

# Emergency preparedness in transportation of radioactive materials

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# Jurisdiction

- Under the division of constitutional powers in Canada, regulation of nuclear matters has been designated to be federal
- Some provincial laws still apply and this includes the area of radioactive emergencies
- As well, general provincial environmental, transportation, or other laws also apply in certain circumstances
- If there was a conflict between federal and provincial laws, (i.e. one was unable to be followed because of the other), the Courts are likely to hold the federal laws to be ``paramount``; however the courts try to find both federal and provincial laws operable
- Most of the relevant provisions relating to radioactive materials transport however are federal

# Transportation of radioactive materials

- According to the CNSC over a million shipments of packages containing radioactive material occur annually in Canada:  
<http://nuclearsafety.gc.ca/eng/acts-and-regulations/regulatory-documents/published/html/regdoc2-14-1/index.cfm>
  - The majority of these shipments do not require a separate licence from the CNSC; they use “certified packages”
  - What types of shipments occur? “Conveyance” is defined in the Canadian regulations consistently with the International Atomic Energy Agency regulations\* as:
    - “Conveyance shall mean:
      - (a) For transport by road or rail: any vehicle.
      - (b) For transport by water: any vessel, or any hold, compartment, or defined deck area of a vessel.
      - (c) For transport by air: any aircraft.” (IAEA Paragraph 217.
- \*“ **IAEA Regulations** ” means the *Regulations for the Safe Transport of Radioactive Material*, published by the International Atomic Energy Agency, as amended from time to time.



# Statutory Provisions

- The CNSC and Transport Canada share responsibility for the regulation of the transportation of nuclear materials in Canada.
- The CNSC has issued Packaging and Transport of Nuclear Substances Regulations, 2015 (PTNSR 2015). The CNSC issues licences and certificates for certain kinds of packaging and transport of nuclear substances.
- These regulations are based on the International Atomic Energy Agency's (IAEA) Regulations for the Safe Transport of Radioactive Material, 2012 Edition:

<http://laws-lois.justice.gc.ca/eng/regulations/SOR-2015-145/index.html>

# RegDoc 2.14.1

- In February 2016, the CNSC published REGDOC-2.14.1, Information Incorporated by Reference in Canada's Packaging and Transport of Nuclear Substances Regulations, 2015.
- REGDOC-2.14.1 is intended to help the regulated community comply with the PTNSR 2015, and it links provisions in the regulations to relevant content in the IAEA Regulations, the Nuclear Safety and Control Act, other CNSC regulations, and other related information. Here is a link to the REGDOC:

<http://nuclearsafety.gc.ca/eng/acts-and-regulations/regulatory-documents/published/html/regdoc2-14-1/index.cfm>



# License to Transport

- The Nuclear Security Regulations provide additional requirements to regulate the security risks of transporting certain defined, higher risk nuclear material (section 5)
- These requirements are additional to the requirements of the Packaging and Transport of Nuclear Substances Regulations 2015
- They require a written security plan with the following elements (Some of this information would not be made public and is limited to those with “a need to know”):
  - Describing the nuclear material
  - Providing a threat assessment of the types of events that may place the material at risk
  - A description of the conveyance (truck, train, plane, ship etc.)
  - A description of the proposed security measures
  - A description of “the communication arrangements made among the licensee, the operator of the land vehicle transporting the nuclear material, the recipient of the material and any off-site response force along the route”
  - Arrangements with off-site first responders along the route
  - The planned route
  - Alternate emergency routes



# Emergency Response Plan

- The general requirement of the *Transportation of Dangerous Goods Act* to have an emergency response plan (section 7) applies to shipments of radioactive materials in certified packages
- The Minister must approve the emergency response plan (or may grant interim approval, or subsequently revoke it).
- The plan must “outline what is to be done to respond to an actual or anticipated release of the dangerous goods in the course of their handling or transporting that endangers, or could endanger, public safety.”

