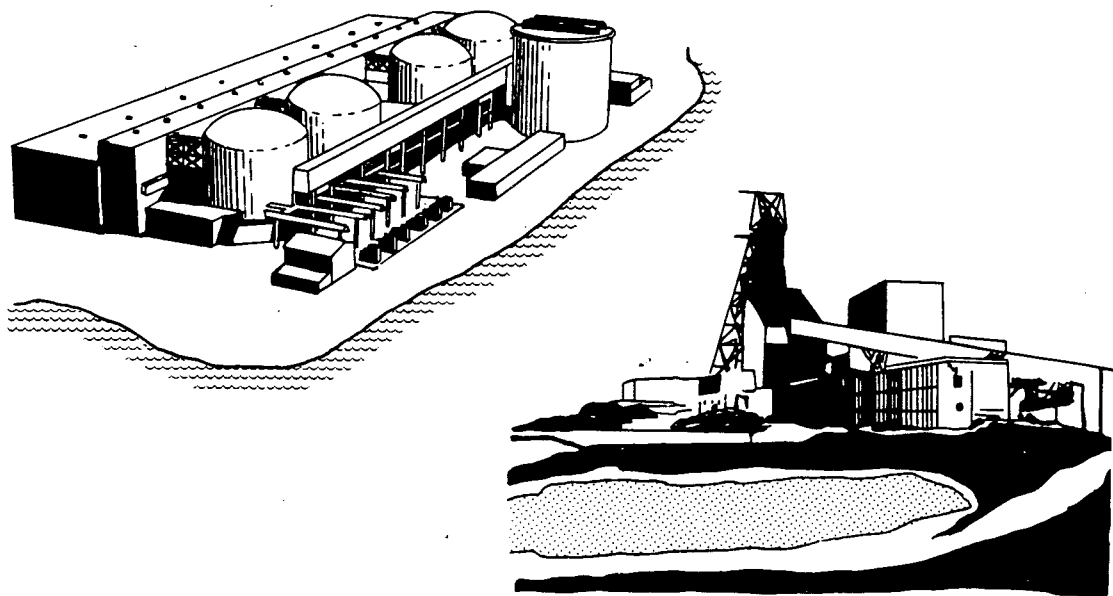




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NUCLEAR ACTIVITIES OF ENVIRONMENT CANADA - 1987



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NUCLEAR ACTIVITIES OF ENVIRONMENT CANADA - 1987

Prepared by

DOE

Nuclear Advisory Committee

November, 1988

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1.0 INTRODUCTION

Environment Canada derives its statutory mandate from the Government Organization Act (1979) for the preservation and enhancement of the quality of natural environment, including water, air and soil quality. With respect to matters concerning nuclear energy, the Atomic Energy Control Act of 1946 empowers the Atomic Energy Control Board (AECB) with the regulatory authority for the development, application and use of atomic energy in Canada. However, the Memorandum of Understanding between Environment Canada and the AECB provides impetus to these two agencies to work towards ensuring the protection of the environment as well as the health and safety of all Canadians. Thus, this department plays a significant role in influencing the AECB's decisions relating to nuclear energy developments.

The departmental mission with respect to nuclear energy sector was clearly articulated in the Results Definition Study of 1986. The fundamental objective or mission is to "provide a precautionary, forward-looking and objective view of the environmental impacts of nuclear activities in or affecting Canada". This study also discussed the strategies to be implemented and the activities to be undertaken in order to achieve the desired results (effects). Consistent with this mission, the department has undertaken and is undertaking a number of activities to help provide sound, competent environmental advice to the federal/provincial agencies, and to the public on the potential impacts of nuclear energy developments on the environment.

This document presents a compilation of the activities that were carried out by the various responsibility centres of Environment Canada during 1987. The intent of this compilation is simply to provide specific information on an important segment of the departmental activities. The document also provides a list of "Core Nuclear Personnel" who may be contacted for scientific/technical advice on nuclear-related matters.

2.0 NUCLEAR ACTIVITIES UNDERTAKEN BY THE RESPONSIBILITY CENTRES

The Minister's mandate is carried out by the department through a number of activities such as the implementation or adoption of objectives or standards relating to environmental quality, control of contaminant releases to the environment, encouragement of sound environmental practices by the industries and provision of environmental advice to the AECEB and to the public. These activities are undertaken by Headquarters and Regional responsibility centres, including Environment Canada's research institutes and Atmospheric Environment Service. This chapter provides a detailed overview of the activities carried out by the respective responsibility centres.

2.1 Management and Emergencies Branch

This Branch hosts the Departmental Nuclear Coordinator** position which is the focal point for the department's nuclear-related activities. The Nuclear Coordinator has the responsibility to develop, recommend and update the departmental positions and policies respecting nuclear issues with support from various responsibilities centres in the department. He also makes sure that the expertise in the department is brought to bear for the resolution of nuclear issues, and ensures that the environmental considerations are taken into account early in addressing those issues. In addition, the Coordinator arranges reviews of the Atomic Energy Control Board's (AECEB) draft regulatory documents as well as other technical documents pertaining to major Canadian nuclear initiatives, and the preparation of departmental briefs. The departmental contributions coordinated by the Nuclear Coordinator include:

- review of the AECEB's proposed general amendments to the Atomic Energy Control Regulations and other AECEB's draft consultative documents;
- review of Atomic Energy of Canada Limited's concept for the disposal of high-level radioactive waste in deep geological formations;
- the departmental submission and supporting information materials for the Minister's appearance (April 7, 1987) before the Standing committee on Environment and Forestry respecting high-level radioactive waste management in Canada; and
- the departmental brief to the Ontario Nuclear Safety Review on environmental protection and emergency issues relative to Ontario's nuclear power plants.

