# FIFTEEN YEARS OF RADIOACTIVE WASTE MANAGEMENT AT ONTARIO HYDRO

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## ABSTRACT

Ontario Hydro is a large Canadian Utility producing 84 percent (7394 MWe) of the Nuclear Electricity generated in Canada. The low and intermediate level radioactive wastes generated by the Ontario Hydro program are currently being managed at the Bruce Nuclear Power Development with various volume reduction, packaging and interim storage systems. Ontario Hydro also owns and operates a radioactive waste transportation system. Studies are in progress for final disposal of these wastes in a suitable geology in Ontario. Since its inception in 1971, Ontario Hydro's radioactive waste management program has evolved into providing a full fledged radioactive waste management capability to the utility's two nuclear generation centres at Pickering and Bruce, and later in the decade, to Darlington. This paper summarizes the various developments in this program; highlights the major facilities both in-service and planned to be built; reviews the experiences gained over fifteen years of in-house waste management; and discusses the proposed reorientation towards ultimate disposal of these wastes.

## INTRODUCTION

Ontario Hydro presently generates 7394 MWe of nuclear electricity from CANDU heavy water reactors; two units at Pickering are currently under rehabilitation, involving replacement of fuel channels in the reactor core. A further 7006 MWe are under construction (Table I). The annual arisings of low and intermediate level solid radioactive wastes produced by Ontario Hydro are shown in Fig. 1. In order to manage these wastes, Ontario Hydro established a Radioactive Waste Operations Site within the Bruce Nuclear Power Development (BNPD) located on Lake Huron approximately 250 km northwest of Toronto. The Waste Operations Site includes a 19 acre (0.077 km$^2$) Storage Site plus a Radioactive Waste Volume Reduction Facility (RWVRF) consisting of a radioactive waste incinerator, a waste drum compactor and a baler. Since 1971, Ontario Hydro has been developing the BNPD Radioactive Waste Operations Site which now contains a variety of storage facilities (Site 2 - Fig. 2).

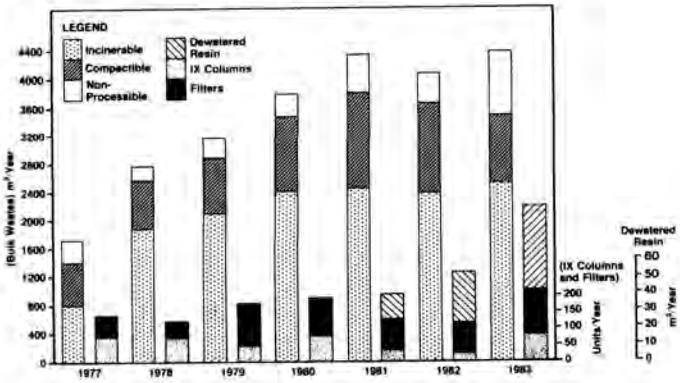

Fig 1. Annual Waste Receipts at the Bruce Nuclear Power Development.

TABLE I

Ontario Hydro Nuclear Generation Program

| Station | Gross Generation MWe | Lifetime Generation (GWh) | Status |
|---|---|---|---|
| Pickering NGS-A (four units) | 4x542 | 186109 | Units 1 and 2 are under extended outage for fuel channel replacement |
| Pickering NGS-B (four units) | 4x540 | 10217 | Two units completed and operating; two more under construction/ commissioning |
| Bruce NGS-A (four units) | 4x826 | 167952 | All operating |
| Bruce NGS-B (four units) | 4x842 | 2070 | One unit completed and operating; three more under construction/ commissioning; in-service 1984-1987 |
| Darlington NGS (four units) | 4x850 | - | Under construction; in-service 1988-1992 |

## EARLY PHASE OF THE PROGRAM (1970-75)

### AECL Facilities

Before Ontario Hydro developed the Radioactive Waste Operations Site at Bruce, early wastes from the NPD reactor and the Douglas Point Nuclear Generating Station were being managed by the Atomic Energy of Canada at its sites at Chalk River Nuclear Laboratories (CRNL) and at the Douglas Point generating station. These first generation facilities were to a large extent instrumental in providing the initial direction to the Ontario Hydro Program.