# “Dangerous Occurrences”

The Packaging and Transport of Nuclear Substances Regulations provide a definition of a “dangerous occurrence”:

35 For the purpose of sections 36 to 38, a dangerous occurrence is **any** of the following situations:

(a) a conveyance carrying radioactive material is involved in an **accident**;

(b) a package shows evidence of **damage, tampering or leakage** of its contents, or its **integrity is degraded** in a manner that may reasonably be expected to impair its ability to comply with these Regulations or its certificate;

(c) radioactive material is **lost, stolen or no longer in the control of a person** who is required to have control of it under the Act;

(d) radioactive material has **escaped** from a containment system, a package or a conveyance **during transport**;

(e) fissile material is **outside the confinement system during transport**;

(f) the level of non-fixed contamination, as defined in the IAEA Regulations, during transport **exceeds the following limits** as applicable when averaged over any area of 300 cm<sup>2</sup> of any part of the surface of the package or the conveyance:

- (i) 4 Bq/cm<sup>2</sup> for beta and gamma emitters and low toxicity alpha emitters, or
- (ii) 0.4 Bq/cm<sup>2</sup> for all other alpha emitters;

(g) there is a failure to comply with the provisions of the Act, the provisions of these Regulations or any licence or certificate that is applicable to a package that may **reasonably be expected to lead to a situation** in which the environment, the health and safety of persons or national security is adversely affected.

# Obligations after a dangerous occurrence

- S. 36 of the Regulation applies after a dangerous occurrence
- Obligation is on “consignor, carrier or consignee of a package or radioactive material involved in a dangerous occurrence or any other person who controls any area affected by a dangerous occurrence”
- Obligation is immediate
- To limit access to the area (signs, barriers or personnel to control entry)
- To prevent the dispersal of the radioactive material “to the extent possible”
- To record names and contact info of persons who may have been exposed and to request they remain available for assessment by an expert in radiation protection



# Who is who

- The Consignor is the person who is sending the shipment – RegDoc 2.14.1 links the definition to the Transportation of Dangerous Goods Regulations as:  
“Consignor: means a person in Canada who
  - (a) is named in a shipping document as the consignor;
  - (b) imports or who will import dangerous goods into Canada; or
  - (c) if paragraphs (a) and (b) do not apply, has possession of dangerous goods immediately before they are in transport.”
- The Consignee is the person who is receiving the shipment – RegDoc 2.14.1 links the definition to the IAEA regulations: Paragraph 210: “Consignee shall mean any person, organization or government that is entitled to take delivery of a consignment”
- According to RegDoc 2.14.1, the Carrier is defined under the Transportation of Dangerous goods Regulations Section 1.4 as:  
“Carrier: means a person who, whether or not for hire or reward, has possession of dangerous goods while they are in transport.”



# Section 36 Considerations

- If an accident occurred in transport, the consignor along with their equipment, monitoring devices, and experts may be some distance away
- The consignee presumably has immediate control, assuming that the driver or staff accompanying the shipment are not themselves injured; they are supposed to have the expertise and equipment to comply with the regulation according to the requirement for an approved emergency plan
- Any other person who controls the area could include transport department, a railway company, a shipping company, the Crown, or private land owners – in many such cases I would query whether the expertise and equipment would be immediately available



# Assessment and reporting

- The consignee / consignor / carrier must also “as soon as feasible” have an expert in radiation assess the situation
- That person must provide an assessment to the Canadian Nuclear Safety Commission “as soon as feasible”
- The consignee / consignor / carrier and holder of the license to transport must make a preliminary report to the CNSC as soon as the obligations under section 36(1) are complied with – this appears to be the obligation of every one of them & it is required “immediately”
- The consignee / carrier / license holder must also immediately notify the consignor if not already aware



# Contents of reports

- The preliminary report following a dangerous occurrence must outline:
  - Location
  - Circumstances of the failure to comply or dangerous occurrence
  - Any action the consignor, consignee, carrier or licence holder has taken in respect of the dangerous occurrence



# Full report within 21 days

- Within 21 days the carrier, consignor, consignee, and holder of the license to transport must file a full report about the dangerous occurrence, with the CNSC which includes:
  - “(a) the date, time and location of the failure to comply or of the dangerous occurrence;
  - (b) the names of the persons involved;
  - (c) the details of the packaging and packages;
  - (d) the probable cause;
  - (e) the effects on the environment, the health and safety of persons, and national or international security that have resulted or may result;
  - (f) the doses of radiation that any person has received or is likely to have received; and
  - (g) the actions taken to remedy the failure to comply or the dangerous occurrence and to prevent its recurrence.” (Section 38 of the Regulation)



# First Responders

- If first responders arrive, it could be argued they are “any other person who controls the area” and the question arises as to whether they are equipped to comply with the regulation themselves; have the training; and have the equipment necessary
- The question is whether, apart from the consignor and presumably the consignee, others who may have to take control of the situation along the route in the event of a nuclear transportation accident may well not be aware of the regulation; the question of the training of carriers’ staff is probably also worth asking



# First Responders' training

- First Responders' training in Ontario is by way of a self-study course
- The current course is undergoing revision and not presently available
- It will be available on the Ontario Fire College Educational Materials Web site

# Guidance for Carriers' Radiation Response Plans

- The CNSC issued GD-314 as guidance for carriers to develop radiation response plans, primarily when carrier radioactive materials in certified packages
- It suggests elements of an emergency plan:
  1. The name of the person responsible for the carrier's emergency response
  2. a telephone number at which that person can be reached 24 hours a day, 7 days a week
  3. any other relevant information about the carrier's emergency response plan for nuclear substances.

