Annual Report 1997-98

Atomic Energy Control Board
Commission de contrôle de l'énergie atomique

Canada

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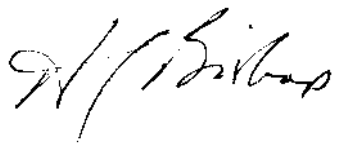
The Honourable Ralph Goodale
Minister of Natural Resources Canada
Ottawa, Ontario

Sir:

I have the honour to present to you the attached Annual Report of the Atomic Energy Control Board for the year ending March 31, 1998. This report has been prepared and is submitted in accordance with the *Atomic Energy Control Act*, section 21(1).

On behalf of the Board,



Agnes J. Bishop, M.D.
President

Canada

Mission

The Atomic Energy Control Board's mission is to ensure that the use of nuclear energy in Canada does not pose undue risk to health, safety, security and the environment.

Table of Contents

President's Message

The past year was one of major change for the Atomic Energy Control Board (AECB), with particular emphasis being placed on the development of new regulatory instruments and improvements in the management of its operations.

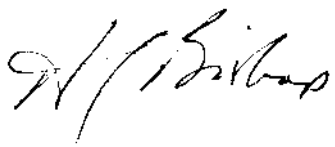
In March 1997, the *Nuclear Safety and Control Act* received Royal Assent. This new legislation will replace the *Atomic Energy Control Act*, which is now more than 50 years old. A major effort during the year has been the preparation of regulations and regulatory guidance documents to ensure the effective implementation of this legislative change. In mid-June, the AECB published a set of 10 draft regulations for public and industry comments. Meetings were also held with major licensees and with several government departments to provide further information on the proposed new regulations and to assist them in preparing their comments. At the end of the reporting period, all the submissions received during the initial consultation process had been reviewed, and revised versions of the draft regulations were being prepared for publication in Part I of the *Canada Gazette*, which will provide another opportunity for public comment. It is anticipated that the regulations will be approved in time for the new Act to be proclaimed and to come into force in early 1999.

During the reporting period, we continued to implement the recommendations stemming from the thorough review of the AECB's internal management policies and practices, which was completed in 1996. Some of the major initiatives that were undertaken during the year include the adoption of an activity-based planning and budgeting system beginning in fiscal year 1997-98, development of a strategic plan, and the launching of a complete reform of human resources policies and programs. We also continued work to develop a core set of fundamental corporate documents on the AECB's mandate, corporate values, priority-setting and work management systems.

We also took steps during the year to improve the AECB's leadership and management, in order to increase its regulatory effectiveness. In October, I announced major organizational changes to help the AECB respond better to the challenges and pressures the organization must meet in the coming years. The changes reflect the need to place greater emphasis on integrated assessment of the performance of nuclear facilities, on establishing standards for environmental radiation protection, on developing corporate documentation, and on managing our external relationships and communications. These organizational changes took effect on January 1, 1998.

In parallel with these structural changes, we also introduced measures to better utilize our human resources through a more effective teamwork approach to managing our work. We are giving increased emphasis to strategic planning, project management, and to performance and accountability at all levels.

I am confident that the changes and initiatives undertaken during the last year will help the AECB, and the Nuclear Safety Commission that will replace it upon proclamation of the *Nuclear Safety and Control Act*, to ensure effective implementation of the new legislative and regulatory regime, thereby continuing Canada's strong central regulatory control over nuclear technology.



Agnes J. Bishop, M.D.

Introduction

This, the fifty-first annual report of the Atomic Energy Control Board (AECB), is for the year ending March 31, 1998.

The Atomic Energy Control Board was established in 1946 by the *Atomic Energy Control Act*. It is a departmental corporation, named in Schedule II of the *Financial Administration Act*. The AECB reports to Parliament through a designated Minister, currently the Minister of Natural Resources Canada.

The mandate of the AECB is to ensure that the use of nuclear energy in Canada does not pose an undue risk to health, safety, security, and the environment. This mandate extends to the control of the import and export of nuclear materials and other prescribed substances, equipment and technology, and involvement in Canada's participation in international activities related to the *Treaty on the Non-Proliferation of Nuclear Weapons*.

The AECB achieves its mandate through regulations and a comprehensive licensing system which covers nuclear facilities, nuclear materials and other prescribed substances and equipment, and the certification of domestic and foreign transport package designs. This licensing system, which operates on a cost recovery basis, is administered so that the concerns and responsibilities of federal and provincial government departments in such areas as health, environment, transport, and labour are taken into account.

The AECB also contributes to international agencies and, through co-operation agreements, assists other countries in improving their regulatory controls over nuclear materials and facilities.

Acknowledgements

The Board acknowledges the assistance it has received from federal and provincial departments and agencies that, by their participation in matters relating to the Board's regulatory activities and by allowing members of their staff to act as inspectors and medical advisers, have contributed to the effectiveness of the Board's regulatory role. It also acknowledges the valued advice obtained through the participation of experts from industry, academia and research institutions in the work of its advisory committees and other ad hoc committees.

Note to readers: Additional information on AECB activities and performance may be found in its 1996-97 Performance Report and its 1998-99 Estimates (Part III - Report on Plans and Priorities).

Organization

The Board

The AECB is constituted as a corporate body with five members, four of whom are appointed by the Governor in Council.

During the reporting period, Dr. Agnes J. Bishop was President of the Board and Chief Executive Officer, and Dr. Arthur J. Carty was a Board member by virtue of his position as President of the National Research Council of Canada. Other Board members were Dr. Yves M. Giroux, Dr. Christopher R. Barnes and Dr. Kelvin K. Ogilvie. The composition of the Board is shown in Annex I.

The Board functions as a quasi-judicial decision-making body. It makes licensing decisions for major nuclear facilities, and sets policy direction on matters relating to health, safety, security and environmental issues affecting the Canadian nuclear industry. The Board met 10 times between April 1, 1997, and March 31, 1998: seven meetings were held at the AECB headquarters in Ottawa; the others were in Saskatoon, Saskatchewan, in Kincardine, Ontario, and in Oshawa, Ontario.

Independent Advisors

Through the President, the Board receives advice from a Legal Services Unit composed of legal experts provided by the Department of Justice; two independent committees — the Advisory Committee on Radiological Protection and the Advisory Committee on Nuclear Safety — composed of technical experts from outside the AECB; and a medical liaison officer who represents the Group of Medical Advisers

The Advisory Committee on Radiological Protection (ACRP) and the Advisory Committee on Nuclear Safety (ACNS) provide advice on generic issues and are not involved with licensing activities. During the reporting period, the Committees met in plenary sessions a total of five times. In addition, Committee working groups met a total of 21 times. Annexes III and IV list the members of the two Advisory Committees.

The Group of Medical Advisers is composed of senior medical professionals nominated by the provinces, Atomic Energy of Canada Limited, the Department of National Defence, and Health Canada, who are appointed as Medical Advisers by the Board pursuant to the *Atomic Energy Control Regulations*. During the reporting period, the Group did not meet, but its working groups met a total of five times on matters relating to the medical aspects of ionizing radiation. Annex V lists the Medical Advisers.

In addition, joint working groups of the Committees and the Group of Medical Advisers met a total of three times.

The Staff Organization

The functions of corporate management and corporate policy development are carried out by the Executive Committee, which consists of the President and the senior officer of each of the five organizational units shown in Annex I.

Major organizational changes were introduced in January 1998 to help respond better to the challenges and pressures the AECB must meet in the coming years. The changes reflect the need to place greater emphasis on integrated assessment of the performance of nuclear facilities, on establishing standards for environmental protection, on developing corporate documentation, and on managing external relationships and communications. Annex II shows the new organization of the AECB.

The **Directorate of Reactor Regulation** is responsible for the regulation of nuclear power reactors, including the development of safety standards and licence conditions; the assessment of licence applications and reactor operations; the preparation of licensing recommendations to the Board; and compliance activities.

The **Directorate of Fuel Cycle and Materials Regulation** is responsible for the regulation of uranium mining and its processing into fuel; research facilities and particle accelerators; radioisotope production and use; decommissioning; radioactive waste; the preparation of licensing recommendations

to the Board; and the transport of radioactive materials.

The **Directorate of Environmental and Human Performance Assessment** is responsible for the assessment of licensees' performance in the areas of radiation and environmental protection, quality assurance, training and human factors. Other responsibilities include technical training for AECB staff and foreign staff under co-operation agreements; AECB obligations under the *Canadian Environmental Assessment Act*; significant events analysis; accident investigation; research programs; and the development of standards.

The **Secretariat** is responsible for the administrative support to the Board and its advisory groups; external relations, corporate documents and public communications; corporate planning and coordination services, including implementation of the *Nuclear Safety and Control Act*; non-proliferation, safeguards and security activities; and AECB responsibilities under the *Nuclear Liability Act*, the *Access to Information Act* and *the Privacy Act*.