The CRNL facilities are located in the topographically high and well-drained deposits of sand[1]. The radioactive waste is generally placed, protected or unprotected above the water table, to reduce the likelihood of contact with water and thus the release of radionuclides. About 80,000 $m^3$ of solid radioactive wastes are presently stored or buried at the CRNL property. Eighty percent is low level (LLW), 15 percent is intermediate level (ILW) and 5 percent is high level (HLW) waste. The LLW is generally buried unprotected in sand trenches well above the water table. Both ILW and HLW in solid form are stored retrievably above the water table in engineered concrete structures. Each structure is fitted with a removable, weatherproof shielding cap and protrudes less than a metre above grade.

The waste management site at Douglas Point (Fig. 2) now referred to as Site 1, is located within the boundary of BNPD, approximately 1.4 km from Douglas Point nuclear station and covers 1.4 acres. There are three types of in-ground structures used for the containment of the wastes - steel lined concrete cylinders for intermediate level wastes, concrete monoliths and trenches for low level wastes. The concrete cylinders are fitted with concrete covers, the monoliths and trenches have corrugated steel and plastic weather covers. The structures are waterproofed and lie above groundwater level, protruding about 0.3 m above grade.

The site has been in the long-term surveillance mode since November 1976; a radiological monitoring program exists at the present time whose purpose is to demonstrate that containment of the stored radionuclides is being maintained to a satisfactory degree.

### Radioactive Waste Operations Site

Development of the Bruce Site for centralized radioactive waste management, accompanying the commissioning of nuclear units at Pickering and Bruce, was a natural choice for Ontario Hydro.

The site is in proximity to the Bruce generating stations thus taking advantage of resources associated with the stations such as a pool of trained manpower skilled in the handling of radioactive wastes, health physics programs, and environmental radiation monitoring programs; these features contribute to minimum costs for waste operations and transportation. The site has various other favourable characteristics such as land availability for future development, distance from large centres of population, distance from sources of water used by, or accessible to the general public, low seismic activity, functional and controlled year round access, and a gently rolling area with negligible erosion.

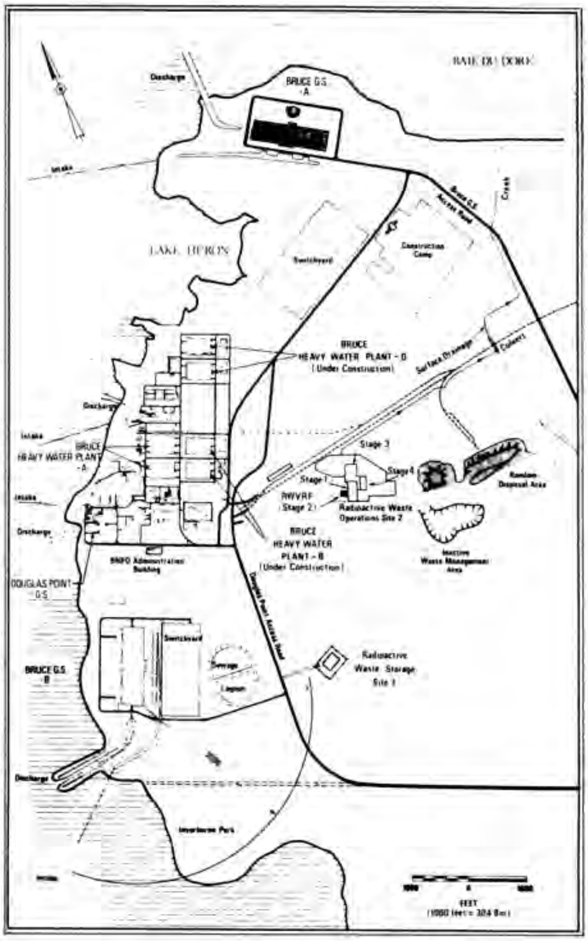

Fig 2. BNPD Site.

Development of the storage facilities at the site was based on the following principles:

(1) All materials are stored in a retrievable manner in facilities having a design lifetime of 50 years.

(2) No radioactive materials are placed directly in soil; engineered structures are used.

(3) Only solids are placed in storage; liquids which are potentially much more mobile and hence more difficult to isolate from the environment are first immobilized.

(4) All waste placement is treated as interim storage. A certain component of the waste stored may outlive the expected lifetime of the storage structures and hence may need to be retrieved and sent to ultimate disposal.