# GD-314

- Guidance document GD-314 also suggests training:
  - It reminds carriers of the mandatory need to train anyone referred to in a radiation response plan and of the mandatory need to document written work procedures.

*Excerpt: “Training should be related to specific jobs or tasks and include detailed actions and protective measures to take during normal job functions as well as in the event of an accident. It also explains the basic principles of radiation protection: time, distance and shielding and provides useful examples, such as placing the packages away from the driver or in unoccupied areas of the warehouse. In some cases, the training may need to include the use of specific equipment, such as dosimeters, radiation survey meters, contamination meters, and information on ionizing radiation and their effects on people. The amount of training needed relates to the nature and extent of the risk, as assessed using the methods previously discussed. Adequate training requires a continuous commitment from both the employer and employee, and involves initial training and refresher courses at appropriate intervals. Periodic evaluation of the effectiveness of the training is suggested, especially where there is a change in tasks being performed by the employee. Relevant records pertaining to the training should be maintained as part of the record of the radiation protection program. In addition to training on the radiation protection program, all workers involved in the transport of nuclear substances should be trained in the application of the Packaging and Transport of Nuclear Substances Regulations.”* [http://www.nuclearsafety.gc.ca/pubs\\_catalogue/uploads/GD-314\\_Radiation\\_Protection\\_Program\\_Design\\_for\\_the\\_Transport\\_of\\_Nuclear\\_Substances.pdf](http://www.nuclearsafety.gc.ca/pubs_catalogue/uploads/GD-314_Radiation_Protection_Program_Design_for_the_Transport_of_Nuclear_Substances.pdf)



# Chemical reactions

- One important issue is contained in the IAEA SSG-26 Advisory Material for the IAEA Regulations for the Safe Transport of Radioactive Material 2012 Edition (link below), and that is the potential for chemical reactions in accident conditions, on top of the radioactive materials risk
- This can make the situation much more complex and dangerous to deal with
- See <http://www-pub.iaea.org/MTCD/Publications/PDF/Pub1586web-99435183.pdf>  
at section 305.1 and 305.2



# General provisions of the Nuclear Safety Control Act and Emergency Planning

- Two overarching purposes of the NSCA are to limit to a ``reasonable level`` the risks to national security, health and safety of persons, and to the environment from use, possession of nuclear substances.
- The CNSC`s job, among other things, is to regulate that possession and use of nuclear substances so as to meet the purposes of the Act.



## NSCA cont`d

- In addition to their regulatory powers such as the regulations and guidelines we have been reviewing, there are extraordinary powers of CNSC`s inspectors to act in cases of reasonable suspicion of unreasonable risk – which can include cases of unsafe transportation, storage or housing of any nuclear substance, including any type of waste.
  - Power to inspect, warrantless searches, searches of vehicles
  - Power to enter, take samples, subject materials to tests
  - Power to issue orders



# NOTIFICATION

- Section 45 of the Act requires immediate notification to the CNSC or appropriate authority of an event that might result in exposure of persons or the environment to an excess dose of radiation
- Notification for events in Ontario are made to the provincial Spills Action Centre regardless of whether they are federal or provincial matters:
- Ontario Spills Action Centre: PHONE 1-800-268-6060  
416-325-3000
- Ontario Health Workers dealing with a radiation emergency / patient should call 1-866-212-2272 (MHLTC Hotline)



# Other Phone Numbers for Notification

- These arrangements are made under the Federal Canadian Environmental Protection Act with the provinces; the Release and Environmental Emergency Notification Regulations SOR/2011-90 specify these notification arrangements
- Quebec has similar arrangement: Call 514-283-2333 / 1-866-283-2333
- Manitoba: Call 204-944-4888
- Emergency Measures Ontario in its nuclear planning brochure offers to host community outreach sessions on its provincial nuclear emergency plan: 416-314-3723



