ONTARIO HYDRO RADIOACTIVE MATERIAL TRANSPORTATION FIELD GUIDE

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ABSTRACT

The recent introduction of both the AECB Transport Packaging of Radioactive Material Regulations and Transport Canada's Transportation of Dangerous Goods Regulations have significantly altered the requirements for transporting radioactive material in Canada. Extensive additional training as well as certification of several hundred Ontario Hydro employees has been necessary to ensure compliance with the additional and revised regulatory requirements.

To assist in the training of personnel, an 'active' corporate Ontario Hydro Field Guide for Radioactive Material Transport document has been developed and published. The contents of this Field Guide identify current Ontario Hydro equipment and procedures as well as the updated relevant regulatory requirements within Canada. In addition, to satisfying Ontario Hydro requirements for this type of information over two thousand of these Field Guides have been provided to key emergency response personnel throughout the province of Ontario to assist in their transportation accident response training.

INTRODUCTION

Ontario Hydro presently owns and operates three multiunit nuclear stations, one located at the Pickering site and two at the Bruce Nuclear Power Development (BNPD) site. Together, these stations operate a total of 16 reactor units which have an in-service capacity of 10 452 MWe gross power. A further 3524 MWe of capacity is under construction at another site.

In addition to the electrical generation both the Bruce, Pickering facilities produce cobalt -60, used for the sterilization of medical instruments such as syringes, sutures, bandages and for cancer therapy. At the BNPD site is located a centralized radioactive waste operations facility where low, medium, and high level radioactive wastes may be received, volume-reduced and stored.

Ontario Hydro also maintains a research facility in Metropolitan Toronto and it operates a small 25 MWe demonstration reactor (NPD) in Rolphton. Other research pertinent to the nuclear generation is carried out by Atomic Energy of Canada Limited (AECL) in their laboratories at both Chalk River, Ontario, and Whiteshell, Manitoba.

Figure 1 gives an indication of the considerable distances which separate these facilities.

Fig. 1. Typical Shipping Routes

Ontario Hydro Radioactive Waste Generation

The radioactive wastes generated at the Pickering and Bruce facilities fall under the classification of Low Specific Activity (LSA), such as: protective clothing, temporary floor coverings, mop heads and wood; type (A) and (B) materials such as: filters and resin used in the reactor process; discarded piping, valves and other hardware arising from the maintenance of reactor systems. The volumes, activities of these types of radioactive wastes are indicated in Table I below.

TABLE I

Annual Ontario Hydro
Radioactive Waste Produced
(October 1985 - October 1986)

Type	Total Volume (m^3)	Activity (Ci)
Incinerable	4371.2	1.5
Compactible	601.9	2.9
Nonprocessible	1199.5	21917.6
IX-Resins - Disposable Container	23.6	32.6
- Bulk	42.0	1925.0
Filters	19.9	1595.5
TOTAL	6258.1	25475.1

At the present time routine transportation of radioactive waste is required only for waste produced at the Pickering site.

Ontario Hydro Radioactive Materials Transport Experience

All Ontario Hydro reactors are of the CANDU design, which utilizes natural uranium fuel and heavy water (D_2O) for both the moderator and heat transport systems. Tritiated Heavy Water has been transported routinely between the various nuclear facility sites in Ontario and radioactive waste is transported to a central site for processing and storage. In addition, Co-60 is routinely transported and irradiated fuel has been shipped on occasion for R&D purposes.

Canadian Transportation Regulatory Environment

Prior to 1985 all movement of radioactive material by road or rail in Canada was governed by the Canadian Transport Commission (CTC) Regulations which were prescribed by the Canadian Atomic Energy Control Board (AECB).

Since the introduction of the TDG regulations the responsibilities for transporting radioactive material has been shared between the AECB and Transport Canada. The division of responsibilities was agreed and is expressed in a specific memorandum of understanding. This memorandum ensures that the maximum use is made of existing international regulations. This agreement also defined the two areas of jurisdiction.

Under this new agreement the Atomic Energy Control Board published the AECB Transport Packaging of Radioactive Material Regulations, 1983, which replaced the aspects of the CTC Regulations which prescribed the requirements for classifying, packaging, labelling and safety marking of radioactive materials.