The **Directorate of Corporate Services** is responsible for supplying services to the AECB to enable it to manage its human, information, financial and physical resources. The Directorate is also responsible for administering the AECB's security and conflict of interest programs.

During the reporting period, the AECB expended 403 FTEs (full-time equivalent) of effort in carrying out its mission. As of March 31, 1998, there were 380 indeterminate staff on strength: 319 in Ottawa at the AECB headquarters, and 61 at site and regional offices. In addition, there were three staff members on leave from the AECB, engaged in various international activities related to nuclear energy.

Regulatory Control and Requirements

Regulatory Control

The *Atomic Energy Control Act* and its regulations impose requirements on all persons who produce, import, export, transport, refine, possess, own, use or sell nuclear materials, as well as on others who are identified in the regulations or in licences. Under law, regulated persons must comply with these requirements.

The AECB maintains regulatory control over the following:

- power and research reactors,
- nuclear research and test establishments,
- uranium mines and mills,
- uranium refining and conversion facilities,
- fuel fabrication facilities,
- heavy water production plants,
- particle accelerators,
- radioactive waste management facilities,
- prescribed substances and items, and
- radioisotopes.

The AECB regulatory regime also includes the control of nuclear materials and other nuclear items, which provides assurance that Canada's national policies and international commitments relating to the non-proliferation of nuclear weapons and other nuclear explosive devices are met. This is carried out by licence conditions, by controlling the import and export of such materials and items in co-operation with other federal government departments according to nuclear non-proliferation and export control policies enunciated by the Canadian government, and by ensuring, in co-operation with the International Atomic Energy Agency and Canada's other nuclear partners, that Canada's obligations under the *Treaty on the Non-Proliferation of Nuclear Weapons* are fulfilled.

Comprehensive Licensing System

Regulatory control is achieved by issuing licences containing conditions that must be met by the licensee. The requirements for licensing vary from those for nuclear generating stations, through the less complex facilities involved in fuel production, to the export and import of nuclear items, and the possession and use of radioactive sources in medicine, industry and research.

For a proposed new facility, licence applicants are required to submit comprehensive details of the design of the facility, its effect on the site that is proposed, and the manner in which it is expected to operate. AECB staff review these submissions in detail, using existing legislation, and the best available codes of practice and experience in Canada and elsewhere. The design must be such that emissions from the facility can meet strict limits in normal operation and under commonly occurring upset conditions. In practice, these emissions are kept so far below the limits that radiation doses to the public are insignificant, and are well within the variability of natural background radiation.

Regulatory control is also achieved by setting standards that licensees must meet. Some are prepared within the AECB, such as requirements for special safety systems at nuclear power stations, or for radiation protection. Many others are set by provincial authorities, such as those for boilers and pressure vessels. Some are industry standards, such as those for seismic design. These standards may be referenced in licence conditions that must be met by the licensee.

Licensees are also required to identify the manner in which a facility may fail to operate correctly, to predict what the potential consequences of such failure may be, and to establish specific engineering measures to mitigate the consequences to tolerable levels. In essence, those engineering measures must provide a "defence in depth" to the escape of noxious material. Many of the analyses of potential accidents are extremely complex, covering a very wide range of possible occurrences. AECB staff expertise covers a broad range of engineering and scientific disciplines, and considerable effort is expended in reviewing the analyses to ensure the predictions are based on well-established scientific evidence, and the defences meet defined standards of performance and reliability.

The AECB's licensing system is administered with the co-operation of federal and provincial government departments in such areas as health, environment, transport and labour. The concerns and responsibilities of these departments are taken into account before licences are issued by the AECB.

Once a licence is issued, the AECB carries out compliance inspections to ensure that its requirements are continually met.

In all cases, the aim of regulatory control is to ensure that health, safety, security and environmental protection requirements have been recognized and met, so that workers, the public and the environment are protected from exposure to radiation and the radioactive or toxic materials associated with the operations.

Dose Limits for Ionizing Radiation

The *Atomic Energy Control Regulations* prescribe the limits for doses of ionizing radiation and exposure to radon progeny resulting from the use and possession of radioactive prescribed substances and from the operation of nuclear facilities. The limits specified are based on scientific information, including advice collected and analyzed over many years, and the recommendations of international bodies. The dose limits are based on a value judgment that is derived not only from the scientific information, but also from knowledge of the level of risk for various hazards in normal life that people are willing to tolerate. Thus, the radiation dose limit is set at a level above which the risk for an individual is considered to be unacceptable. For radiation protection purposes, the AECB assumes that there is no threshold below which there are no harmful effects, and subscribes to the principle that all doses should be kept as low as reasonably achievable, social and economic factors being taken into account. The regulatory process is therefore designed to ensure that the actual doses are very much lower than the limits.

As with most nations having radiation-related activities, the *Atomic Energy Control Regulations* are based on the recommendations of the International Commission on Radiological Protection (ICRP). The current regulations are based on recommendations made in 1959. In 1990, the ICRP issued new recommendations supporting lower dose limits. These recommendations are largely based on the long-term research carried out on the survivors of the bombing of Hiroshima and Nagasaki, and on other groups such as patients who received radiation treatment.

As part of the larger effort to prepare new regulations to accompany the *Nuclear Safety and Control Act* (see below), the AECB is developing new radiation protection regulations that will be consistent with the ICRP recommendations of 1990. These may have a significant effect on the operations of many licensed activities, in particular uranium mines, hospitals and industrial radiography. An extensive public consultation process has been followed in the development of these regulations. This process has included a Canada-wide series of public meetings with female radiation workers, to discuss the implications of the proposed reduction in the dose limit for pregnant workers and to obtain their viewpoints.

In accordance with the new radiation protection regulations, licensees will have to supply all information on radiation exposures and doses to the National Dose Registry, maintained by Health Canada.

New Legislation

On March 20, 1997, *the Nuclear Safety and Control Act* received Royal Assent, but it will not come into force until revised regulations are approved. The AECB has therefore intensified its efforts to develop new regulations that reflect the changes incorporated into the new legislation.

In May 1997, a notice was sent to approximately 5000 licensees and interested parties to notify them that draft regulations were available for comment. The regulations were also posted on the AECB's web site and announced in the AECB's *Reporter*. As a result, 1588 individual comments were received from 42 individuals and organizations. An internal working group, consisting of technical and legal staff, reviewed each one of the comments and prepared recommendations on the best way to disposition them.

While the public consultation was taking place, the draft regulations were also reviewed by the Department of Justice. Responses to the comments received during this initial consultation and the resulting revised regulations have been returned to the Department of Justice for approval to publish in

Part I of the *Canada Gazette* for the official comment period required for all regulations.

Regulatory Guidance Documents

In addition to the various regulations issued pursuant to the *Atomic Energy Control Act*, the AECB issues guidance documents in the form of Regulatory Policies, Regulatory Standards and Regulatory Guides. These further define or explain what the AECB expects for specific nuclear operations. Prior to being issued formally, these documents are made public as Consultative Documents and may also be referred for review to one or both of the AECB advisory committees (Advisory Committee on Nuclear Safety and Advisory Committee on Radiological Protection). During the reporting period, the AECB continued its review of its regulatory guidance documents in order to simplify the document structure and to ensure that legal obligations placed on licensees appear only in legislation, regulations and licences.

In January 1998, a Corporate Documents Section was established to provide effective document management systems and services to develop and manage the formal corporate documents required by the AECB.

Nuclear Facilities

The *Atomic Energy Control Regulations* require a nuclear facility to be operated in accordance with a licence issued by the AECB.

Before a licence is issued, the applicant must meet criteria established by the AECB for the siting, construction and operating stages. The AECB evaluates information provided by the applicant concerning the design and measures to be adopted to ensure that the facility will be constructed and operated in accordance with acceptable levels of health, safety, security and environmental protection.

Throughout the lifespan of the facility, the AECB monitors its operation to verify that the licensee complies with the *Atomic Energy Control Regulations* and the conditions of the licence. At the end of its useful lifespan, a facility must be decommissioned in a manner that is acceptable to the AECB and, if required, the facility site must be restored to unrestricted use, or managed until the site no longer presents a hazard to people or the environment.

Power Reactors

As of March 31, 1998, there were 22 power reactors licensed by the AECB: four Bruce A and four Bruce B reactors near Kincardine, Ontario; four Pickering A and four Pickering B reactors near Pickering, Ontario; four at Darlington near Bowmanville, Ontario; one at Gentilly near Trois-Rivières, Quebec; and one at Point Lepreau near Saint John, New Brunswick. Annex VI lists power reactor licences.

A tritium removal facility is also located at the site of the Darlington reactors. This facility is designed to remove radioactive tritium from the heavy water used in reactors in order to reduce the hazards to the operating staff and the release of radioactive material to the atmosphere. For most of the reporting period, the facility was shut down for planned maintenance. The average capacity factor for the period was approximately 37%.