# Federal Emergency Plan

- The Federal Emergency Response Plan is found at <http://www.publicsafety.gc.ca/cnt/rsracs/pblctns/mrgnc-rspns-pln/index-eng.aspx> on the Public Safety Canada website dates to January 2011
- This is a general plan to cover all emergencies
- Under that plan, Transport Canada's response functions include matters such as restricting traffic, and providing technical emergency advice on hazardous materials



# Federal Nuclear Emergency Plan

- This nuclear specific plan dated January 2014, found on the Health Canada website is specific to nuclear hazards: <http://www.hc-sc.gc.ca/hc-ps/pubs/ed-ud/fnep-pfun-1/index-eng.php>. It does not apply to transportation of “regulated quantities” of radioactive material
- It sets out goals such as regaining control of the situation, preventing dose to persons, prevent radiological health effects.
- It provides notification, advice, field support and other functions for nuclear emergencies – fuel waste facilities or transportation are not specifically identified and would fall into Category D - the nuclear hazards not otherwise listed.

# Ontario Nuclear Emergency Response Plan

- The Ontario plan dates to 2009  
[https://www.emergencymanagementontario.ca/english/emcommunity/response\\_resources/plans/provincial\\_nuclear\\_emergency\\_response\\_plan.html](https://www.emergencymanagementontario.ca/english/emcommunity/response_resources/plans/provincial_nuclear_emergency_response_plan.html)
- It covers a Response Plan for Other Radiological Emergencies including transportation
- The provincial plan requires detailed planning for an accident where “doses would be low”. More severe accidents only require “appropriate additional planning and preparedness” to plan for matters as described on the next slide.



# The types of planning for more severe accidents is supposed to include:

- i. Timely *public alerting* and direction;
- ii. Prioritizing evacuations for those closest to the hazard;
- iii. Radiation monitoring and, if necessary, *decontamination*;
- iv. If needed, medical assessment, treatment and counselling. (section 2.3.3 (e) of the PNERP)



## Excerpt From the PNERP – Measures that could be implemented in “special circumstances” under the PNERP

### “2.10 Modifications to Concepts

- The basic operational and organizational concepts described in this Plan may need to be modified under special circumstances. These modifications will be made in the specific implementing plan that relates to it.
- **Exposure Control Measures**
- Entry Control
- Sheltering
- Evacuation
- Thyroid Blocking
- Use of Protective Equipment
- Decontamination

### • **Ingestion Control Measures**

- Milk Control
- Water Control
- Pasture Control
- Produce and Crop Control
- Livestock Control
- Food Control
- Land Control<sup>\*</sup>
- Environmental Decontamination<sup>\*</sup>
- **Table 2.1: Protective Measures**
- **Note** - These measures are defined in the **Glossary, Annex K.**



# Emergency Preparedness for Fuel Waste Facilities and Fuel Waste Transportation

- With no high level nuclear fuel site at present, there is no site specific nuclear emergency response plan yet developed
- Similarly there is no specific nuclear emergency response planning yet for transportation routes for such high level waste; the province's PNERP notes that radiological emergencies can occur anywhere; in an event emergency responders set up a downwind “protective action zone” (to monitor) and a “controlled zone” under their control including “hot” and “warm” zones.



# Existing nuclear facility emergency plans

- Each of the Nuclear Power Plants has a combination of municipal, provincial and federal emergency response plans that are applicable
- Eg Durham Region for Darlington and Pickering; Kincardine for Bruce etc.
- See CELA's presentation from February 2015 on the Nuclear Waste Watch site for more information or the detailed presentations found at [www.cela.ca](http://www.cela.ca) regarding nuclear emergency planning at Ontario's nuclear power plants.



# Radiation Health Protection Plan (RHPP)

- The RHPP is posted on the MOHLTC website [http://www.health.gov.on.ca/en/pro/programs/emb/rhrp/docs/radiation\\_health\\_response\\_plan.pdf](http://www.health.gov.on.ca/en/pro/programs/emb/rhrp/docs/radiation_health_response_plan.pdf)
- It was finalized and posted in 2014
- An accident or release from transportation or a waste facility would be called a “radiological emergency” under the RHPP (everything other than nuclear power plants or other major nuclear installations – accidents at these are called “nuclear emergencies”)
- In either case, the emergency occurs when there is “actual or potential hazard to public health, property, and/or the environment from ionizing radiation”



# Radiation Health Protection Plan cont'd

- The RHPP uses the principles of “time, distance, and shielding” to reduce dose by internal or external exposure to radionuclides.
  - Reduce the time of exposure
  - Increase the distance from the source
  - Shield people from the source
- I would caution that shielding is only suitable for some types of radio-nuclides



# RHPP

- The plan states that

“Reducing internal radiation exposure can be achieved through the following actions:

- Wearing appropriate personal protective equipment
- Controlling the spread of loose contamination
- Decontaminating individuals and items in a timely manner
- Treating with appropriate pharmaceuticals in a timely manner e.g., potassium iodide, Prussian blue.”



