated, the type and level of contamination.

**Plume:** A cloud of airborne radioactive material that is transported in the direction of the prevailing wind from a nuclear facility. A plume results from a continuing release of radioactive gases or particles. (This term may also be used for waterborne radioactive material resulting from a liquid emission. Where the context does not make it clear, this will be referred to as a **Waterborne Plume**). (See also **Puff**).

**Plume Exposure Control:** Emergency operations aimed at reducing or avoiding exposure to a plume or puff of radioactive material. Measures to deal with surface contamination and re-suspension might also be included.

**Precautionary Measures:** Measures which will facilitate the application and effectiveness of protective measures. (For a list of some of these, see **PNERP Master Plan, paragraph 2.2.7**).

**Primary Zone:** The zone around a nuclear installation within which planning and preparedness is carried out for measures against exposure to a radioactive plume. (The Primary Zone includes the Contiguous Zone). The actual Primary Zone for each designated nuclear installation is specified in the relevant Implementing Plans of the Provincial Nuclear Emergency Response Plan.

**Produce and Crop Control:** Restrictions on the harvesting or processing of potentially or actually contaminated crops, vegetables and fruits. Measures include: embargoing export outside the affected area; storage to allow radionuclide decay; diversion to non-food chain use; destruction and disposal of contaminated produce.

**Projected Dose:** The highest committed effective equivalent dose, or committed equivalent dose to a specified organ or tissue, likely to be received through all applicable exposure pathways by the most exposed member of the critical group in the area for which the projection is being made.

**Protective Action Levels (PALs):** Projected dose levels which provide technical guidance on the need to take certain protective measures. For values, see **PNERP, Master Plan, Annex E**.

**Protective Measures:** Measures designed to protect against exposure to radiation during a nuclear emergency.

**Puff:** A plume of short duration. The distinction between a puff and a plume is a matter of time. The upper limit on the duration of a puff is half an hour. (See also **Plume**).

**Radiation:** In the context of this Plan, radiation means ionizing radiation (i.e. radiation with the potential to harm human tissue or cells produced by a nuclear substance or a nuclear facility).

**Radiological Emergency:** Emergency caused by an actual or environmental hazard from ionizing radiation emitted by a source other than a nuclear installation.

**Radiological Device (RDs):** Could be lost or stolen radioactive sources which may be in locations resulting in radiation exposure and/or contamination of the public, contamination of a site and/or contamination of food and water supplies.

**Radiological Dispersal Device (RDDs):** A device that causes the dissemination of radioactive material.

**Response Sectors:** The Primary Zone is subdivided into Response Sectors to facilitate the planning and implementation of protective measures.

**Radionuclide** (or radioactive isotope or radioisotope): A naturally occurring or artificially created isotope of a chemical element having an unstable nucleus that decays, emitting alpha, beta and/or gamma rays until stability is reached.

**Restoration:** Operations to restore conditions to normal after a nuclear/radiological emergency.

**Restricted Zone:** The area within which exposure control measures are likely to be needed, based on the results of field monitoring. These measures would be applied within this Restricted Zone as per the Protective Action Levels.

**Secondary Zone:** The zone around a nuclear installation within which it is necessary to plan and prepare measures against exposure from the ingestion of radioactive material. (The Secondary Zone includes both the Primary and Contiguous Zones). The actual Secondary Zone for each designated nuclear installation is specified in the relevant site-specific part of the Provincial Nuclear Emergency Plan.

**Selective Evacuation:** The evacuation of a specified group of people, such as seriously ill patients in hospitals, bedridden residents of nursing homes, or disabled residents.

**Sheltering:** A protective measure which uses the shielding properties of buildings and their potential for ventilation control to reduce the radiation dose to people inside. (For details, see **PNERP Master Plan, Section 2.2**).

**Source Term:** A generic term applied to the radioactive material released from a nuclear facility. It includes the quantity and type of material released as well as the timing and rate of its release. It could apply to an emission that was currently occurring, or one which had ended, or one which could take place in the future.

**Special Group:** A group for which special constraints arise in the application of a protective measure, such as intensive care patients in hospitals and institutions, bedridden patients in nursing homes, handicapped persons and prison inmates.

**Support Municipality:** Pursuant to Section 7.0.2 (4) of the EMPCA, the LGIC may, by order, specify a municipality to act in a support capacity to provide assistance to designated municipality(ies).

**Thyroid Blocking:** The reduction or prevention of the absorption of radioiodine by the thyroid gland, which is accomplished by the intake of a stable iodine compound (such as potassium iodide) by people exposed or likely to be exposed to radioiodine.

**Transborder Nuclear Emergency:** A nuclear emergency involving a nuclear facility or nuclear accident or event outside the borders of Ontario that might affect people and property in the province.

**Venting:** The release to the atmosphere of radioactive material from the containment of a nuclear facility through systems designed for this purpose.

**Vulnerable Group:** A group which, because it is more vulnerable to radiation, may require protective measures not considered necessary for the general population, such as pregnant women and, in some cases, children.

**Water Control:** Measures taken to avoid the contamination of drinking water supplies and sources, and to prevent or reduce the consumption of contaminated water.

**Weighted Dose.** Expressed in terms of sievert (or rem). See Effective (Equivalent) Dose.