### Trenches and Tile Holes:

The storage facilities built in the early phase of the program at this Site included in-ground trenches and tile holes which could be considered "second-generation" facilities succeeding generically similar facilities at Douglas Point and CRNL (Fig. 3). These storage facilities are made up of two major components: the storage structure itself and the subsurface drainage systems adjacent to and underlying the structures. These drainage systems prevent the accumulation of water between the concrete storage facilities and the surrounding soil, which in turn removes the possibility of water ingress into the storage facilities. In addition to preventing the accumulation of water, the drainage systems also provide a convenient means of detecting and controlling any potential leakage of radioactive leachate from the storage facilities.

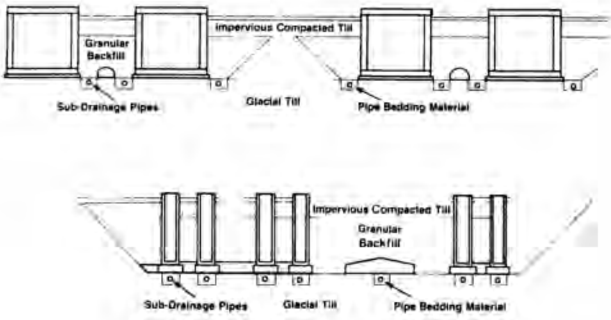

Fig. 3. Trenches and Tileholes.

Concrete trenches are shallow in-ground reinforced structures that receive low level wastes. Because of the modest radioactivity levels much of this waste can be manually loaded. On completion of loading, 0.31 m thick precast concrete lids are sealed to the trenches using neoprene gaskets. The trench internal dimensions are 3 m wide x 3 m deep x 40.3 m long and it is divided into three compartments. Trench walls are 0.38 m thick. The bottom of each trench compartment slopes to a sump and standpipe to permit water detection and removal.

Concrete tile holes are vertical tile facilities which by virtue of their small cross-sectional area minimize radiation exposure during loading and are used for intermediate level wastes such as cartridge filters and packaged ion exchange resins which have typical contact radiation fields of less than 1 Sv/h (100 Rem/h). The tile hole which is .69 m internal diameter by 3.5 m deep holds two ion exchange columns or disposable filters which are bottom unloaded from the shielding flask to the tile hole facility. Loaded tile holes are backfilled with a high slump concrete to form a monolithic cylindrical structure. Retrieval of the encased waste requires retrieval of the one-piece tile hole monolith by lifting lugs on the reinforcing steel cage or inner steel liner.

In the early phase of the program, with waste quantities generally low, these facilities provided excellent build-as-you-require modular systems, with limited but adequate weather protection, earth shielding and good constructability characteristics.

Extensive hydrogeologic investigations have been performed[2] in the vicinity of the BNPD Radioactive Waste Operations Site. The facilities are founded on relatively impermeable soil deposits of glacial origin with rates of ground water flow through the majority of unweathered zone of the clayey deposits between 0.01 and 0.12 m/a. However the weathered zone of these soil deposits as well as interbedded sand lenses have somewhat faster ground water velocities. Because of these more permeable zones, and generally higher precipitation of Southern Ontario, the facilities were conservatively 'engineered', vis-a-vis some of the shallow land burial concepts prevalent in other countries.

## GROWTH PHASE OF THE PROGRAM (1975-1980)

With the Pickering-A multi-unit generating station on-line (1973), Ontario Hydro's waste arisings considerably increased to about 1000 $m^3$/a of low level wastes and about 50 $m^3$/a of intermediate level wastes (ion exchange resins and filters). This and the rapidly expanding nuclear construction program identified a need for efficient in-station waste management by way of sorting, as well as a need for efficient volume reduction at the Waste Operations Site prior to storage of waste in the in-ground facilities, to minimize the space requirements in engineered storage facilities.

Procedures were put in place for sorting the incinerable (cellulose wastes), compactible (plastics) and the non-processible (metallic wastes) categories of solid waste. Various convenient "waste sorting" locations around the station were established near rubber areas, reactor building airlock entrances and other locations, either permanent or temporary, where wastes arise. These locations have two or three garbage cans lined with clear polyethylene bags and each can is labelled combustible, compactible or non-processible.