In 1985 Transport Canada proclaimed regulations concerning the transportation of all dangerous goods including corrosives, flammables, and radioactives for all modes of transport. The Transportation of Dangerous Goods (TDG) Regulations now govern and define requirements for the shipping documentation, safety marks, emergency response capability and personnel training for all classes of dangerous goods for all modes of transport.

Personnel Training

The most significant change which has effected the transportation of all dangerous goods in Canada is Section 9.7 of the TDG Regulations, which states that 'no person shall handle, offer for transport or transport dangerous goods unless they are trained or under the direct supervision of a person who has been trained.' Once the employer is satisfied that his employees have received adequate training in the duties they will perform they must be issued a certificate of training. The employee is then required under the regulations to produce a certificate when requested to do so by an inspector.

The effect of this regulatory change has made a significant impact on Ontario Hydro's routine operation since Class 7, radioactive material is prepared, transported and received by all facilities on a daily basis. Therefore, a training program involving many of individuals at all our nuclear facilities had to be quickly developed and implemented.

The communication and training for this program had to be clear and concise while presenting a large volume of information. This training had to be both job-specific while still providing an adequate overview of the regulatory intent.

The training was identified and approached in a three-tier effort with:

- presentations on the Acts and Regulations,
- informal job specific workshops (ie, documentation preparation), and
- distribution of the Ontario Hydro Field Guide

Radioactive Material Transportation Field Guide

Following the training of all Ontario Hydro personnel involved with the shipping of radioactive material and their certification, all individuals received the corporate Radioactive Material Transportation Field Guide. This document provides an integrated overview of all information pertinent to the equipment, procedures and the regulatory requirements for the transport of radioactive material.

This field guide was developed in two parts. Part I deals with the packages used by Ontario Hydro for shipment of its radioactive materials. Highly radioactive material must be transported in Type B packages which are designed to survive a severe transportation accident.

Each container used by Ontario Hydro for shipments of highly radioactive material has been allotted a single page in this field guide with specific information for quick reference. Each

Package Identification Card includes a description of the package and contents and the required safety marking. Photographs of both the container and the vehicle as well as a cross-sectional diagram will assist Ontario Hydro personnel as well as emergency response personnel in quick identification of containers and contents.

The standard format for each Package Identification Card lists in the heading:

- its use,
- AECB Certificate,
- and the package qualification

The package description includes the overall dimensions, gross weight, shielding and inner cavity size (in both metric and imperial units). The container contents list all materials which are permitted to be carried under the present AECB certificate. For packages which presently possess special arrangement certificates a statement to that effect and an indication of which contents require an escort vehicle.

A section has been included which indicates the required safety marks for each package. The appropriate placard and label are identified to indicate on the shipment advice form and to display on the vehicle and package.

The maximum allowable package dose-rate on contact and at 1 metre has been included (in both mrem and Sieverts). The present package identification pages include:

- 1 m^3, Type A Container
- Nupac OH-142, Bulk Resin Container
- NOD-F1, Irradiated Fuel Flask
- Modified Super Tiger Overpack, Filter and Ion Exchange Column Flask
- Paper Tiger, Heavy Water Drum Overpack
- NLI-6502, Pressure Tube Flask
- F231, Cobalt 60 Flask
- NPD 25 Bundle Flask, Irradiated Fuel Flask
- Ontario Hydro TDO Package, Tritiated Heavy Water Container

The design concept for the Ontario Hydro Irradiated Fuel Road Casks has been identified under the Proposed Type B Container Section.

The Emergency Preparedness Section of RMEP has provided the generic Radioactive Material Emergency Response Action Information.

Part I also provides general information on Strong Industrial and Type A packages under the heading Packages Used by Ontario Hydro to Ship Radioactive Material. It should be noted that these types of containers could fail in the event of an accident and for this reason the radioactivity contained is limited to a low level.

Part II of this field guide (Sections 3.0 to 13.0) provides information about the requirements which must be met by Ontario Hydro prior to any shipment of radioactive material in Ontario.

The Glossary has been included to identify key terms used when documenting radioactive material for transportation purposes. Section 4.0 identifies the present Radioactive Material Shipment Regulations relevant in the Province of Ontario. These include the TDG, AECB Transport Packaging and the Spills Bill Regulations. In addition, the international regulations for the various modes of transport have been identified.