** Since September 1988 Departmental Nuclear Coordinator is located in the Industrial Programs Branch.

The Departmental Nuclear Coordinator also serves as the Executive Secretary to the DOE Nuclear Advisory Committee (DOENAC). The DOENAC is an advisory body to the Senior Management on nuclear-related issues and is comprised of DOE members who have varied interests and expertise in nuclear areas.

2.2 Industrial Programs Branch

2.2.1 Uranium Mining and Milling

- Published the 1986 mine (including Uranium mines) status report which assesses compliance with the Metal Mining Liquid Effluent Regulations.
- Completed submissions to ADM's compliance monitoring Report (Project 10) for mines (including uranium mines) for 1986 and 1987.
- Commented to AECB (through regional offices) on uranium mining companies' applications and renewals for operating licences, base line studies and proposals for close-out of mines.
- Provided technical advice and comments to EIS's to Regional offices on uranium mining and milling processes and waste management practices as requested.
- On-going participation in the Ontario Municipal Industrial Strategy for Abatement (MISA) program for the development of metal mining effluent quality regulations. These will apply to uranium mines, but MOE is relying on the AECB to stipulate the standards for radionuclides in the effluents.
- Issued Mine and Mill Wastewater Treatment report which applies to uranium as well as to metal mines.
- Participated in inter-departmental meetings chaired by DIAND on the potential development of a uranium mine near Baker Lake in the NWT.
- Published a report on the Assessment of Radiological Impact of Uranium Mining in Northern Saskatchewan. The report (EPS 2/MM/1, June 1986) generated considerable media interest in the province of Saskatchewan.
- Radionuclide leaching studies on uranium tailings that were approximately 20 years old, fresh tailings and tailings solidified by a proprietary process were conducted at the Waste Water Technology Centre. A report on this seven-year study was published - EPS/3/MM/2, April 1987.

2.2.2 Nuclear Power Generation

- Environmental Codes of Practice: A series of documents which are intended to identify good environmental protection practices for new or expanded steam electric stations during siting, design, construction, operation and decommissioning phase of these projects are being developed.
- Design Phase Code: The first of a series of documents on Environmental Code of Practice for the Steam Electric Power Generation (SEPG) was developed in consultation with a federal-provincial industry task force and published in March 1985. A comprehensive appendix document was published in December 1986. The Design Phase Code addresses water-, waste water-related and solid waste aspects of steam electric plants which include CANDU reactors. Design recommendations are presented that will eliminate or minimize the detrimental environmental effects of once-through cooling systems, of wastewaters and of solid waste disposal sites.
- Siting phase Code: The second in the series of the SEPG Environmental Codes of Practice, the Siting Phase, was published in March 1987. This Code presents site selection criteria along with supporting rationales that will minimize the detrimental environmental effects of once-through cooling water systems, solid waste disposal sites, and atmospheric emissions from steam electric generating stations. These siting criteria address five main components of the environment: land use, terrestrial ecology, surface and ground water, aquatic ecology, and atmospheric environment.
- Construction phase Code: A Construction Phase working group was formed composed of utility and provincial representatives. The draft Code developed was finalized based on comments received and is now waiting for publication.
- Decommissioning Phase Code: A contract to consider the environmental and economic implications of decommissioning fossil-fuelled G.S.'s was completed in March 1987. Results and recommendations from this work will be used in developing a Decommissioning Phase Code.
- Consideration of nuclear facilities will await the results of the decommissioning activities by Atomic Energy of Canada Ltd. (AECL) at the Gentilly I and Douglas Point generating stations. No date has been set for completion of the Decommissioning Code of Practice. An Operations Workshop to be co-sponsored by the Canadian Electrical Association and Environment Canada has been scheduled for November 21-23, 1988. This will identify operational environmental issues and priority research areas for future R&D.

- Two Studies have been carried out: The London Nuclear report, "Review of Technologies to Control Airborne Emissions from CANDU Stations" was completed and distributed for peer review in FY 85/86. Comments have since been received. The Monserco report "Radioactivity Concentration and Dose Calculations Using a Chain-Lake Model of the Great Lakes" was prepared in draft but yet to be finalized.
- Lepreau II Nuclear Reactor: Participated in the review, revision and update of the federal/provincial response to the recommendations of the Review Panel on the EIS document. The response was sent to the Minister in February 1987.
- Prepared and coordinated the departmental brief on environmental aspects with respect to Ontario's nuclear power plants for submission to the Ontario Nuclear Safety Review.

2.2.3 Miscellaneous

- A computerized prototype data base for environmental releases of radionuclides and non-radionuclides from nuclear facilities is developed. The database presently contains effluent data for Ontario uranium mines for the period 1980-86. The data base will be used to assess the trends in the accumulation of long-lived radionuclides in the environment, identify significant data gaps to provide substantive and useful data on environmental radioactivity.
- Documents prepared by the AECL on the concept assessment for the disposal of nuclear fuel wastes were extensively reviewed and commented. It is anticipated that final documents on the subject will be issued to the regulatory agencies (AECB, DOE and MOE), in 1991 for review, and a full scale public hearing will be held under the auspices of Federal Environment Assessment and Review Office.
- The AECB proposed amendments to the AEC Regulations were reviewed extensively. A departmental response identifying areas of concern to DOE was forwarded to the AECB.
- A number of consultative documents from the AECB were reviewed and comments forwarded to the Nuclear Coordinator.
- Regional requests for review of technical documents were responded.
- Environment Canada reports were presented to Joint Panel on Occupational and Environmental Research on Uranium Production in Canada at the Panel's semi-annual meetings. The reports briefly summarized DOE's projects in the nuclear field. The membership of the Joint Panel consisted of Federal/Provincial department/agencies, Industry, Labour, research foundations, etc.