Centralized Waste Processing Systems were introduced at the Waste Operations Site, which included incineration for the incinerable component, and compaction/baling systems for compactible waste. These systems are housed at the Waste Volume Reduction Facility (WVRF); the non-processible waste is sent directly to storage.

### Low Level Wastes

With increased production of low level wastes, efficient means of volume reduction and diversification of storage systems from in-ground systems to space-efficient above-ground systems were found needed, especially to reduce site dependence of storage systems and improve our ability to bring into service new facilities in a short time independent of construction weather constraints.

### Incinerator

Since 1977, the incinerable waste category has been volume reduced, prior to storage, in a batch pyrolysis type starved air incinerator (Fig. 4). The system consists of a primary chamber, to which 15 $m^3$ (2,000 kg) of waste is top charged per batch, and where the waste is pyrolyzed at a temperature of 500°C. Combustion is completed in a propane fired afterburner chamber where volatile gases and particulate carry over are burnt off at a temperature of 900°C before they enter the flue gas treatment system. The flue gas is cooled to 200°C by dilution with air and by an air to air heat exchanger. The flue gas is then passed through a baghouse before it is released to the stack.

The radwaste incinerator system is a working prototype, and as such, has had problems due to some basic design deficiencies. Nevertheless, the operation has been very productive. The process, control and equipment have been steadily modified during the course of operation. One of the main deficiencies has been the excessive length of the burn cycle (40 hrs compared to design 24 hrs) which

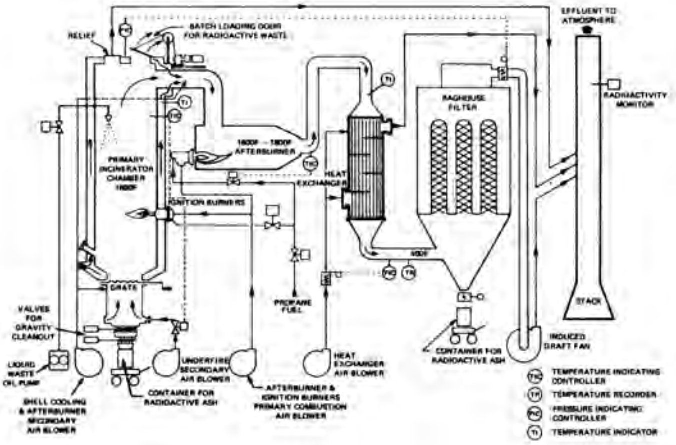

Fig. 4. Incinerator Schematic.

limits the maximum incineration capacity to about 3,000 $m^3$ of waste per year. Other problems such as flue gas heat exchanger corrosion and plugging (somewhat alleviated by upstream partial air dilution cooling), failure of automatic control mode of operation, excessive propane consumption, and deformation of primary chamber inner steel liner (a portion of which has been replaced with a refractory lining), have been largely rectified with excellent support from the manufacturer. The incinerator is currently being modified to upgrade its capacity to 6000 $m^3$/a via conversion to semi-continuous waste loading.

Compactor/Baler:

Ontario Hydro has used a mechanical compactor to volume reduce the compactible waste category since 1977. The compactor utilizes 0.2 $m^3$ drum as the packaging container. Waste in plastic bags is inserted into the drum and the force ram is lowered and compresses the waste. More waste is introduced until the drum is filled. The gross volume reduction factor achieved is approximately 4.5:1; however, due to the cylindrical drum package form, the net stored volume reduction factor is only approximately 2.5:1.

To improve the storage efficiency of compacted waste, a baler was later installed. The baler utilizes a rectangular compartment as the waste receptacle. A 0.4 $m^3$ cardboard box is used as a liner and acts as a container for the waste. After completion of the compaction process the package is tied with steel straps before the force ram is withdrawn. The final package is double plastic wrapped. The baler, due to its higher platten force exerted on the waste and its rectangular final waste package form, is a more efficient mechanical compaction unit, achieving a gross volume reduction factor of 7.5-9.0:1 and a net stored volume reduction factor of 5-6:1.