The AECB maintains staff at each of the power reactor stations to monitor licensee compliance with the *Atomic Energy Control Regulations* and licences issued by the Board. A total of 27 engineers and scientists are posted on a full-time basis at reactor sites. In addition to inspecting to ensure safe operation and maintenance of the reactors, these specialists investigate any unusual events at the reactors.

As well, the AECB has a number of specialists at its headquarters in Ottawa. In co-operation with the site staff, these specialists review the design, safety analyses and radiation protection provisions of all reactors to verify that the performance, quality and reliability of key components and plant systems and procedures are adequate to assure safety. This review includes an assessment of the management of the facilities. Head office staff also co-ordinates the review and resolution of generic safety issues, and codifies AECB regulatory requirements.

Personnel Qualification Assessment

The AECB maintains a staff of specialists whose function is to obtain assurance that the nuclear power plant operations personnel are well trained and adequately competent. This assurance is obtained through the evaluation of training programs, the evaluation of utility-administered testing, and AECB written and simulator-based examinations of key operations personnel.

Effective January 1, 1998, the responsibilities of this group were expanded in expectation of the proclamation of the *Nuclear Safety and Control Act* and supporting regulations. The Personnel Qualification Assessment Division will now be responsible to ensure that all personnel required to be qualified under the new act and regulations are competent to perform their duties, and that this competence is maintained through continuing training and appropriate requalification activities. As a result, the focus of the Division is now broadened to include many facilities and activities other than those related to nuclear power plants.

Significant work has been done to develop regulatory guidance documents concerning training and qualification of licensees' personnel in preparation for the implementation of the new regulations. Of particular importance this past year was the work done to specify and document

regulatory requirements on requalification tests administered by utilities to key operations personnel at nuclear power plants, and to develop a procedure for the evaluation of those tests by AECB staff.

During the period, evaluations of nuclear power plant training programs were carried out for: control room operators (initial and continuing training), fuel handling operators, field operators, chemical technicians, control technicians and mechanical maintainers. Significant effort was also directed to follow-ups of previous training program evaluations.

On January 1, 1998, the AECB radiation protection examination for candidates to authorized positions at nuclear power plants was discontinued. This AECB examination his now replaced by a utility-administered examination, subject to the prior acceptance by the AECB of the radiation protection training and continuing training programs, including the utility's examination process and the test itself. As of March 31, 1998, one utility had not yet received approval from the AECB to administer this examination.

During the reporting period, simulator-based performance testing of shift supervisor and control room operator candidates continued, as did complementary written testing. Candidates from six of the seven nuclear power plants were presented for these examinations, and a combined total of 14 control room operators and shift supervisors were formally authorized to take up their duties. In addition, evaluations were carried out of simulator-based requalification tests performed by the utilities. The objective of these tests is to demonstrate the continued qualification of key operations personnel.

The combination of performance and written examinations for shift supervisors and control room operators, with the evaluation of training program and testing activities for operations personnel whose work and activities can bear on the safety of nuclear power plants, contributes significantly to ensuring that only highly competent people operate nuclear power plants.

Safety of Reactor Operation

One measure of the safety of reactor operation is the radiation dose that workers receive. The health risk to workers due to radiation exposure is controlled by ensuring that no worker exceeds the regulatory dose limits specified in the *Atomic Energy Control Regulations*, and by ensuring that all doses are as low as reasonably achievable, social and economic considerations taken into account. In 1997, there were approximately 6,500 utility staff exposed to radiation at the nuclear power generating stations. Of these, no worker exceeded the current dose limits of 50 millisieverts per year. One worker exceeded the quarterly limit of 30 millisieverts and nine workers exceeded 20 millisieverts. The total occupational collective dose, measured as the sum of all worker doses, was 11.39 person-sieverts in 1997, for an average worker dose of 1.74 millisieverts. The collective and average worker doses in 1996 were 12.64 person-sieverts and 2.20 millisieverts respectively. These results compare favourably with experience in other countries.

A second measure of the safety of reactors is the amount of radioactive material that is discharged to the environment, resulting in radiation doses to the general public. In 1997, the doses to the most exposed members of the public (critical group) resulting from the routine operation of the different reactors were less than 1% of the public dose limit.

Unusual Events at Operating Reactors

Although the AECB judged that reactor operation was acceptably safe, operation was not uneventful. In the 1997 calendar year, there were 790 unusual events at the operating reactors which required a formal report to the AECB. The unusual events ranged from minor spills of radioactive heavy water to an error made by an operator during routine testing of the automatic shutdown system at one plant, which could have led to damage to the reactor fuel.

None of the events had any impact on public or worker safety, or on the environment. However, the AECB requires that all reportable incidents be analysed by the licensee to determine the cause and the necessary remedial action to avoid recurrence.

The AECB also reviews these event reports to analyse and report on trends in parameters which characterize the events, and to develop "lessons learned" and recommendations arising from the trend analysis for changes in licensee or regulatory activities.

Pressure-Retaining Systems

In nuclear power reactors, the integrity of pressure-retaining systems is of the utmost importance. Some of these systems contain nuclear fuel and other radioactive substances, and control the flow of cooling water necessary to remove heat from the nuclear fuel. A failure of one of these key systems could result in a nuclear safety hazard.

In Canada, the regulation of pressure systems, being a matter of public and occupational safety, is in general carried out by the provinces. The provincial legislation refers to a common set of Canadian national standards, published by the Canadian Standards Association. These standards in turn invoke the *Boiler and Pressure Vessel Code* published by the American Society of Mechanical Engineers. This Code describes the technical standards for pressure-retaining components applied throughout North America. Nuclear systems are designed, fabricated, operated and inspected to higher standards than conventional systems. The Code also prescribes third-party inspections of equipment, and inspections and approvals of fabrication and repair processes such as welding. Specially qualified inspectors carry these out. These inspectors are employees either of provincial inspection agencies or of insurance companies in the pressure vessel insurance business.

Since 1993, the AECB has taken steps to assume direction of pressure boundary regulation at nuclear facilities. In the three provinces where there are nuclear reactors, the inspection agencies are cooperating with this change in direction. There is a formal agreement with the recently privatized provincial agency in Ontario, and the AECB is pursuing negotiations for similar arrangements with the provinces of Quebec and New Brunswick. AECB expects to enact pressure-retaining component regulations once the *Nuclear Safety and Control Act* and its implementing regulations come into force.

Review of Ontario Hydro Nuclear Program

Over the past few years, the AECB's inspections, evaluations and audits had shown a decline in the quality of operation and maintenance at Ontario Hydro nuclear stations. Though it had concluded that the reactors were being operated safely and that they could continue to be licensed to operate in the short term, the AECB felt that the "defence in depth" had been eroded and that significant improvements were necessary to maintain adequate standards of safety in the longer term. Ontario Hydro Nuclear senior managers had been informed of this on several occasions and, although they implemented several recovery plans to correct the problems, they had failed to make any sustained improvements.

In early 1997, Ontario Hydro initiated a series of detailed reviews of its entire nuclear program to improve operational performance and safety beyond the minimum required by regulations in Canada. The Independent Integrated Performance Assessment and Safety System Functional Inspections Reviews were performed at all Ontario Hydro nuclear sites and at the Ontario Hydro head office in Toronto. The conclusions of these reviews were extremely critical of the management of Ontario Hydro Nuclear. They identified a large number of shortcomings in the operation and maintenance of the nuclear generating stations. Ontario Hydro stated that the reports were, by design, negative in slant and emphasized the weaknesses in performance rather than the strengths.

AECB staff carefully reviewed all of the assessment and inpection reports prepared by Ontario Hydro, and determined that Ontario Hydro's findings were generally similar to those they had made during the past years.

Following its review, Ontario Hydro established an extensive recovery program, which involved the temporary shutdown over the next few years of Pickering A and Bruce A nuclear reactors. This will allow Ontario Hydro to concentrate its efforts on the other stations, which are more recent.

The AECB will monitor very closely the actions taken by Ontario Hydro under its announced program

of overhaul and upgrading. Considerations of future licence renewals will take into account the various developments under the improvement program.

On December 31, 1997, Ontario Hydro placed all Pickering A reactors in an approved shutdown state, as modifications to the reactors' shutdown systems required by the operating licence had not been completed.

All Bruce A reactors have also been shut down, and are either defuelled or are in the process of being defuelled.

Other Issues

The AECB has required licensees to assess the impact of the year 2000 on computer software that has nuclear safety significance. Licensees are preparing plans to identify software and systems important to safety that may be affected, and quality assurance procedures for validating software modifications before the modifications are installed.

During 1997-98, work of the power reactor divisions focussed on the development of compliance inspection procedures for assessing operating practice, the development of competency profiles for AECB project officers, and the finalization of a set of indicators that, used with other assessment results, will give an objective measure of the safety performance of Canadian nuclear power plants.