- The Resolution adopted at the Ninth London Dumping Convention (LDC) Consultative Meeting in 1985, called for a suspension of the sea dumping of low-level radioactive wastes pending further studies. The Tenth LDC Consultative Meeting held in October 1986 adopted a resolution establishing an inter-governmental panel of experts from Contracting Parties to conduct those studies. The panel is to examine or undertake studies and assess the wider political, legal, economic and social aspects of radioactive waste dumping; the issue of comparison to land-based options and the costs and risks associated with them; and the question of proof regarding the safety and environmental acceptability of sea dumping of low-level radioactive wastes.

2.3 Water Quality Branch

2.3.1 National Radionuclides Monitoring Program

The objective of this program is to assess the background levels of radionuclides in the Canadian surface waters. A total of 21 monitoring stations were established across Canada; these stations are located away from the point sources of radionuclide releases, such as uranium mining and milling operations, nuclear fuel fabrication plants, operating nuclear power reactors, etc. The monitoring program is a joint project with NWRI; the WQB collects monthly samples from the 21 stations, and NWRI (or AECL under contract) analyses the annual composite of these samples. The water samples are analysed for selected radionuclides, both natural in origin and man-made (fall-out). The first four years' monitoring data were reported in the IWD Scientific Series No. 156, 1987.

2.3.2 East Poplar River Study, Southwest Saskatchewan

This is a ground water/surface water study. The objective of this study is to assess the water quality in the East Poplar River before it crosses the Canada-US border into Montana. About 5 km north of this border, the Cookson Reservoir was built on the river to supply cooling water to the coal-fired power station at Coronach. To operate this station, a large volume of coal is strip-mined nearby, and the dewatering water, which is rich in radioactive- and trace-elements, is discharged into the reservoir. A draft report is prepared which presents the available information and make recommendations for further studies to acquire relevant data on parameters/activities that affect the water quality in the East Poplar River.

2.3.3 Radiological Environmental Data Base

The WQB is trying to acquire radiological data relating to surface waters from other departments and agencies, and incorporate those data into the existing data base, NAQUADAT. Some data from the Ministry of Saskatchewan Environment have been acquired, and are being processed. The data from the National Radionuclide Monitoring Program is being stored in NAQUADAT. Radiological data from MOE will be acquired and incorporated into NAQUADAT.

2.3.4 High Level Radioactive Wastes

AECL is responsible for developing a methodology for the eventual disposal of nuclear fuel wastes. The WQB has participated and will continue to participate in the assessment of the concept as far as ground water/surface water quality is concerned.

2.4 National Hydrology Research Institute

2.4.1 Southwest Saskatchewan Ground Water Study (Poplar River Study)

A contract is being negotiated with the University of Regina to incorporate reviewers' comments on the first draft of the Poplar River study and to prepare the final report. The report will eventually be published in the IWD publication series.

2.4.2 Uranium Mines

Review of the ground water components of the environmental impact statements for the Collins Bay "A-Zone", "D-Zone" and "Eagle Point" expansion and the Cigar Lake test mine were provided to Environmental Protection, Western and Northern Region. These comments were collated with those from members of the Western and Northern Region, Regional Screening and Coordinating Committee.

2.4.3 High Level Radioactive Waste Disposal Program

The research program in NHRI was terminated at the end of FY 85/86. Remaining publications are in the final stages of preparation and printing.

2.5 National Water Research Institute

2.5.1 Sedimentary Transport of Radionuclides

The impact of U.S. nuclear fuel reprocessing activities at West Valley, NY on the Niagara River/Lake Ontario aquatic system is under investigation. A large number of water and sediment core samples have been analyzed for several radionuclides. The results obtained thus far indicate that a large fraction of radioactivity released to the west Valley aquatic system eventually migrated to Lake Ontario via the Niagara River. The migration is mediated by association with sedimentary particles which eventually settle down to the bottom of Lake Ontario. A paper detailing these findings is being published in the Water, Air and Soil Pollution journal.

2.5.2 Radionuclides in the Ottawa River and St. Lawrence River

The levels of naturally-occurring and artificially-produced gamma-ray emitters are being measured in the water, suspended sediment and water filtration plant floc samples collected in or near this aquatic

ecosystem with the view of assessing the levels and modes of association of radionuclides released during natural weathering or via effluents from the Chalk River Nuclear Laboratories. The data obtained thus far suggests very little, if any, impact on this system from the CRNL labs. In addition to the above samples, sediment cores from several smaller lakes along this aquatic system are also being analyzed by the Pb-210 method to determine sedimentation rates. This information is required for ongoing NWRI studies to assess the impact of non-radioactive pollutants on St. Lawrence River. Two scientific papers dealing with this project will be presented at a forthcoming (1988) international symposium on large rivers to be held in Quebec City.

2.5.3 Partitioning of Radionuclides at Natural Interfaces

The partitioning of several naturally-occurring radionuclides and of Cs-137 at water/surface microlayer interface is under investigation. Some radionuclides are found to be retained more efficiently in the surface microlayer.

2.5.4 Radionuclides in Langley Bay/Lake Athabasca

This is a joint project with EP, WNR, Regina. Nearly all the samples collected during the 1983 and 1986 field surveys have been assayed for various radionuclides. The project seeks to assess the behaviour of radionuclides released during uranium milling operations to the local aquatic environment. The results obtained so far have been published in scientific journals Health Physics and Archives of Environmental Contamination and Toxicology. A paper was presented at the International Symposium on Cellular Impacts in Ecotoxicology, Lyon, France (May 1987). The results basically show that nearly two-third of the tailings released still reside in the main disposal site. Of the ten percent or so that reached the nearby Langley Bay, a small portion has reached Lake Athabasca but the bulk is spread throughout the bay from where it is leaching into the overlying waters and is being assimilated by the biota. The radiation dose rates to the aquatic biota are found to be very small.