Low Level Storage Buildings:

An above-ground storage building, called the Low Level Storage Building (LLSB) is now being used for storage of low level wastes with radiation fields less than 10 mSv/h (1 Rem/h) thus relieving the trenches and tile holes for mostly intermediate level wastes. The LLSB design is based on a prefabricated, prestressed concrete superstructure (Figure 5). The superstructure design consists of concrete roof columns with 0.38 m thick concrete walls and 0.16 m concrete roof. The LLSB floor design is poured concrete such that any foundation material with suitable bearing capacity may be used. The approximate building dimensions are 50 m long by 30 m wide by 8 m high and can store about 6,600 $m^3$ of packaged wastes. The LLSB is designed as an unheated building; however, the design includes: a $CO_2$ (gas) fire extinguishing system; smoke detection equipment; a modest forced air ventilation system; internal fixed lighting; and an internal drainage system. All radioactive wastes are pre-packaged in self-stacking metal containers. The free standing metal containers are stacked to a height of 6.25 m inside the LLSB. Loading of the wastes into the LLSB is accomplished by a front end loading vehicle similar to a forklift. To facilitate future expansion, the LLSB is designed as a module whereby successive LLSBs can be added to existing buildings utilizing a common wall and the fire protection system. The major advantages of the LLSB are: lower costs relative to in-ground trenches; more efficient land utilization; and a shorter construction lead time required to place a facility in-service.

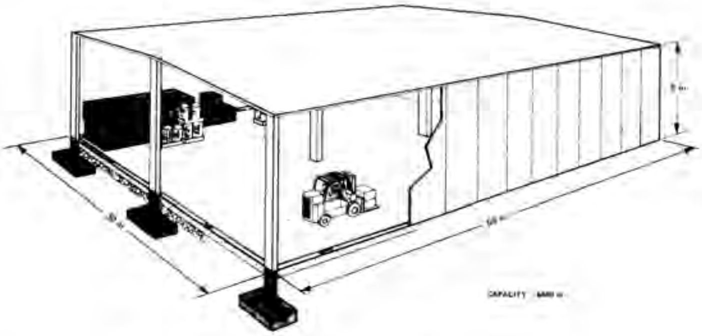

Fig. 5. Low Level Storage Buildings.

The LLSB is designed to complement rather than to supplant the roles of the other structures in use at the site. The use of the storage building for the low level waste below 10 mSv/h (1 Rem/h) will allow the capacity of the in-ground trenches to be reused once the waste in this category, which is presently stored there, is retrieved and placed in the LLSB. This together with the selective placement of some wastes from the tile holes (which have decayed to lower levels since initial placement) into the trenches will allow the existing storage site to provide adequate storage capacity for all of Ontario Hydro's needs until the start of the next century.

At this time the first LLSB is in service; a second LLSB is under construction and is scheduled to be in-service in 1985.

Intermediate Level Wastes

For ion exchange resins the use of disposable ion exchange vessels was discontinued after Pickering GS A; systems where the spent resin is slurried to central storage tanks have been used at all other Ontario Hydro stations. From the storage tanks, the resin is slurried into 3 $m^3$ carbon steel cylindrical liners located within Type B overpacks for shipment to the Waste Operations Site; the resin is dewatered but not immobilized. Special efforts to fluidize the resin were required to prevent the tendency of the resin to harden and agglomerate.

Quadricells:

"Quadricell" is an above-ground storage facility, at the Waste Operations Site, primarily designed to contain bulk quantities of spent ion exchange resins (Fig. 6). To load the Quadricells, the shipping cask is removed from the transport truck and the resin is bottom unloaded in a shielded manner into the Quadricell from the cask. The Quadricells are also designed for a secondary role of storing highly radioactive reactor core components. Being totally above grade the Quadricells have the advantage of being largely site independent, reinforced concrete being used to provide two independent envelopes with a monitored interspace. Each Quadricell module, consists of two independent reinforced concrete barriers: one a cubic structure 6 $m^2$ by 5.5 m high that is internally separated into four cells; and four inner cylindrical concrete vessels that are placed within the cells. The present facility consists of 15, 24 $m^3$ capacity Quadricells placed in line. It covers an area about 6 m wide by 83 m long. Retrieval of the waste is based on lifting the 30 Mg inner concrete vessel and contents. No confinement or retrieval credit is currently taken for the steel liner can. The Quadricell is capable of withstanding credible earthquakes associated with the area and is resistant to missile impacts such as small aircraft and tornado borne utility poles.