Section 6.0 discusses the Classification of Radioactive Material and notes the five groups pertinent to Ontario Hydro as:

- Excepted Radioactive Material
- Radioactive Material, LSA n.o.s.
- Radioactive Material, Fissile, n.o.s. Class I, II or III
- Radioactive Material, Special Form, n.o.s.
- Radioactive Material, n.o.s.

Unless the dangerous goods offered for transport are exempt, as in the case for Excepted Radioactive Material, the classification must be fully documented as set out in Part III of the regulations. It is the responsibility of the consignor (shipper) to properly document this classification prior to the transport.

Section 7.0 deals with the Safety Marks as required by both the Transportation of Dangerous Goods Regulations and the AECB Transport Packaging of Radioactive Material Regulations. A colour reproduction is displayed beside the relevant regulatory requirements for all Ontario Hydro safety markers.

Safety marks are used to indicate the presence of dangerous goods and to identify the type and degree of risk they represent. They are displayed on containers, packages, tank's cylinders and on transport units.

There are four types of safety marks: labels, placards, signs and other safety marks.

Safety marks are not necessarily symbols but additional information which may be required. For example, the shipping name and product identification number (UN) on a small package or container is a safety mark. It is the consignor's responsibility to display all safety marks, while the carrier must display the vehicle placards.

In Section 8.0 the Documents Which Accompany Shipments are reproduced, along with a short statement, identifying the appropriate information which is required to be noted on each. The documents identified in this section are:

- Radioactive Material Shipment Advice Form
- Emergency Response Form
- AECB Package Design Approval Certificate
- Certificate of Training

It is also the responsibility of the consignor to prepare an accurate and complete shipping document when offering dangerous goods for transport. All information which is required to be provided on the shipping document has been incorporated in the Ontario Hydro Radioactive Material Shipment Advice Form instruction sheet. This is a tear away sheet which provides all information the consignor will require to assure regulatory compliance.

Section 9.0 displays the Typical Shipping Routes which Ontario Hydro utilizes when shipping radioactive material. In this section it has been noted that while Ontario Hydro generally selects routes dependent on road and traffic conditions, when shipping under an AECB Special Arrangement Certificate specific routes may be predetermined.

The requirements of Dangerous Occurrence Reporting are identified in Section 10.0. The Transportation of Dangerous Goods Regulations, AECB Transport Packaging of Radioactive Material Regulations and the Ontario Spills Bill Regulations requirements are spelled out individually for both immediate and subsequent notification.

Section 11.0 provides a brief overview of Emergency Response to Transportation Accidents by Ontario Hydro. In the event of a transportation accident involving radioactive material in Ontario, Ontario Hydro has procedures, trained manpower and equipment to respond 24 hours a day, on any given day. This section also highlights the Transportation Emergency Response Plan (TERP) presently in place and the toll-free 24-hour emergency phone number.

Section 12.0 provides a breakdown of the Radioactive Material Transported by Ontario Hydro. A table provides the average number of shipments per month for each radioactive material type based on a recent four month period. This table identifies clearly that the majority (80%) of all shipments of radioactive material are of a low activity level.

A table has been provided in Section 13.0 for external groups in order to provide perspective for the Radiation Exposure Levels one would experience if exposed to a typical radioactive material package. In addition, a table is provided representing biological effects of radiation received by the whole body for exposures ranging from 0.005 rem to 1 000 rem.

Emergency Response Personnel

Early in the developmental stage it was recognized that this type of information would be particularly useful to emergency response groups which would be required to respond in the event of a transportation accident. For this reason, the final version represents a considerable amount of consultation with the Ontario Provincial Police, Office of the Fire Marshall and the Ontario Emergency Health Service Group. It was important that this final product could be incorporated in their respective training programs. Since the initial printing over 2 100 copies have been requested and distributed throughout these three groups.

Conclusions and Future Work

This Field Guide will be kept up-to-date. When packages are added to or deleted from the Ontario Hydro transportation fleet, information will be provided to all registered users. In addition as the regulations which pertain to the transport of radioactive material are amended the relevant amendments will be forwarded to these registered users.

All copies distributed to external emergency response groups have been provided with the offer that Ontario Hydro will provide follow-up presentations where the need is identified. Employees with technical expertise will speak to external groups to assist in maximizing the utilization of the information provided within this document.

Since the initial printing of 2500 copies is quickly diminishing, a second printing is anticipated in the near future.