2.5.5 Chernobyl Radionuclides

The analyses of rainwater, cloudwater and lakewater samples collected immediately following the April 25, 1986 nuclear accident at Chernobyl, U.S.S.R. for various radionuclides have been completed. The levels were found to be extremely small. It was inferred that the Chernobyl cloud transited through Central Ontario with a mean residence time of about 12 days. In addition we assessed the North American data on Ru-103 and Cs-137 in air in terms of release patterns at source to conclude that radioactive plumes of distinct radiochemical composition reached Canada via the easterly, westerly as well as the less-recognized arctic routes. The latter work was done in collaboration with Professor J.C. Roy of Laval University. The results of our studies have been accepted for publication in the journal of Science of the Total Environment and the Journal of Environmental Radioactivity. The results were presented at two international conferences on nuclear accidents held at Madrid, Spain and Cadarache, France.

2.6 Atlantic Region

2.6.1 Pt. Lepreau I

This nuclear power plant is operating in accordance with the specified standards stipulated in the operating licence. Environmental monitoring is carried out by the operator of the nuclear facility as per AECB licence. In order to assess the long-term environmental impact of the operation of the Point Lepreau nuclear generating station, the Point Lepreau Environmental Monitoring Program (PLEMP) has been established within the Department of Fisheries and Oceans. A federal/provincial working group on environmental radioactivity has been established to ensure that the concerns and responsibilities of different agencies are addressed in a coordinated manner by PLEMP. EC is a member of this working group which advises PLEMP on field activities and reviews reports produced by this program.

2.6.2 Pt. Lepreau II

Environmental Assessment and Review Panel Report has been reviewed and a formal response prepared by EMR on behalf of the federal government. The exact status of this document and of the project itself is uncertain.

2.6.3 Heavy Water Plant, Port Hawkesbury and Glace Bay

Both plants owned and operated by AECL are now shut down and decommissioned in accordance with the AECB guidelines. The units were dismantled and wastes removed from site, or handled on site.

2.6.4 Nuclear Fuel Fabrication Plant, Moncton, NB

This unit is shut down and is in the process of decommissioning.

2.7 Région du Québec

2.7.1 Déclassification du Gentilly I (GI)

En décidant de ne plus exploiter la centrale nucléaire Gentilly I, l'Energie Atomique du Canada Limitée (EACL) a procédé en 1985 au démantèlement de la centrale. Du combustible irradié est entreposé dans 11 silos (canisters) en béton armé construits dans la partie ouest du bâtiment de turbine de Gentilly I. Cette partie s'appelle maintenant "L'Aire des silos de stockage du combustible irradié" (ASSCI) (Spent Fuel Canister Area). Les déchets radioactifs ont été compactés et déposés dans les fosses de l'aire de stockage de déchets radioactifs (ASDR) appartenant à la centrale de Gentilly II (Hydro-Québec). Les "monitoring" de l'ASSCI et de l'ASDR sont effectués par l'EACL et l'Hydro-Québec respectivement. Le rôle de la Direction régionale de Protection, C&P, consiste à assister la Commission de Contrôle de l'Energie atomique (CCEA) dans la surveillance et le suivi des opérations de ces deux aires.

2.7.2 Opérations du Gentilly II (G2)

La Centrale nucléaire Gentilly II est toujours en opération. Le propriétaire de la centrale, Hydro-Québec possède un permis de la CCEA pour opérer une aire de stockage des déchets radioactifs (ASDR) produits par l'exploitation des centrales G1 et G2. Les déchets sont déposés dans les fosses en béton armés avec couvercles aussi en béton armé. Comme dans le cas de G1, La DPE de la région du Québec assiste la CCEA dans la surveillance et le suivi des opérations de l'ASDR.

2.7.3 Usine de l'eau lourde de Laprade

La construction de cette usine fut arrêtée il y a quelques années, donc elle n'a jamais été en opération. Actuellement, les employés de l'EACL s'occupent à entretenir les installations physiques de l'usine. Aucune activité de nature nucléaire n'est en cours à cet endroit. Aucune implication de notre ministère n'est requise.

2.8 Ontario Region

2.8.1 Low Level Radioactive Wastes

a) Licenced Waste Management Facilities

Facilities licenced by the AECB are: Port Granby (Eldorado), Welcome (Eldorado), Chalk River (AECL), and Bruce (Ontario Hydro).

Port Granby and Welcome

There are two aspects to these facilities. One relates to the current operations while the other concerns decommissioning activities.

The main operational concern at Port Granby is shoreline erosion and bluff stability. EP-OR with technical assistance from NWRI participates in quarterly geotechnical inspections of the bluffs. Environment Canada (EC) has been involved in the development and review of stabilization plans and testing of stabilization methods for the bluff. NWRI has applied computer modelling technique to evaluate erosion process. They have also undertaken sediment studies in the nearshore area of Port Granby. EP-OR also led the development of an approach to reviewing and redefining discharge objectives for arsenic.

At the Welcome facility, activity has focussed on modifications to collection and treatment ponds and clean up of off-site contamination. AES assisted EP-OR in the review of the meteorological/ hydrological aspects of the pond design. EC suggestions were incorporated in the final design. WTC provided lab assistance for the audit of off-site clean up. In the previous year, the establishment of clean up criteria received considerable attention.

Plans for the decommissioning of the Port Granby and Welcome facilities and the establishment of a disposal facility were to be

submitted for an EARP panel review. A panel was selected and an EC technical review group was established. Due to public and political pressures associated with the siting of the new disposal facility this process was postponed. A task force was established to review the process for siting a low level radioactive waste disposal facility. Environment Canada provided input to Siting Process Task Force which was included in their report (December 1987). The report indicated a prominent role for EC in future Task Force activities on low-level radioactive waste management.