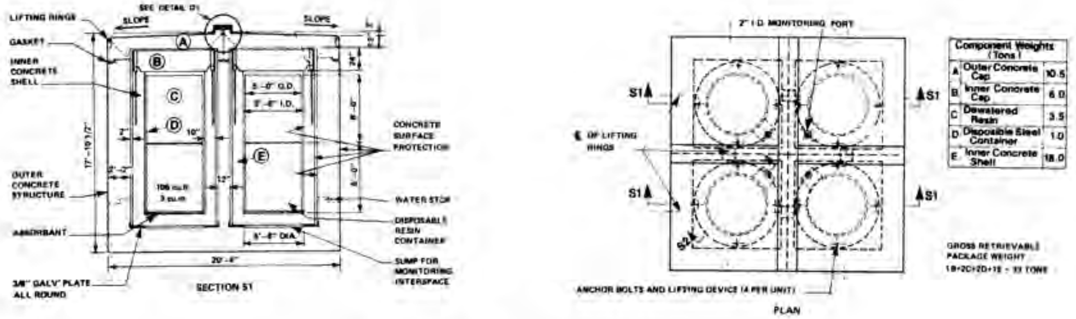

Fig. 6. Quadricell.

Waste Transportation

Ontario Hydro owns and operates transportation packages that are categorized according to the IAEA transportation regulations and as licensed for use by the Canadian regulatory authority, the Atomic Energy Control Board. At present two kinds of packagings in which Type A quantities may be shipped are in use; these are 0.2 $m^3$ drums and 1 $m^3$ rectilinear containers. Greater packaging and shipping efficiency are achieved with the rectilinear packages. Most of the waste is shipped as Low Specific Activity (LSA).

Type B overpacks are used for the shipment of cartridge filters or disposable ion exchange columns. 3 $m^3$ capacity Type B casks are used for the transportation of bulk dewatered resin or for other non-routine wastes.

All of the routine reactor operating wastes from Pickering A (and eventually Darlington) are transported through mainly rural areas to the Bruce Nuclear Power Development for processing and storage. Since 1963, Ontario Hydro has made over 3,500 waste shipments with no release of radioactivity to the environment. Approximately four shipments of LSA material and one shipment of Type B material are required from a four unit station per month.

## TRANSITION PHASE (1980-85)

The transition phase in the Ontario Hydro program is marked by the approaching peak waste arisings from two of the generating station complexes at their maturity (at Pickering and Bruce), cost constraints posed by the economic climate and the increasing need to stabilize radioactive waste management costs.

Although the Radioactive Waste Operations Site at BNPD has sufficient site capacity for continuing the current reactor wastes storage policy into the next century, considerable financial outlay is necessary for the building of additional storage structures, replacement of volume reduction equipment and continued storage operations. Major among these are the requirement for a new radioactive waste incinerator at an estimated cost of 20M$ (1984$), required to replace the current incinerator, around 1990, and costs of Low Level Storage buildings of about 3M$ (1984$) recurring every three to four years. With the acquisition of a licensed disposal site/facility, these requirements could be eliminated and studies indicate that the wastes could be permanently disposed of at less cost. Ontario Hydro management are now reviewing corporate strategies for storage vis-a-vis disposal with the intention of bringing in expeditious disposal capability.

In the interim period, studies and programs are underway to further improve upon existing systems with respect to costs, emissions, handling, and facility/system integration. New storage and processing facilities will be brought into service as needed.

## New Facilities

### In-ground Storage Containers:

Additional storage capacity for intermediate level wastes will now be provided using a new in-ground concept called In-ground Storage Containers (ISCs). This concept minimizes the excavation and concreting required to construct the facility, allowing vertical borehole augering techniques (Fig. 7). Two watertight structural barriers are provided in the ISCs to reduce site dependence, eliminating the need for drainage systems as in the case of earlier designs of trenches/tile holes. The operational advantages of the original tile holes are retained.

### Radblocks:

Another flexible intermediate level waste management concept under prototype development is the Radblock (Fig. 8). Radblock is a portable, concrete structure provided with four or five internal cavities in which waste components are placed; it is a precast, reinforced concrete design. The concrete provides radiation shielding and provides engineered containment to the waste. Due to simple construction, Radblocks can be built as required. Their construction will not interfere with ongoing site operations since they can be completely constructed off-site by a manufacturer. The design provides the flexibility that at some point in the future, the Radblock can be considered a transportation and disposal package.