In 1998-99, the new Power Reactor Operations Division and Power Reactor Evaluation Division will focus on the implementation of the project officer competency profile training program, the development of standards and licensing plans for evaluating the safety performance of nuclear power reactors, the development of a plan for the systematic review of Ontario Hydro's multi-year nuclear asset optimization plan, and the development of a plan for resolution of outstanding technical issues.

Heavy Water Plants

Deuterium oxide (heavy water) is essential for the operation of the CANDU nuclear reactor, where it is used as a moderator for the fission reaction and as a coolant to transfer heat from the fuel. It is defined as a prescribed substance and thus is subject to regulation by the AECB. Although no radiation hazards result from the production of heavy water, the process uses large quantities of hydrogen sulphide, a highly toxic gas. Licensing conditions require heavy water production plants to be engineered and maintained to contain this gas, and to have adequate safety and emergency systems.

As of March 31, 1998, one heavy water plant was licensed to operate at the Bruce Nuclear Power Development near Kincardine, Ontario.

The Bruce Heavy Water Plant was shut down for most of 1997. In March 1997, a planned maintenance outage of part of the facility began. On May 1, the partial outage became an entire plant outage when steam supply from Bruce A was lost due to an unscheduled shutdown of all reactors, the primary source of process steam for the heavy water plant. On August 13, 1997, Ontario Hydro announced the permanent closure of the plant. The decision to shut down was made, in part, because of Ontario Hydro's decision to shut down the Bruce A reactors in the spring of 1998.

Note to readers: Additional information on the performance of the Canadian heavy water plant and nuclear generating stations may be found in the staff annual assessment reports for each facility. These are available from the AECB Communications Division.

Special Studies

During the year, AECB staff had discussions with AECL on proposed enhancements to its CANDU 6 design. These discussions are expected to continue. The goal is to provide assurance that future CANDU 6 designs will include any changes that are needed: (1) to comply with evolving regulatory requirements, (2) to address AECB generic concerns, and (3) to address lessons learned from operating experience.

Throughout the reporting period, the AECB continued to provide advice on Canadian licensing requirements for the proposed International Thermonuclear Experimental Reactor (ITER). The AECB provided advice to the Canadian ITER Siting

Board to assist it in preparing a Licensing Basis Document. However, the document has not been submitted for AECB review. The work requested by the ITER Siting Board is now complete. Any further AECB involvement would require a new request from ITER Canada (a newly incorporated body that has replaced the ITER Siting Board)

Research Reactors

As of March 31, 1998, there were seven operating research reactors in Canadian universities: three in Ontario, two in Quebec, and one each in Nova Scotia and Alberta. There was also an operating research reactor at the Saskatchewan Research Council in Saskatoon. Six of these eight reactors are of the SLOWPOKE-2 type, designed by Atomic Energy of Canada Limited. The facility at McMaster University in Hamilton, Ontario, is a 5 megawatt, pool-type reactor, and the remaining one is a subcritical assembly. A subcritical assembly that operated at the University of Toronto was decommissioned during the reporting period.

With the exception of the reactor at McMaster University, all of the research reactors are very low-power facilities that are inherently safe. Operations have been conducted in an acceptable manner.

The McMaster University reactor (MNR) also operated throughout the year in a satisfactory manner. Conversion of the reactor core from highly enriched uranium to low enriched uranium fuel is planned to begin in the fall of 1998. Much of the analysis associated with the fuel conversion will be integrated into the ongoing update of the MNR Safety Analysis Report (SAR), which was last revised in 1972. The updated SAR will use modern analysis tools to model reactor operation.

The École Polytechnique Slowpoke reactor was refuelled in September 1997. This was the first time a Slowpoke reactor core had been replaced.

Annex VII lists research reactor licences.

Nuclear Research and Test Establishments

The Atomic Energy of Canada Limited research facilities at Chalk River, Ontario, and Pinawa, Manitoba, are licensed by the AECB. Routine compliance inspections during the reporting period indicated satisfactory operation of these facilities.

The Chalk River facilities include the 135 megawatt NRU reactor and the zero power ZED-2 reactor.

The AECB is currently assessing the safety of continued NRU operations. This reactor has been operated since 1957 and is expected to be shut down by the end of 2005.

The AECB continued to have discussions with AECL aimed at early resolution of key licensing issues for the Irradiation Research Facility (IRF), which is being designed to replace the NRU reactor. AECL has stated that for budgetary reasons, no IRF work is planned in 1998-99, except for a limited effort on the environmental assessment plan.

Work on reviewing the MDS Nordion Medical Isotope Reactor (MMIR) Project continued during the year. The MMIR project, to be located at the Chalk River Laboratories, consists of two 10 MW MAPLE reactors and a new radioisotopes processing facility. It will be built and operated by AECL but owned by MDS Nordion. Its purpose is to produce radioisotopes for medical use.

In April 1997, the AECB accepted the conclusion of the environmental screening report that the MMIR project is not likely to cause significant adverse environmental effects. This cleared the way for licensing actions to proceed.

In December 1997, the AECB approved construction of the MMIR project. Actual construction is scheduled to begin in May 1998, subject to AECB approval of the construction quality assurance program. The facilities are scheduled to be in service and supplying medical isotopes by the year 2000.

Annex VIII lists nuclear research and test establishment licences.

Particle Accelerators

A particle accelerator is a machine that uses electric and magnetic fields to accelerate a beam of subatomic particles and generate ionizing radiation, which in turn is used for cancer therapy, research, analysis or isotope production. Machines that are capable of producing nuclear energy or radioactive materials require an AECB licence for their construction, operation and decommissioning.

As of December 31, 1997, there were 64 accelerator licences in effect. These authorized the construction, use or decommissioning of 88 cancer therapy machines and 24 accelerators used for non-medical purposes. In addition, four companies were authorized to explore the underground formations around oil wells with portable accelerators.

During the reporting period, 14 inspections were performed and no serious violations were found. No overexposures of licensees' staff or the public resulted from any of these licensed activities. No incidents were reported to the AECB.

During the reporting period, the AECB approved the construction of the ISAC (Isotopes Separator and Accelerator) facility at Vancouver, B.C. This major extension to the TRIUMF accelerator research centre is expected to produce the world's highest intensity radioactive ion beam.

Uranium Mine Facilities

As of March 31, 1998, there were 16 facilities licensed under the *Uranium and Thorium Mining Regulations*, SOR/88-243, located in Ontario, Saskatchewan and the Northwest Territories.

A joint federal-provincial panel, set up under the *Federal Environmental Assessment and Review Process Guidelines Order*, held supplementary public hearings on the Cigar Lake and Midwest projects during August 1997 to address proposed changes for the disposal of tailings at the McClean Lake JEB pit. The panel issued a final report on the Cigar Lake and Midwest Projects in November 1997 recommending that the projects be allowed to proceed with conditions. At the end of the period, the panel report was still undergoing federal and provincial government review.

During August 1997, a construction licence was granted to the McArthur River Project to commence the construction of all necessary surface facilities and support infrastructures, and to carry out an underground development and construction program, including the siting of the No. 2 shaft.

The Cogema McClean Lake Operation is currently in a construction and operational status, where the construction of the mill and support facilities is in the final stages, while open-pit mining and stockpiling of ore from the JEB Pit is complete. The AECB review of the application to convert the JEB pit to a tailings disposal facility continues.

At Cogema's Cluff Lake Operation, the Dominique-Janine open-pit operation is complete, while mining of the underground DJU and DP mine operations continue.

At Cameco's Rabbit Lake Operation, underground mining at Eagle Point continues. The D-Zone open pit has been mined out, backfilled and flooded. The A-Zone open pit has also been mined out, backfilled and flooded.

At Cameco's Key Lake Operation, open-pit mining of the Deilmann Pit was completed in April 1997. The mill facility continues to operate from stockpiled ore until ore is received from the McArthur River Project.

Dosimetry carried out for uranium mining facility workers consists of the measurement of whole body doses and exposure to radon progeny. The maximum permissible whole-body annual dose limit is 50 millisieverts (mSv). The annual limit for exposure to radon progeny is 4 working level months (WLM). In 1997, whole body doses were measured for about 3,000 workers, and radon progeny exposure estimates were made for approximately 2,600 workers. No worker received more than 20 mSv whole-body dose, and 67 underground miners were exposed to more

than 1 WLM of radon progeny. The average annual whole-body dose for open-pit miners was 0.5 mSv; for mill workers 1.8 mSv; and for underground miners 4.4 mSv. The average annual exposure to radon progeny for open-pit miners was 0.03 WLM; for mill workers 0.19 WLM; and for underground miners 0.68 WLM. No mine or mill worker exceeded the maximum permissible limits. These levels are comparable to previous years.

During the next year, the AECB anticipates continued activity reviewing Cameco's applications for construction licence amendments for the McArthur River Project, amendments to the Key Lake Operating Licence to allow modifications to the mill for the processing of McArthur River ore, and the conversion of the Deilmann In-Pit Tailings Management Facility from subaerial to subaqueous tailings deposition. In addition, Cogema is expected to apply to complete the construction of the McClean Lake Project and to permit operation of the mill.