Chalk River

EP-OR became involved in a joint regulatory process with the AECB this year. The major project requiring EP-OR attention was the development of a shallow land burial concept by AECL. Comments on this concept were provided to AECB. They intend to proceed with the construction of a prototype facility. AECL has been advised that if they proceed with this project they must obtain an AECB construction approval, a public information meeting must be held and they must comply with the requirements of EARP. EP-OR will participate in the detailed review of this project.

Bruce

This is a low priority project for EP-OR. It does not pose many environmental concerns. EP-OR participates in compliance inspections and joint regulatory reviews as time and resources permit.

b) Historic Wastes

Historic wastes are wastes which are no longer licenced by the AECB and the industry/agency can no longer be held accountable for the management of these wastes. These are primarily wastes from the 1940's and 1950's.

The Low-level Radioactive Waste Management Office (LLRWMO) of AECL is responsible for managing historic wastes. In Ontario, historic wastes are located in several locations in the towns of Port Hope (including sediments in the harbour) and in Scarborough.

Port Hope

By government direction, the historic wastes in Port Hope are to be included in the plans for disposal of Port Granby/Welcome waste. Port Hope waste will also be considered in the Task Force review. This activity is subject to Environmental Assessment and Review Process (EARP) requirements. The LLRWMO is continuing with studies related to the removal of the wastes. Clean-up criteria are of particular concern as is the method of dredging the contaminated sediments from the harbour. EP-OR has received NWRI assistance in reviewing the dredging aspects.

At the same time, the International Joint Commission (IJC) has identified Port Hope Harbour as one of 17 Canadian "areas of concern" on

the Great Lakes for which a "Remedial Action Plan" must be prepared. EP-OR is coordinating a Federal-Provincial team which is preparing this for the IJC. EP-OR has also conducted and supported field investigations in the harbour related to sediment, benthological and fish contamination. During the investigation, uncertainty associated with the environmental significance of thorium was identified (AECL and ICRP Dose conversion factors differed by greater than 2 orders-of-magnitude). Follow-up reviews support the assignment of greater significance to thorium. This information should be considered in environmental monitoring programs and environmental assessments.

c) Ongoing Wastes

Central Facility

The LLRWMO has investigated options for the development of a central waste management facility in Ontario to handle the ongoing low-level wastes generated each year. This activity has been incorporated into the activities of the Task Force on Low-level Radioactive Waste Disposal in Ontario. If it were to proceed the project must comply with EARP and it would be subject to AECB licensing.

2.8.2 Uranium Mining

All operating mines in Ontario are located in the Elliot Lake area. Two other mines, under a decommissioning licence, are located near Espanola (Agnew Lake mine) and Bancroft (Madawaska mine).

Elliot Lake

Operating mines in the Elliot Lake area are: Denison (Main and Stanrock) and Rio Algom (Panel, Quirke, and Stanleigh). In addition, Denison recently opened an yttrium recovery plant. The operational plans of the facility were reviewed by EC. All mines are complying with the Metal Mining Liquid Effluent Regulations. Handling sludge accumulation in the settling ponds and reducing ammonia toxicity are areas which have received attention this year. EP-OR has also supported a joint study with AECB on water-sediment interactions in the Serpent River. Treatment modifications at Quirke and Stanrock have been reviewed by EC.

Agnew Lake and Madawaska

Both of these sites are currently under decommissioning licences which run until 1988. EP-OR conducts a groundwater sampling program at Agnew Lake. EC is involved in annual evaluations of the facilities which will be used as a basis for deciding in 1988 whether or not to abandon the sites.

2.8.3 Refining and Conversion

Eldorado operates a refining facility in Blind River and a conversion facility in Port Hope.

The refinery in Blind River has been operating well. EP-OR reviews monitoring data and licences.

The conversion facility in Port Hope poses more concern. The new UF₆ plant has had occasional problems controlling air emissions and production problems led to the reopening of portions of the old UF₆ plant which was shut down two years ago. AES is completing a meteorological study for EP-OR which will aid in evaluating the air emission models used for establishing release limits.

Both of these facilities could be subject to a MISA review.

2.8.4 Nuclear Power Generation

There are currently 16 power generation reactors operating at Pickering (8) and Bruce (8). In addition, four reactors are under construction at Darlington. The Rolphton and the Douglas Point facilities have been shut down.

Environment Canada has been involved in the assessment of shutdown procedures and interim management plans for decommissioning of the Rolphton and the Douglas Point facilities.

2.8.5 Heavy Water Plants

Heavy water plants operating in Ontario are located at the Bruce Nuclear facility. EC review monitoring data and AECB licences for these plants.

2.8.6 Nuclear Fuel Fabrication Plants

There are three fuel fabrication plants in Ontario located at Toronto (CGE), Peterborough (CGE) and Port Hope (Westinghouse). EC review annual monitoring data from these facilities.

2.9 Western and Northern Region

2.9.1 Abandoned Uranium Mines

Rayrock, NWT

The abandoned mine, mill and uranium tailings continue to be of concern to the local native population. The Science Institute of the Northwest Territories (SINWT) has been given the responsibility to bring together all interested parties and reach consensus on any necessary closure, monitoring and decommissioning of the site. Indian and Northern Affairs Canada (DIAND) is the federal lead agency, with advice being provided by Environment Canada, National Health and Welfare, and the Atomic Energy Control Board (AECB). Environment Canada, Environmental Protection, has studied the tailings and is advising DIAND on continued environmental monitoring and clean-up.

Gunnar, Saskatchewan

Considerable research has been conducted at this mine by Environment Canada (Environmental Protection), the Saskatchewan Research Council (SRC) and, most recently, EMR's National Uranium Tailings Program (NUTP). Environmental Protection published a paper in 1986 on the various options for reclaiming the tailings. NUTP is developing a general mathematical model of the environmental impact of uranium tailings. Once this general model becomes available, Environmental Protection will consider a site-specific application of the model to the Gunnar situation.