### Dry Storage Modules:

An additional waste component that requires disposal is the reactor core retubing waste, that will be generated from the Pickering Units 1 and 2 fuel channel replacement. These components will be stored on the Pickering site in large concrete casks called Dry Storage Modules (Fig. 9) for an interim period prior to disposal. These 200 tonne, transferrable/transportable modules provide the opportunity for once-through handling of the irradiated components through various phases of short and long-term management of the materials. Each DSM will have a capacity of at least 155 pressure tube liners or 150 end fittings which are the components to be replaced from Units 1 and 2 fuel channels; the steel sheathed, reinforced, heavy concrete modules provide .61 metre (24 in.) shielding for these core components.

The module is designed to be able to maintain its structural integrity during all phases of handling. These include:

(1) Construction handling; the module being repositioned from a vertical position, in which it is constructed, to a horizontal loading position.

(2) On-Site transportation from the construction area to the loading area, and from the loading area to the storage area.

(3) Alignment and shimming loads at the DSM loading area.

(4) Transportation to a disposal site.

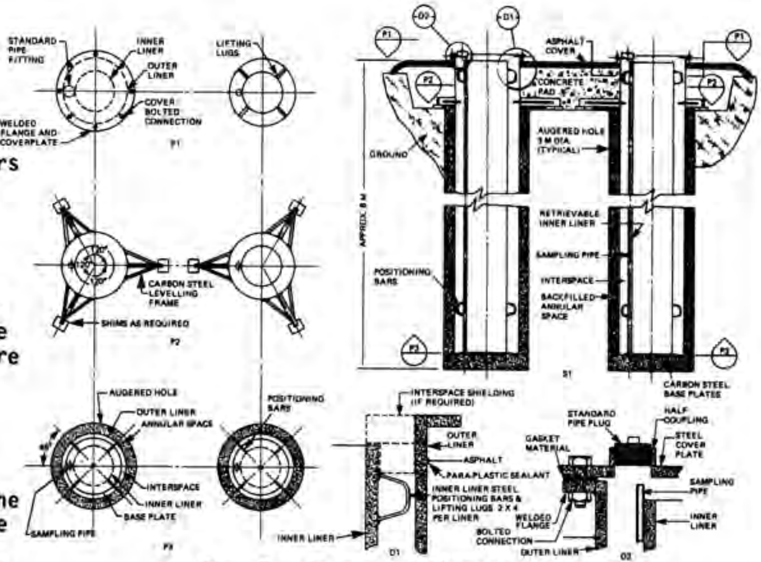

Fig. 7. In-ground Storage Container.

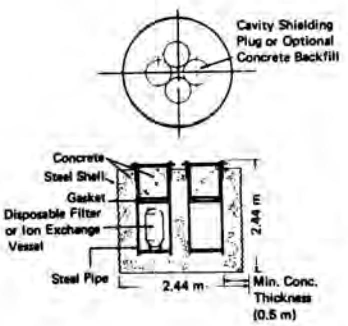

Fig. 8. Radblock

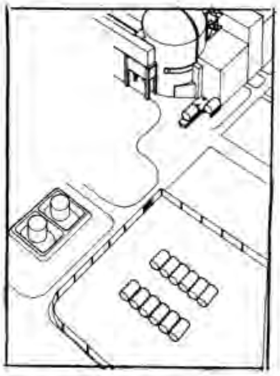

Fig 9. DSM Facility.

The DSMs will be stored in a fenced storage area on the Pickering site at some distance from the public access exclusion boundary; periodic sampling, contamination surveys and direct dose rate monitoring will be carried out.

### Tritium Recovery Facility:

As a step to minimize tritium emissions, a Tritium Removal Facility (TRF) based on a catalytic exchange/cryogenic distillation system will be located at Darlington. The pure tritium gas which will arise from the removal process will be immobilized as a metal tritide for storage. Although the primary motive is to reduce station emissions and in-station occupational exposure from tritium, a further benefit accrues by reducing emissions and occupational exposure from low level waste management operations. Systems for the packaging, purification and distribution of the pure tritium are in the final stages of design.