Annex IX lists licences and approvals for uranium mines and mills.

Uranium Refining and Conversion Facilities

Uranium concentrate (yellowcake) from the mine/mill is upgraded by refining and conversion to uranium trioxide (UO_3), and subsequently into uranium dioxide (UO_2) and uranium hexafluoride (UF_6). The UO_2 is used directly in the manufacture of fuel bundles for CANDU-type reactors; the UF_6 is used as feed material for the uranium enrichment process, which increases the concentration of the fissile uranium-235 isotope. Approximately one quarter of the uranium mined in Canada is used for domestic nuclear energy production, while the remainder is exported. Some of the by-product material from the enrichment process carried out in other countries is returned to Canada for conversion into uranium metal.

The refining and conversion processes are carried out in facilities owned and operated by Cameco Corporation. The yellowcake is made into UO_3 at a plant in Blind River, Ontario. In 1997, the estimated radiation dose to members of the public due to uranium emissions to the environment from that operation was approximately 0.0022 millisievert (0.044% of the public dose limit). The average whole-body dose received by refinery workers was approximately 1.5 millisieverts (3.0% of the occupational dose limit).

The UO_3 from Blind River is shipped to Cameco's conversion facility, located in Port Hope, Ontario. There the UO_3 is converted to UO_2 intended for domestic reactor fuel production, and to UF_6 for export. In 1997, Cameco's Port Hope facility operating licence was renewed by the AECB, allowing an increase in the limit on UF_6 production from 10,000 to 12,500 tonnes of uranium per year at the existing UF_6 plant, and extending the authorization to produce uranium metal in the existing Speciality Metals plant to include natural uranium as well as depleted uranium. The additional UF_6 production will be achieved by utilizing latent capacity in existing equipment and systems, while remaining within the previously established limits for safety and protection of workers, the public and the environment.

In 1997, the estimated radiation dose to the most exposed member of the public resulting from the operation of the facility was 0.21 millisievert (4% of the public dose limit). No facility worker exceeded the occupational dose limits. The maximum dose received by a facility worker was 5.9 millisieverts (11.8% of the occupational dose limit). The average dose received by the facility workers was approximately 0.43 millisievert (0.9% of the occupational dose limit).

In addition to the mining and milling of uranium ore to produce uranium, uranium can be extracted from other sources.

Phosphate rock, which is used in the production of phosphoric acid, contains uranium as a contaminant. In the early 1980s, Earth Sciences Extraction Company (ESEC) built a small facility to extract uranium from phosphoric acid produced at the Western Co-op fertilizer plant in Calgary, Alberta. In 1987, that plant was shut down for economic reasons. As a result, the ESEC facility has not operated since then. It is being maintained in a safe state in accordance with the requirements of the AECB

operating licence. In 1996, the AECB allowed ESEC to modify the facility to process phosphoric acid without recovering the contained uranium. This involves operating the main systems of the facility but not those related to uranium production. Since June 1997, the licensee has been operating the facility in this mode of operation and is continuing to keep the uranium recovery parts of the facility physically isolated.

Annex X lists uranium refinery and conversion facility licences.

Fuel Fabrication Facilities

The UO_2 powder produced by Cameco is used to manufacture fuel bundles for the CANDU reactors operated by Ontario Hydro, Hydro-Québec and the New Brunswick Power Corporation. The manufacturing process involves a series of operations: the powder is formed into small pellets; sets of pellets are loaded into zircaloy tubes; each tube is capped and sealed by welding; and finally, the completed tubes are assembled into bundles. These operations are carried out by two companies — General Electric Canada Incorporated and Zircatec Precision Industries Incorporated.

General Electric forms pellets at its plant in Toronto, Ontario, and then ships them to its plant in Peterborough, Ontario, where the fuel bundles are completed. The estimated radiation dose to the public at the perimeter of the Toronto plant was 0.04 millisievert (less than1% of the public dose limit). The average worker whole-body dose at that facility was 6.2 millisieverts (12.4% of the occupational limit). No radiation dose to the public resulted from the operation of the Peterborough plant, because it releases essentially no uranium to the environment. The average worker whole-body dose at that facility was 2.1 millisieverts (4.2% of the occupational limit).

Zircatec Precision Industries conducts all the fuel fabrication and bundle assembly operations at one plant located at Port Hope, Ontario. The estimated radiation dose to the public at the perimeter of this plant was approximately 0.13 millisievert (2.6% of the public dose limit), and the average whole-body dose received by workers was approximately 2.6 millisieverts (5.2% of the occupational dose limit).

Annex X lists fuel fabrication facility licences.

Radioactive Waste Management

Nuclear facilities and users of prescribed substances produce radioactive waste. The AECB regulates the management of radioactive waste to ensure that it causes no undue risk to the health and safety of persons or to the environment.

The radioactive content of the waste varies with the source. Management techniques, therefore, depend on the characteristics of the waste. As of March 31, 1998, there were 20 licensed waste management facilities and activities in operation: 13 in Ontario, two in Quebec, two in Alberta, one each in Saskatchewan and New Brunswick, and one covering the Low-Level Radioactive Waste Management Office's decontamination activities at various locations in Canada. In addition, there were waste management facilities and activities associated with other AECB-licensed facilities, namely Atomic Energy of Canada Limited's (AECL) Chalk River Laboratories in Ontario and Whiteshell Laboratories in Manitoba, and active and decommissioned uranium mining/milling operations in the Northwest Territories, Saskatchewan and Ontario.

Annex XI lists radioactive waste management licences.

Because of the construction and location of waste management facilities, members of the public do not receive any significant dose of radiation from the contained radioactive waste. Only in a few facilities is it possible for workers to be exposed while handling the waste, and none received doses in excess of any regulatory limits during the reporting period.

Reactor Waste

Spent fuel from a power reactor is highly radioactive and remains so for a long time. It is stored initially under water in large pools at the reactor site. After a minimum number of years in pools, some of the spent fuel is stored in dry concrete containers, until a permanent disposal facility becomes available.

The fuel from the Douglas Point, Gentilly-1 and NPD reactors, all now permanently shut down, is stored dry, in welded steel containers inside concrete "silos". In each case, the reactor and associated facilities have been partially decommissioned and are in a "storage-with-surveillance" mode. Typically, the wastes from the decommissioning are stored within the reactor facility in a variety of ways appropriate to the hazard of the wastes.

Ontario Hydro stores irradiated fuel from the Pickering Nuclear Generating Station in a dry concrete container facility at the site. In July 1996, Ontario Hydro applied for a construction licence to build a dry-fuel storage facility at its Bruce Nuclear Power Development Radioactive Waste Site 2. The AECB has determined that this project (named the Bruce Used Fuel Dry Storage Facility) requires a comprehensive study under the *Canadian Environmental Assessment Act*. The comprehensive study is currently under review by the AECB, in conjunction with other specialist expert federal departments. Referral of the comprehensive study to the Canadian Environmental Assessment Agency for its consideration is expected in 1998.

New Brunswick Power also stores irradiated fuel from the Point Lepreau Nuclear Generating Station in an on-site dry concrete container facility.

Hydro-Québec stores irradiated fuel from its Gentilly-2 Nuclear Generating Station in an on-site modular-type (CANSTOR) concrete container facility.

Other less intensely radioactive wastes resulting from reactor operations are stored in a variety of structures in waste management facilities located at reactor sites. Prior to storage, the volume of the wastes may be reduced by incineration, compaction or baling. As well, there are facilities for the decontamination of parts and tools, laundering of protective clothing, and the refurbishment and rehabilitation of equipment.

On March 13, 1998, the panel set up in accordance with the *Federal Environmental Assessment and Review Process Guidelines Order* to carry out a public review of a concept for disposal of high-level reactor wastes deep in rock formations released its report to government.

The key finding was that while the technical aspects of safety were judged to be acceptable, there was still a need to achieve broad public support for

the concept before siting of an actual facility should begin. The panel recommended a series of actions which government should undertake over a three-year period before deciding how to proceed.

AECB staff members are working with officials of other government departments and agencies to develop a federal government response to the panel recommendations. It is expected that this response will be available by the fall of 1998.

IRUS Disposal Facility

In October 1996, AECL submitted a revised application for the construction of the IRUS (Intrusion Resistant Underground Structure) disposal facility at its Chalk River Laboratories. The IRUS facility would be used for the disposal of low-level solid radioactive waste presently held in storage at the Chalk River site. In April 1997, AECB staff provided preliminary comments to AECL on the revised application, and AECL is performing additional analyses and preparing additional documentation in response to those comments. Regulatory review of the IRUS facility is expected to continue in 1998.

Refinery Waste

In the past, wastes from refineries and conversion facilities were managed by means of direct in-ground burial. This practice has been discontinued since 1988. The volume of waste produced has been greatly reduced by recycling and reuse of the material. The volume of waste now being produced is drummed and stored in warehouses pending the establishment of an appropriate disposal facility.