Lorado, Saskatchewan

This site is much smaller than the above mentioned Gunnar site. There has been some preliminary environmental research by Environmental Protection and other agencies, but attention has been focusing on the Gunnar tailings and Langley Bay.

2.9.2 Decommissioning Uranium Mine

Beaverlodge, Uranium City

The mine closed in 1981 and was decommissioned by 1985. Environmental monitoring, site inspections and remedial work will continue until the company can demonstrate that it has met the decommissioning objectives which were set by the federal and provincial governments. Environment Canada, Environmental Protection, is a member of the Joint Review Group of federal, provincial and company representatives that is directing the activities. Environmental Protection will be involved in various meetings and field inspections until the land is returned to institutional control under the Government of Saskatchewan.

2.9.3 Operating Uranium Mine

Collins, Bay, Saskatchewan

A series of mining developments since 1974 has led to Environmental Protection's present involvement in four separate activities:

- (a) Permanent disposal of the Collins Bay "B-Zone" tailings in the mined-out Rabbit Lake pit;
- (b) In-place decommissioning of the Rabbit Lake tailings;
- (c) Remedial action for contaminated runoff from the Rabbit Lake mine and mill site; and
- (d) Reviewing the Environmental Impact Assessment for the Collins Bay "A-Zone", "D-Zone" and "Eagle Point" expansion.

Advice is provided to the AECB and a Joint (federal/provincial/company) Review Group. Review of the Environmental Impact Assessment

should commence before March 1987 and will involve the Western and Northern "Regional Screening and Co-ordinating Committee" for EARP, with DOE input being augmented by comments from the Canadian Forestry Service and Fisheries and Oceans Canada. Environmental Protection will also forward comments from DIAND.

Key Lake, Saskatchewan

Developments at this mine have been proceeding smoothly since a major spill of mine and mill waters, the so-called Key Lake Spill, in 1984. Environmental Protection is continuing to advise the AECB on environmental matters and to accompany them on an annual joint inspection of the operations. Conceptual decommissioning plans are being developed and refined.

Cluff Lake, Saskatchewan

Two items are presently receiving regulatory attention:

- (a) Reprocessing of highly radioactive tailings to recover gold and uranium; and
- (b) Development of a conceptual decommissioning plan for the tailings management facility.

Environmental Protection provides advice to the AECB. Reprocessing of the tailings is scheduled to commence in February 1987 but the Interchurch Uranium Committee is expected to apply for an injunction. The current decommissioning plan is under regulatory review and appears to require some modification. Environmental Protection has also been providing financial assistance to the University of Saskatchewan for a radiological study of the aquatic ecosystem downstream of the effluent releases from the mill.

2.9.4 Proposed Uranium Mine

Cigar Lake, Saskatchewan

Environmental Protection has been reviewing baseline environmental studies and project descriptions for several years. A formal EIS is expected before March 1987, which will be reviewed by the Western and Northern "Regional Screening and Co-ordinating Committee". The first EIS will be for a test mine and may not involve extensive public participation. A second EIS will follow on full scale development and could involve a public hearing under EARP and/or the Government of Saskatchewan's environmental impact assessment process.

2.9.5 Bio-radiological Research Area, Langley Bay

Langley Bay is a small body of water on the shore of Lake Athabasca which continues to receive eroding tailings from the Gunnar Uranium Mine. Environment Canada (Environmental Protection) has been conducting research into the accumulation and effects of radionuclides in

water, sediment, aquatic plants and fish. A publication is under peer review. Research will continue as dictated by the results and conclusions from presently completed field work.

2.9.6 Radionuclides in the Vegetation of Northern Saskatchewan and adjacent Northwest Territories

The Biology Department of the University of Saskatchewan has been contracted to undertake a study of the natural accumulation of radionuclides in the terrestrial vegetation near former, operating and potential uranium mines. The second draft of the consultant's report is under review by a 21 member committee drawn from federal and provincial agencies, the uranium mining industry and other universities. A final report will be published in 1987. Environment Canada, Environmental Protection, is the lead government agency for the study, with financial assistance being received from DSS, DIAND, AECB and the Saskatchewan Health Research Board. A follow-up report on "Radionuclides in Terrestrial Animals" will be considered.

2.9.7 Brochure on "Radioactivity and Fish"

The first draft of the brochure and its supporting literature review have been received from the Saskatchewan Research Council (SRC). Once finalized after extensive review, the intent is that the brochure be published in English, French, Chipewyn, Dogrib, Cree and other languages spoken in uranium development areas in Saskatchewan and the Northwest Territories. A previous study by SRC for Environmental Protection and other agencies (AECB and Saskatchewan Environment) "Levels and Effects of Radionuclides in Aquatic Fauna of the Beaverlodge Area (Saskatchewan)" forms the basis for the brochure. Further brochures on "Radionuclides in Vegetation" and "Radionuclides in Terrestrial Animals" are possible.

2.9.8 Waste Management Facility, University of Saskatchewan, Saskatoon

The University is about to close their sanitary landfill and commence disposing of chemical and radioactive wastes at a proposed waste management building and the City of Saskatoon's sanitary landfill. Low-level liquid radioactive wastes will be released to the City's sewer system. The design provides for a possible expansion to include an incinerator. AECB is currently licensing the construction of the facility. Saskatchewan Environment and the City of Saskatoon will also be licensing and monitoring the operation. The University is presently finalizing its plans, including a public information program, and seeking all necessary approvals. Environmental Protection is providing advice to the AECB. Public concern could be high, especially if or when an incinerator is announced.