# RHPP - Medical treatment

- Medical treatment may have to be provided by first responders in a nuclear or radiological emergency: first aid, triage, transport to hospital, helping to prevent spread of contamination
- Medical treatment may also have to be provided by hospitals in the vicinity of the emergency: as first receivers of injured and/or contaminated victims; provision of medical care; and preventing spread of contamination
- Certain hospitals are designated as part of the Provincial CBRN (Chemical, Biological, Radiological, and Nuclear) Emergency Preparedness Program



# RHPP - Hospitals

- Those hospitals in the CBRN program are expected to be able to handle a contaminated victim and have responsibilities that include:
  - Screening for acute exposure
  - Triage of those externally contaminated from the non-contaminated (non-life-threatening scenarios).
  - Monitoring for external and internal contamination.
  - Conducting external decontamination.
  - Reducing internal contamination and treating acute exposure symptoms. (From RHPP Section 3.4.3)
  - Public health units and municipalities also have health roles under the RHPP



# RHPP – Designated Hospitals

- There are hospitals designated for each of the operating nuclear plants in Ontario:
  - Bruce Nuclear – Kincardine Hospital
  - Pickering and Darlington NGS - Rouge Valley – Ajax Hospital; Pickering Hospital; and Lakeridge Health – Bowmanville Hospital
  - Chalk River Laboratories – Pembroke Regional Hospital
  - Fermi 2, Michigan – no hospital designated
- Toronto Western Hospital - Radiation Trauma Unit is designated as the tertiary to treat acute radiation syndrome



# CBRNE Teams

- The RHPP states that Ontario has 3 specialized response teams for chemical, biological, radiological, nuclear, or explosive incidents, located in Windsor, Toronto, and Ottawa
- Other municipalities would use hazardous materials teams if they have them, the OPP's Urban search and rescue/ CBRNE teams, or similar teams at the RCMP or Canadian Forces
- The province also has a mobile emergency medical assistance team (EMAT) deployable within 24 hours to any location in Ontario
- Federal and International assistance is also available through the federal nuclear emergency plan or international assistance agreements



# RHPP Scenarios

- 18 Scenarios are outlined in the RHPP; one involves transportation of radioactive substances
- Another two involve events at the nuclear power plants
- Accidents involving radioactive waste or high level fuel waste are not singled out in a scenario; they fall more generally into the scenarios involving radiological emergencies



# Specific treatment of emergency planning by NWMO

- So far emergency planning has received limited treatment by NWMO at least on the public record
- There are statement that emergency plans will need to be created consistent with the requirements outlined here eg see this 2011 report:  
[file:///C:/Users/Theresa/Downloads/1922\\_apm-rep-00440-0005\\_apmtransportationdesign\\_finalreport\\_NWMO\\_2011.pdf](file:///C:/Users/Theresa/Downloads/1922_apm-rep-00440-0005_apmtransportationdesign_finalreport_NWMO_2011.pdf)
- Otherwise the references are generally to hazardous and radioactive materials transport requirements including preparation of an emergency plan and provision of emergency equipment to retrieve packages, as well as radioactive packaging and labelling, both under provincial and federal requirements and in line with international guidance
- With transportation of high level nuclear fuel proposed by the NWMO to occur over at least 30 years, emergency planning for transportation routes would be a critical issue

# Provincial Review of Provincial Nuclear Emergency Plan

- The province is working on a new provincial nuclear emergency plan
- No public consultation has yet been held
- See the current plans and maps at EMO's nuclear emergency page:  
<http://www.emergencymanagementontario.ca/english/beprepared/ontariohazards/nuclear/nuclear.html>
- Ask to have your say in reviewing the provincial plan:
- Emergency Management Ontario:
  - [http://www.mcscs.jus.gov.on.ca/english/contact\\_us/contact\\_us.asp](http://www.mcscs.jus.gov.on.ca/english/contact_us/contact_us.asp)