The seepage and runoff water from the waste management facilities where direct in-ground burial was practised continues to be collected and treated prior to discharge.

Radioisotope Waste

A number of waste management facilities process and manage the wastes that result from the use of radioisotopes for research and medicine. In general, these facilities collect and package waste for shipment to approved storage sites. In some cases, the waste is incinerated or allowed to decay to insignificant radioactivity levels, and then discharged into the municipal sewer system or municipal garbage system.

Historic Waste

The federal government has commissioned the Low-Level Radioactive Waste Management Office to undertake certain initiatives with respect to accumulations of so-called "historic" wastes (low-level radioactive wastes that accumulated prior to AECB regulation) in the town of Port Hope, Ontario, in anticipation of its ultimate transfer to an appropriate disposal facility.

As a consequence, the Office has consolidated some waste accumulations and established temporary holding facilities for wastes uncovered during routine excavation within the town. The activities of the Office are being monitored by the AECB and, where appropriate, licences have been issued for particular waste accumulations.

The federal government and the Town of Deep River were engaged in discussions over the past years concerning the federal government's initiative to identify a volunteer community willing to accept a disposal facility for the low-level radioactive waste from in and around the town of Port Hope. In October 1997, these discussions ended and the Town of Deep River formally withdrew from the federal voluntary siting process. Following this withdrawal, the affected municipalities in the Port Hope area contacted the federal government concerning the possibility of identifying a local solution for managing the Port Hope area wastes. These discussions are continuing.

Decommissioning

The shutdown and decommissioning of facilities licensed by the AECB must be accomplished safely according to plans approved by the Board.

Major decommissioning projects are continuing at Atomic Energy of Canada Limited's research facilities at Whiteshell and Chalk River, and at AECL's demonstration/prototype power reactor sites (Douglas Point, NPD, and Gentilly-1). These reactors,

and the WR-1 reactor at Whiteshell, are now partially decommissioned and are in a state of "storage-with-surveillance". This surveillance period is to allow for the decay of radioactivity in the reactor, thus reducing radiation dose to workers involved in the final dismantlement. AECL is continuing to submit conceptual and final decommissioning plans for components of its research facilities.

Decommissioning of the Stanrock and Denison (Denison Mines Limited) and the Quirke and Panel (Rio Algom Limited) uranium mining facilities in the Elliot Lake area is continuing. The last operating uranium mining facility in the area, Stanleigh, ceased operations in September 1996. Rio Algom Limited submitted a final decommissioning plan for this facility, and the proposal (which is analogous to the approach being implemented in the other area facilities undergoing decommissioning) was reviewed in public through the Canadian Environmental Assessment Agency process. A decommissioning licence has been issued by the AECB to Rio Algom Limited for the Stanleigh facility.

Rio Algom Limited is also completing the process of submitting the documentation required by the AECB for licensing decommissioning activities at the other idle mines in the Elliot Lake area. These mine sites have not been operational for almost 40 years, and were not previously licensed by the AECB.

Indian and Northern Affairs Canada is conducting decommissioning work under AECB licence at the Rayrock idle site in the Northwest Territories. Performance monitoring of the decommissioned site is expected to begin in 1998.

The University of Toronto has completed the decommissioning of its subcritical assembly.

The N*uclear Safety and Control Act* and its supporting Regulations will explicitly address the decommissioning of facilities, and will require licensees to provide financial guarantees to fund the decommissioning of their facilities. In preparation for the enactment of these new requirements, AECB staff is preparing regulatory guides for decommissioning and financial guarantees.

Nuclear Materials

Persons who possess, sell or use nuclear materials must obtain a licence from the AECB. The information required to support applications for such licences is less detailed and complex than for a nuclear facility. However, the applicant must satisfy the AECB that the proposed activity will be conducted in accordance with the requirements of the *Atomic Energy Control Regulations* and the licence conditions.

The use of nuclear materials is widespread across Canada, and another of the AECB's responsibilities is to regulate the packaging of such materials for shipment.

Prescribed Substances

During the reporting period, there were 20 companies holding 24 Prescribed Substance Licences for uranium, thorium or heavy water. The types of activities licensed ranged from possession and storage, analysis and processing of material for research, and multiple commercial uses, e.g. radiation shielding, aircraft balance weights, calibration devices, and analytical standards.

A unique Prescribed Substance Licence was issued in August 1997 to the Sudbury Neutrino Observatory for 1,100 tons of heavy water.

Radioisotopes

Radioisotopes are used widely in research, in medicine for diagnostic and therapeutic purposes, and in industry for a variety of tasks including quality control, which uses radiography, and process control, which uses gauging techniques. Licences are required for all of these applications. For certain other devices such as smoke detectors and tritium exit signs, where the quantity of radioactive material is small and the device meets internationally accepted standards for safety, the user is exempt from licensing, but the manufacturer, distributor and importer must be licensed.

As of March 31, 1998, there were 3,775 radioisotope licences in effect. The distributions by type of user, and by province and territory, are shown in the table on this page.

Radioisotope Licences

Type of Users

2,229	Commercial
866	Medical
379	Governmental
301	Educational Institutions

Distribution

1,429	Ontario
970	Quebec
426	Alberta
415	British Columbia
118	Saskatchewan
116	Manitoba
101	Nova Scotia
101	New Brunswick
52	Newfoundland
15	Prince Edward Island
12	Northwest Territories
6	Yukon
14	U.S.A and abroad

During the reporting period, 3,555 inspections of radioisotope licensees and 9 inspections of prescribed substance licensees were carried out. These inspections identified 254 violations of the *Atomic Energy Control Regulations* or licence conditions that could directly have affected radiation safety, and 1,045 other infractions and deficiencies in compliance with the *Atomic Energy Control Regulations* or licence conditions that did not directly affect radiation safety. Inspectors responded on 186 occasions to incidents involving radioisotopes, and to other public concerns about ionizing radiation. The incidents are categorized in the box on the following page.

During the reporting period, 97 incidents were reported to the AECB, compared to 65 the previous year. The increase is attributed to improved detection of radioactivity in scrap shipments and better documenting of unusual occurrences by AECB staff. A major medical spill possibly resulted in an exposure above regulatory limits, however, none of the other incidents posed any significant exposure to

individuals or risk to the environment. Reported incidents are expected to increase in number as reporting requirements are more clearly defined and licensees are made aware of them. The types of incidents are shown in the box on this page.

Due to the high costs of decontamination, metal scrap recyclers are installing radiation detection systems to monitor trucks and railcars for radioactive material. Rejected shipments are returned to their point of origin. In six instances where company employees could not locate the radioactive material in the shipment, AECB inspectors went to the site to investigate whether the material was of a nature and quantity that regulatory action would be necessary. In none of the instances was action required. Several of the alarms were due to the presence of discarded smoke detectors in the scrap, and naturally occurring radioactive material was responsible for the others.

In two of the medical incidents, hospital rooms were contaminated for a few days until the radioactivity had decayed or been cleaned up. The sources lost were very small or short-lived. A group of nurses at an Ontario hospital have attributed their thyroid problems to working with a radioactive drug in the 1970s and 1980s. At the time of this report, AECB staff and the Board's Medical Adviser were gathering information on the matter.

Other occurrences included two instances where inadequate decommissioning required minor clean-up. During the reporting period, it was also discovered that contaminated lead powder had been made into protective aprons and other consumer products. The contaminated powder originated in the United States. Working with the Radiation Protection Bureau of Health Canada, AECB staff investigated, assisted with radiation measurements, notified users and facilitated the return of these products to the suppliers.

On numerous occasions, AECB staff responded to public concerns about radioactive material or radiation exposure that proved to be unfounded. In one instance, an inspector flew from Edmonton to Vancouver to respond to the concerns of tenants in an apartment building about exposure to ionizing radiation during an industrial radiography job. In

Incidents Involving Radioisotopes

Portable Gauges

13 crushed or damaged
5 stolen and three later recovered

Fixed Gauges

1 damaged in fire
6 equipment failures
1 lost and not recovered
1 leaked
1 sent to scrap
1 shipped improperly
1 involved in a road accident
2 exposed workers

Oil and Gas

13 source stuck in a well;
- 10 recovered,
- 3 abandoned/cemented in
1 source lost and recovered
1 source stolen and recovered

Industry

1 overexposure

Scrap Metal

22 shipments rejected and returned
6 visits by AECB inspectors
2 shipments returned to Canada from U.S.A.
1 shipment awaiting return to U.S.A. from Canada

Medical

3 sources lost; 1 recovered
2 facilities contaminated
1 workers allege radiation injury
1 major spill

Other

1 source burned in a fire
2 inadequate decommissioning
2 found sources
4 contaminated lead products
2 facilities contaminated

another instance, a suspected intake of radioactive material turned out to be a chemical effect in the radioactivity counting equipment.

During the reporting period, there were two cases of radiation overexposure compared to the 17 reported overexposures during the previous year.