2.9.9 Whiteshell Nuclear Research Establishment, Pinawa, Manitoba

Several activities are underway at this AECL nuclear facility:

- (a) The organically-cooled research reactor is being decommissioned;

- (b) A prototype reactor based on the SLOWPOKE design is being constructed to demonstrate the potential for generating heat and electricity on a scale suitable for small isolated communities;
- (c) AECB investigating more formal licensing of AECL waste management facilities; and
- (d) AECL staff are consolidating their research findings into a major concept assessment document on the disposal of high-level reactor wastes (spent nuclear fuel) by deep burial in granitic rock.

Environmental Protection staff are engaged in providing advice to AECB and AECL on environmental protection measures and on the concept assessment documents.

2.3.10 AECL Underground Research Laboratory, Lac du Bonnet, Manitoba

This facility is being expanded to accommodate joint research with the United States on high-level radioactive waste disposal. In 1986, Environmental Protection co-ordinated a federal/provincial review of the proponents' environmental screening documents. AECL followed the spirit and intent of the federal EARP Guidelines. Environmental Protection and Manitoba Environment and Workplace Safety and Health are monitoring the implementation of environmental protection measures.

2.10 Atmospheric Environment Service

2.10.1 Research and Development

The Air Quality and Inter Environmental Research Branch of AES has an ongoing research program in modelling atmospheric transport, disposal and deposition for accidentally-spilled chemicals into the atmosphere on short range to long run spatial scales. Radioactive chemicals releases form part of this program. The branch developed an operational package of Air Quality programs for emergencies (AQPAC) and it is operational at AES regional weather centres across Canada. Research is continuing into developing and updating further modelling and weather monitoring tools with special application to emergencies. The branch is also conducting cooperative research in modelling transport and dispersion in the atmosphere with the team members of Ontario Nuclear Emergency plan. In addition, the branch is responsible for coordination of DOE's environmental emergency program.

2.10.2 Monitoring for Radioactivity

Weather Services Directorate of AES operates and maintains a network of 26 stations across Canada to monitor radioactivity in air and precipitation. The once-a-week air samples and once-a-month precipitation samples are analysed and data are published by Health and Welfare Canada. In case of a nuclear accident, the frequency of monitoring will be increased as the situation demands.

2.10.3 Activities at Regional Weather Centres

AES has six regional weather centres across Canada. At these centres the staff respond, on request, to environmental emergencies by using operational air quality package of programs and also by provision of weather forecasts. These accidents can be of nuclear in nature or toxic chemical releases from industrial sites, storage and transportation containers. Particularly of interest in this context are radionuclides from CANDU reactors, hydrogen sulphide from heavy water plants, and hydrogen fluoride and ammonia from nuclear fuel refineries. Also these weather centres provide assistance in data transmission and information dissemination to the emergency response team and public on request through their existing 24-hour operational communication equipment.

The AES regional Scientific Services Divisions review, on request from FEARO, Environmental Impact Analysis (EIA) reports pertaining to all phases of nuclear fuel cycle. Some recent studies are:

- Ontario region of AES has recently conducted an extensive study of "on-site" monitoring of weather data at Port Hope and numerical modelling of the long-term air concentrations for Eldorado Nuclear Limited's nuclear fuel processing facility in Port Hope, Ontario.
- Atlantic region of AES has participated in the review of EIA for the second unit of nuclear power generating plant at Pt. Lepreau, New Brunswick. The region is also actively participating in the environmental monitoring programs at the Pt. Lepreau Site.

3.0 DEPARTMENT OF THE ENVIRONMENT NUCLEAR ADVISORY COMMITTEE

The environmental effects associated with the nuclear energy production and the related activities are a major public concern. In order to address this concern and to fulfill the commitments under its broad mandate, the Department of the Environment (DOE) has a responsibility to ensure that environmental implications are taken into account in the energy decisions made by the governments and industry. In view of this responsibility in influencing the implementation of energy policy and programs in an environmentally sound manner, the departmental senior management established a Departmental Nuclear Advisory Committee (DOENAC). The main objective of the Committee is to provide a departmental forum to discuss and evaluate the DOE nuclear program, and to develop and recommend consistent departmental policies and positions on nuclear related issues for approval by the senior management. The members of the DOENAC, updated as of November 1988, are listed in Table 1.

4.0 DOE CORE NUCLEAR GROUP

In order to carry out the departmental activities that are exclusively concerned with the radionuclides and associated contaminants, the department relies on a "Core Group" of personnel. Members of this core group are so designated by virtue of their knowledge and expertise in the technical as well as the regulatory aspects of nuclear activities in Canada. Table 2 lists the names of the DOE Core Nuclear Personnel and their areas of expertise. These members may be contacted for technical and scientific advice in matters related to environmental nuclear issues.

5.0 PUBLICATIONS

The following provides a list of Environment Canada reports and technical papers published during 1985-1987.

1. Environmental Codes of Practice for Steam Electric Power Generation - Design Phase, Report EPS 1/PG/1 (1985).
2. Joshi, S.R., "Recent sedimentation rates and Pb-210 fluxes in Georgian Bay and Lake Huron", Sci. Total Environment, vol 41, p. 219 (1985).
3. Novakowski, K.S., Flavelle, P.A., Raven, K.G. and Cooper, E.L.; "Determination of groundwater flow pathways in fractured plutonic rock using a radioactive tracer", Int. J. Appl. Radiat. Isot., vol 36, No. 5, p. 399 (1985).
4. Novakowski, K.S., Evans, G.V., Lever, D.A. and Raven, K.G. "A field example of measuring hydrodynamic dispersion in a single fracture", Water Resources Res. vol 21, No. 8, pp 1165-74 (1985).
5. "A study to assess the distribution of radionuclides in the aquatic ecosystem in the vicinity of the Serpent River mouth", A report to Environment Canada, EPS-Ontario Region by Beak Consultants Ltd. (1985).
6. "Benthological, chemical, radiological and chronological evaluation of sediments in Port Hope Harbour, Ontario", a report to Environment Canada, EPS Ontario Region, by Beak Consultants Ltd. (1985).
7. Status Report on Water Pollution Control in the Canadian Metal Mining Industry (1982), Report EPS 1/MM/2 (1988).
8. "An assessment of the radiological impact of uranium mining in Northern Saskatchewan, Canada". A report to the Environment Canada and Atomic Energy Control Board, Report EPS 2/MM/1 (1986).
9. Constable, T.W., "Acidification and radionuclide leaching in unsaturated uranium mill tailings", Proc. of the Second Intnatl. Conf. Radioactive Waste Management, Winnipeg (1986).
10. Environmental Codes of Practice for Steam Electric Power Generation - Design Phase Appendices, Report EPS 1/PG/1A (1986).
11. Lawson, D.W., "Options for reclaiming the Gunnar uranium tailings, Saskatchewan, Canada", Proc. of Symp. on Geotechnical and Geohydrological Aspects of Waste Management, Fort Collins, Colorado, pp 339-349 (1986).
12. Constable, T.W. and Snorgrass, W.J., "Leachability of radioactive constituents from uranium mine tailings", Report EPS 3/MM/2 (1987).