### Research and Development

In support of both the interim management and final disposal of radioactive wastes, comprehensive research/technology programs are also in place to provide detailed information on waste characterization, processing, packaging and isolation of wasteforms in a disposal environment. Volume reduction, processing and packaging techniques originally conceived for storage are also being reassessed for disposal. Economic arguments suggest discontinuation of incineration as a processing step prior to disposal, on the grounds that costs of incineration outweigh disposal cost increments resulting from less efficient volume reduction techniques such as baling or drumming.

Work is in hand on the immobilization of moderator resin containing carbon-14 in cement/epoxy and water extendible polyester matrices and on determination of the wasteform's leaching resistance. Immobilization and encapsulation of aqueous and organic liquids, (including tritiated wastes from Darlington TRF), ion exchange resins, and miscellaneous solid wastes with various solidification matrices has been studied. Data have been developed on the physical properties of waste forms produced with asphalt, cement, cement/polymer, epoxy resins and water extendible polyester.

Although most of the radioactivity in low and intermediate level waste decays to negligible values in two to three hundred years, some residual activity will remain in the waste due to a long-lived isotope of carbon, C-14, with a half life of 5730 years. The wastes of concern with respect to C-14 (such as moderator resin) will require special attention to immobilization and encapsulation technology and to engineered and natural barriers to ensure that any release from any long-term storage/disposal facility would be gradual and with isotopic dilution in the geomedia, such that risks would be acceptably low. A number of research programs are currently underway to characterize hydrogeological and geochemical properties of generic geomedia specially with respect to C-14 to lend support to assessments of long-term safety.

## REORIENTATION PHASE TOWARDS LONG-TERM MANAGEMENT (1985-1990)

Although storage is providing safe management of radioactive wastes, it is recognized that some components of the wastes presently in storage will remain hazardous beyond the useful lifetime of the storage facilities and will require long-term management by transition from the use of storage to management methods which achieve permanent disposal of the wastes. The term "disposal" implies that wastes will, without additional action, remain satisfactorily isolated for at least as long they remain hazardous. Since, unlike irradiated fuel, these wastes do not have any current or future resource value, disposal of wastes which will remain hazardous for an appreciable time need only be delayed until suitable facilities are available. For this reason, management studies and development programs have been established within Ontario Hydro to pursue the objective of establishing the technology necessary for disposal of radioactive wastes, either on a 'go-it-alone' basis or in conjunction with other radioactive waste producers in the province.

Disposal methods could range from various land-based methods (shallow, intermediate and deep burial) to lake, sea or ocean disposal. However, land-based methods are considered to be the optimum disposal option for Ontario Hydro's reactor wastes from technical, economic and socio-political considerations. Proper characterization and classification of reactor wastes permits use of a number of practical schemes such as engineered trenches or tunnels in soft media such as clay or till and rock caverns in shale or limestone. Improvements in the waste sorting methods (such as with waste activity and gamma spectrometry monitors) will also allow us to declassify a segment of the waste (as non-radioactive) and following regulatory approval, dispose by conventional methods (e.g. landfills).

Among the geomedia available in Southern Ontario, clay, till, shale and limestone deposits have very low permeabilities, excellent potential for waste isolation and occur at shallow to intermediate depths. Salt beds in Ontario have been extensively mined and are not considered as suitable a medium. In Southern Ontario, use of crystalline hard rocks such as granite and gneiss, although a good host medium for a repository are deeply situated and would require expensive deep mine facilities if they were to be considered for low and intermediate level waste disposal.

A "system" reorientation of the radioactive waste processing, transportation and storage program towards disposal in the years to come is recognized to be a necessary ingredient to improve the economy of radioactive waste management. This will lead to a stabilization of radioactive waste management costs in the face of the maturing nuclear generation program and also meet corporate responsibilities with respect to long-term management of radioactive wastes.

## CONCLUSIONS

In conclusion, the Ontario Hydro radioactive waste management program has grown considerably in the past fifteen years and has led to the development of considerable expertise in the design, safety analysis, licensing, construction and operation of radioactive waste management systems and facilities. In addition, specialized knowledge has been accumulated in a number of research and development areas related to waste handling; waste characterization and conditioning and hydrogeological and environmental sciences. In the interim period while the Corporation reorients itself to meet disposal objectives, processing and storage methods and requirements are being reviewed and systems are being acquired to ensure continued availability of radioactive waste management capability in this period. With the development of disposal technology, a complete range of radioactive waste management capability, from any project's inception through to the disposal of its radioactive wastes, would be available.

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