In order to ensure that operators of radiography exposure devices have a basic knowledge of radiation protection and safe working practices, an examination is administered at various locations across the country five times a year. During the reporting period, 233 persons passed the exam from a total of 413 exams written, for a success rate of 56.4%. In January of 1998, the administration of the qualified operator exam was turned over by contract to Natural Resources Canada.

During the reporting period, the AECB held three workshops on radiation safety for medical and industrial professional organizations, and for associations that represent licensee groups. Two workshops on radiography were held in Calgary and Edmonton, Alberta. A workshop for hospital and university radiation safety representatives was held in Victoria, British Columbia. Promotional exercises were also carried out by AECB staff for members of emergency services to increase their understanding of radiological risks.

Packaging and Transportation

In Canada, some one million packages of radioactive material are transported annually by road, rail, sea and air. To ensure that this transport is conducted safely, the AECB regulates the transport of radioactive materials under the *Transport Packaging of Radioactive Materials Regulations*, SOR/83-740. As well, the AECB co-operates with Transport Canada in regulating the carriage of radioactive materials under the *Transportation of Dangerous Goods Act*.

These safety standards are based in large part on the *Regulations for Safe Transport of Radioactive Material* of the International Atomic Energy Agency (IAEA). The latest revision to these regulations were approved by the IAEA during the previous reporting year. Special efforts continue to be made by the AECB to contribute to the IAEA in the development of air and sea transport regulations through technical meetings and research programs. In addition, the AECB has assisted in the development of IAEA databases for accidents and for approved package designs for use internationally, and has also provided expert consultative assistance to the IAEA on regulatory matters.

During the reporting period, there was significant effort related to preparing new transport regulations. These new transport regulations will bring Canadian requirements into line with regulations being used in the rest of the world.

During the reporting period, the AECB applied safety standards to the design of packages used to transport radioactive materials and to shipment approvals. The AECB issued 52 certificates that included 9 special arrangement certificates, 17 endorsements of foreign certificates, and 26 Canadian-origin package certificates, which include 2 special-form certificates. As of March 31, 1998, the AECB maintained 117 valid certificates, of which 59 were for Canadian packages and 42 were for endorsements of foreign-origin packages. These certificates are in use by over 255 registered users.

During the reporting period, there were 22 incidents involving radioactive material. None of these incidents resulted in any significant increased exposure of workers or the public to radiation, nor was there significant environmental degradation. They are as follows:

- on five occasions, packages were lost. Four packages were eventually recovered and one package containing radioactive material with a short half-life, decaying away with no radiological consequences, was not found.
- on five occasions, packages were found to be improperly prepared. No significant radiological consequence was identified as a result of the non-compliance.
- on a total of nine occasions, 18 packages were subjected to puncture, crush, drop or other impact forces as a result of handling or vehicle accidents. Four packages were damaged. Although packages were subjected to significant forces in some of these accidents, there was no significant release of material.

- on three occasions, packages were found to be leaking. On two occasions, the leaking material was found not to be radioactive. On one occasion, a minor spill occurred during unloading of radioactive material from the package. There was no significant radiological consequence as a result of the spill.

During the past year, the transportation staff and regional office inspectors conducted over 280 transport compliance actions and responded to a steady flow of requests for compliance assistance from licensees.

Compliance Monitoring

The AECB verifies that licensees comply with the *Atomic Energy Control Regulations* and the conditions of licences in a variety of ways:

- inspectors are located at all nuclear power reactor sites, and in Saskatoon to more easily access the uranium mines in northern Saskatchewan;
- staff in regional offices located in Calgary, Alberta, Mississauga and Ottawa, Ontario, and Laval, Quebec, carry out routine and special inspections;
- staff at all locations review and respond to periodic reports and emergencies, investigations, transport actions, and notices of abnormal occurrences, most of which are reported by licensees as a regulatory requirement.

To support its compliance program, the AECB maintains a Laboratory Services Section in Ottawa that has the capability of carrying out analyses of samples taken during compliance or environmental inspections of licensees.

During the reporting period, laboratory staff performed approximately 5,000 chemical and radiochemical measurements on 2,500 samples.

Approximately 400 field instruments used by AECB inspectors are supplied, serviced and calibrated by this laboratory.

The Laboratory Services Section also assists other federal government organizations with radiation measurements, and international organizations in the prevention of nuclear smuggling.

Regulatory Research and Support Activities

The AECB funds a mission-oriented research and support program to augment in-house effort on regulatory activities. This work is contracted out to the private sector and to other agencies and organizations. The objective of the program is to produce pertinent and independent information that will assist the AECB in making sound, timely and credible decisions. Where appropriate, joint programs are undertaken with other government departments or agencies, or other organizations to maximize the value obtained, and to benefit from related research needs.

During the reporting period, the total expenditure for mission-oriented regulatory research and support contracts was $2.10 million. For program management purposes, the regulatory activities addressed in the program are categorized into mission object groups. These groupings reflect the business areas for which the work is done. Projects in the program are also organized and managed in sub-program groups that reflect discipline-related research themes. The program for the reporting period comprised 15 such sub-programs and a small number of other projects outside the sub-program groups. The organization of the program into sub-programs provides a rational means for budget allocation and prioritization, and makes the purpose of work done in the program more visible and transparent to the Board, AECB staff, licensees and the public. The table on this page gives a breakdown of program expenditure by business areas.

Reports issued by contractors on work done in the research and support program are available for public information. Some of the reports are also released as AECB INFO-series publications.

Regulatory Research and Support Program

Distribution of Funding for 1997-98

Business areas	**%**
Nuclear Reactors	47
Health Physics	15
Waste Management	9
Special Services	8
Other Fuel Cycle Facilities	6
Uranium Mines and Mills	5
Non-Fuel Cycle Applications	5
Transportation	4
Regulations and Regulatory Process Development	1

Non-Proliferation, Safeguards and Security

Nuclear Non-Proliferation

In support of Canada's nuclear non-proliferation policy, the AECB continued its activities to ensure that Canada's nuclear exports are used only for peaceful, non-explosive purposes, and to contribute to the emergence of a more effective and comprehensive international nuclear non-proliferation regime.

The AECB participates with the Department of Foreign Affairs and International Trade (DFAIT) in the negotiation of bilateral nuclear cooperation agreements (NCA) between Canada and its nuclear partners. Currently there are 22 NCAs in force (see table on this page), covering 36 countries.

The AECB also negotiates and implements administrative arrangements with its counterparts in other countries. These arrangements are aimed at ensuring that nuclear cooperation is conducted within the terms of Canada's NCAs. Pursuant to the AECB mandate in this area, staff participated in high-level bilateral and technical consultations on matters of mutual interest with a number of Canada's nuclear partners, including Australia, Euratom, Romania and the USA. Contacts with the Slovak Republic continued to be explored.

AECB staff continued to play an important role in multilateral nuclear non-proliferation forums, including the Zangger Committee and the Nuclear Suppliers Group (NSG), and their various working groups. The 1997 Plenary Meeting of the 34-country NSG was held in Ottawa in May 1997, with the AECB President, representing Canada, in the chair. Hosted jointly by the AECB and DFAIT, this was the first Plenary Meeting of the NSG held in North America. An AECB staff member was re-elected to chair the NSG Dual-Use Consultations for the second year. During the period, AECB staff represented Canada on the Dual-Use Annex Working Group, the Information Sharing Working Group and the Transparency Working Group. With the AECB President chairing the NSG, Latvia's membership was successfully concluded and outreach activities with non-NSG members were conducted with Turkey, Kazakhstan and Slovenia.

Canadian Bilateral Nuclear Co-operation Agreements

Partner	Date in Force
Argentina	July 1996
Australia	October 1959
Brazil	April 1997
China	November 1994
Columbia	June 1988
Czech Republic	February 1995
Egypt	November 1982
EURATOM*	November 1959
Hungary	January 1988
Indonesia	July 1983
Japan	July 1960
Lithuania	May 1995
Mexico	February 1995
Philippines	April 1983
Republic of Korea	January 1976
Romania	June 1978
Russian Federation	November 1989
Slovak Republic	October 1996
Slovenia	April 1996
Switzerland	June 1989
Turkey	July 1986
Ukraine	(signed; not yet in force)
United States of America	July 1955
Uruguay	(signed; not yet in force)

* EURATOM: *Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom.*

The AECB provides advice to DFAIT on the objectives, policies and procedures related to Canadian nuclear non-proliferation efforts and on matters related to verification. As well, the AECB is involved in the implementation of Canada's uranium export policy and participates in the interdepartmental Uranium Exports Review Panel with DFAIT and Natural Resources Canada.

Import and Export Control

At the national level, the AECB continued to licence the export of nuclear materials, equipment and technology in a manner consistent with Canada's nuclear non-proliferation and export policies. Pursuant to the *Atomic Energy Control Act*, the AECB also licences the import of nuclear materials and the export of nuclear-related dual-use items.