13. Constable T.W., "Leachability of Solidified (Ba, Ra)SO₄ Sediments in Simulated Settling Ponds", Paper presented at the 42nd Annual Industrial Waste Conference (1987).
14. Mine and Mill Wastewater Treatment, Report EPS 2/MM/3 (1987).
15. Environmental Codes of Practice for Steam Electric Power Generation - Siting Phase, Report EPS 1/PG/2 (1987).
16. Baweja, A.S., Joshi, S.R. and Demayo, A., "Radionuclide content of some canadian surface waters: A Report on the National Radionuclides Monitoring Program, 1981-1984", Scientific Series No. 156, Inland Waters Directorate, Environment Canada (1987).

Table 1.

Departmental Nuclear Advisory Committee Members (November 1988)

Dr. S.M. Daggupati
Atmospheric Environment Service

Dr. J.G. Hollins
Corporate Planning Group

Mr. R. John
Inland Waters Directorate, C & P

Alternate Member (IWD)
Dr. A.S. Baweja

Dr. S.R. Joshi
National Water Research Institute

Dr. D.W. Lawson
Western & Northern Region, C & P

Mr. D. Lennox
National Hydrology Institute

Mr. T. Le-Van
Quebec Region, C & P

Mr. J.M. Millen
Pacific & Yukon Region, C & P

Mr. R. Neumeyer
Atlantic Region, C & P

Mr. D. Pascoe
Ontario Region, C & P

Alternate Member (OR)
Mr. R. Krauel

Dr. E.F. Roots
Office of the Science Advisor

Dr. P. Vasudev
Industrial Programs Branch, C & P

Dr. W. Zuk
Chemical Contaminants Branch, C & P

Table 2.

DOE Core Nuclear Group (Updated to November 1988)

Contact Person	Position	Responsibility Centre	Area of Expertise/Activity
P. Vasudev 819-953-1127	Nuclear Coordinator	Industrial Programs Branch, Hull	<ul style="list-style-type: none"> - Coordination/Focal Point - Technical and Policy advice - Environmental radiation - Radioactive wastes
C. Barraud 819-953-1189	Assistant to the Director	Technology Development and Technical Services Branch, Hull	<ul style="list-style-type: none"> - Planning and policy development - High-level radioactive waste disposal
A.S. Baweja 819-953-1559	Monitoring and Surveys Officer	Water Quality Branch, Hull	<ul style="list-style-type: none"> - Radiological water quality monitoring - High-level radioactive waste management - Uranium mill tailings management
S.M. Daggupaty 416-739-4451	Research Scientist	Atmospheric Environment Service, Downsview	<ul style="list-style-type: none"> - Modelling of atmospheric transport, dispersal and deposition - Operation of monitoring network - Public information
P.G. Finlay 819-953-1126	Head, Electric Power Section	Industrial Programs Branch, Hull	<ul style="list-style-type: none"> - Radioactive pollution control technologies - Nuclear power generation
✓ P.Fowlie 416-336-4633	A/Head, Laboratory Services Section	Waste Water Technology Centre, Burlington	<ul style="list-style-type: none"> - Radionuclide analytical services
G. Grove 306-975-5701	Head, Groundwater Resources Section	National Hydrology Research Institute, Saskatoon	<ul style="list-style-type: none"> - Transport of radionuclides - Uranium mining waste management - Low level radioactive wastes
R.E. Jackson 416-336-4587	Head, Groundwater Section	National Water Research Institute, Burlington	<ul style="list-style-type: none"> - High level radioactive waste - Transportation/Migration of radionuclides
R.D. John 819-953-3456	Head, Agreements & Data Interpretation	Water Quality Branch, Hull	<ul style="list-style-type: none"> - Environmental assessment of uranium mill tailings - Uranium refining and exploration - Environmental radiation and dosimetry - Public information
✓ S.R. Joshi 416-336-4573	Research Scientist	NWRI, Burlington	<ul style="list-style-type: none"> - Aquatic pathways of radionuclides - Radiological methods development - Aquatic environmental assessment
R. Krauel 416-973-5858	Sr. Environment Design Engineer	Ontario Region, Toronto	<ul style="list-style-type: none"> - Low-level radioactive waste management - Uranium mining and refining - Compliance and licensing of nuclear facilities
D.W. Lawson 306-780-6462	Uranium Specialist	W&N Region, Regina	<ul style="list-style-type: none"> - Aquatic modelling - Regional representative for uranium industry - Public information
J.S. Scott 819-953-1104	Head, Mining & Milling Section	Industrial Programs Branch, Hull	<ul style="list-style-type: none"> - Uranium mining, milling and waste management - Uranium refining - Advice on mine licensing