Proposed exports and imports of such items are evaluated by AECB staff, taking into account applicable requirements relating to Canada's nuclear non-proliferation policy, national law, bilateral NCAs, the *Treaty on the Non-Proliferation of Nuclear Weapons* (NPT), International Atomic Energy Agency (IAEA) safeguards, health, safety and security. Proposed exports of Canadian uranium are also evaluated against uranium agreements accepted by the Uranium Exports Review Panel. Records of authorized exports and actual shipments are maintained by the AECB on behalf of the Panel. The distribution, by final destination, of quantities of Canadian natural uranium that were exported during the 1997 calendar year, subject to licences issued by the AECB, is shown in the table on this page. These exports total 10,225 tonnes.

During the reporting period, 481 export licences and 262 import licences (which included 173 transshipments) were issued or amended. The AECB facilitated, through the issuance of licences, export trade nearing $1 billion, and imports, which included transshipments, in excess of $1.5 billion.

Canadian Uranium Exports in 1997

Destination	Tonnes
United States	6,187
Japan	1,968
France	587
Sweden	450
United Kingdom	374
Republic of Korea	315
Germany	184
Spain	160
Total	**10,225**

Safeguards

The AECB administers the agreement between Canada and the IAEA for the application of safeguards. This agreement is for the exclusive purpose of verifying that Canada's safeguards obligations under the NPT are being met. AECB staff members coordinate the access and activities of IAEA inspectors who are authorized to carry out safeguards inspections at nuclear facilities in Canada, and also arrange for IAEA installation and maintenance of safeguards equipment at these facilities. In addition, as part of its obligations, the AECB submitted to the IAEA during the 1997 calendar year 567 reports detailing 18,358 transactions involving nuclear material. At the end of the period, 34,179 tonnes of nuclear material were accounted for and were subject to IAEA inspection.

Domestic policies on nuclear material reporting by licensees are developed, implemented and monitored to ensure compliance with the *Atomic Energy Control Act*, the *Atomic Energy Control Regulations* and licence conditions in respect of Canadian nuclear facilities.

With Canada chairing the Committee 24 on "Strengthening the Effectiveness and Improving the Efficiency of the Safeguards System", the IAEA and its Member States succeeded in May 1997 in concluding a Protocol Additional to IAEA Safeguards Agreements. Evolving beyond the Programme 93+2, the Protocol marks the most significant change in IAEA safeguards in a quarter century. It also marks the beginning of the Strengthened Safeguards System (SSS), a consolidation of quantitative nuclear material accountancy safeguards and qualitative Protocol activities, into a comprehensive system.

The AECB initiated SSS consultations with the IAEA Secretariat, enabling Canada to become the first Member State to conclude Subsidiary Arrangements with the IAEA that detail the Protocol's implementation. To this end, an industry outreach program was intensified and preparation for the Protocol's implementation in Canada was continued.

Canada is represented by an AECB staff member on the IAEA's Standing Advisory Group on Safeguards Implementation (SAGSI). SAGSI provides advice to the Director General of the IAEA on a variety of safeguards implementation aspects, including SSS implementation, issues concerning the Safeguards Implementation Report, safeguards criteria, and safeguards research and development requirements.

The AECB provided the services of a staff member to serve on the IAEA Action Team set up under the terms of UN Security Council Resolution 687 to eliminate Iraq's weapons of mass destruction and the means to produce and use them.

Canadian Safeguards Support Program

Since 1976, Canada has undertaken a safeguards research and development program to supplement the resources of the IAEA and the operational efforts of the AECB in resolving specific safeguards concerns. This program is delivered by the AECB through the Canadian Safeguards Support Program (CSSP). All tasks in support of the IAEA are initiated by the IAEA through a formal request and approval procedure, and are carried out by developers, under contract. CSSP staff act as an interface between the IAEA and the developers, balancing their understanding of the IAEA's needs against viable options from the developers.

The CSSP undertakes safeguards tasks for system studies and development of equipment, techniques and procedures, and provides cost-free experts (CFE) to the IAEA. Equipment development includes projects such as development and installation of a new generation of spent fuel bundle counters and core discharge monitors, digital and remote surveillance systems, nuclear material sealing systems, and nuclear fuel verifiers. Successful solutions to safeguards problems must be affordable, reliable, maintainable, offer low intrusion to nuclear operators and reduce the demand on IAEA inspectors.

During the reporting period, the CSSP undertook over 30 tasks at a cost of $2.3 million. The table on this page provides a breakdown of the funding. These tasks included the provision of four CFEs to the IAEA.

CSSP Expenditures for 1997-98

Task Category	Thousands of dollars
Equipment Development	1,316
CFEs, Training and IAEA Travel	760
Program Management Costs	126
System Studies	113
Miscellaneous	3
Total	**2,318**

One of these was the CFE referred to above, who began work on the IAEA Action Team.

A new generation of radiation monitoring equipment was under development in the previous year. The heart of this equipment is the Autonomous Data Acquisition Module, which is versatile enough to accept many different detectors. The first application of this technology is a new generation of bundle counters for CANDU reactors. It was authorised for inspection use by the IAEA in the reporting period. The second surveillance application is a powerful and affordable core discharge monitor, which can be retrofitted into existing facilities. IAEA authorization for inspection use is expected imminently. Several systems have been purchased from the Canadian manufacturer and installed on a provisional basis.

In March 1998, work was completed on the development of safeguards approaches for spent fuel conditioning plants and geological repositories under the IAEA SAGOR project. The SAGOR project was a multinational project involving Belgium, Canada, Finland, France, Hungary, Sweden, the UK and the USA to develop model safeguards approaches for these facilities. The CSSP had a major role to develop the safeguards approach for the operating repositories and to provide a compendium of geophysical techniques for possible use in the suggested safeguards approaches.

During the reporting period, AECB staff and contractors working under the CSSP made presentations at several international meetings:

the Institute of Nuclear Materials Management annual meeting, the annual meeting of the European Safeguards Research and Development Association, and the IAEA Safeguards Symposium.

Discussions were held with several countries (Republic of Korea, Argentina and Romania) regarding information exchanges on safeguards implementation and R & D with respect to CANDU reactors.

Physical Security

The AECB ensures the development and implementation by licensees of effective physical protection measures for Canadian nuclear facilities and nuclear material, in accordance with regulations made pursuant to the *Atomic Energy Control Act*. During the reporting period, AECB staff conducted ten annual security inspections at Canadian nuclear facilities and at eight waste management areas to verify compliance with the *Physical Security Regulations*, SOR/83-77. Several follow-up inspections were undertaken to ensure that licensees were taking appropriate corrective action. Additionally, there were 46 Inner Area Authorizations and 77 Security Guard Notices issued pursuant to regulatory requirements.

AECB staff monitored three security exercises conducted by licensees and their respective off-site response forces. These exercises evaluate the validity of licensee contingency plans and the licensee's competence to handle adequately emergencies initiated by a security incident.

The AECB, in conjunction with DFAIT, ensures that measures for the physical protection of nuclear materials in Canada are consistent with Canada's international obligations, specifically the IAEA recommendations, the *Physical Protection of Nuclear Material* (INFCIRC/225/Rev. 3), and the *Convention on the Physical Protection of Nuclear Material* (INFCIRC/274/Rev. 1). Among other requirements, the Convention sets minimum levels of physical protection for nuclear material in international nuclear transport. The AECB serves as the official Canadian point of contact for the Convention. Approximately 400 applications for the export or import of nuclear materials were scrutinized for security implications pursuant to Convention requirements.

AECB staff continued to participate in efforts by the IAEA to combat the illicit trafficking in nuclear materials and radioactive substances. The AECB serves as the official Canadian point-of-contact for the IAEA Illicit Trafficking Database.

In response to growing international concerns with the regulatory framework supporting the physical security of nuclear facilities, the IAEA has developed an International Physical Protection Advisory Service. During the reporting period, AECB staff participated as cost-free experts on two such missions, one to Hungary and the other to Romania.

An AECB staff member participated as a guest lecturer at the IAEA-sponsored international training course on the physical protection of nuclear facilities and nuclear material.

International Activities

The scope of international discussions on nuclear safety has grown in recent years, reflecting increased post-Chernobyl concern about trans-frontier risks. The experience and expertise of the AECB give Canada a major influence in the development of international safety guidelines.

AECB staff participates in activities of the International Atomic Energy Agency (IAEA), the International Commission on Radiological Protection (ICRP), the United Nations Scientific Committee on Effects of Atomic Radiation (UNSCEAR), the Nuclear Energy Agency (NEA) of the Organization for Economic Co-operation and Development, and other international organizations concerned with the peaceful uses of nuclear energy.

AECB staff continued its ongoing involvement in committees, working groups and technical meetings that dealt with a wide range of topics, which included: the finalization of an international convention on the safety of radioactive waste and spent fuel management; preparation of inspection practices for nuclear power reactors; issues with respect to planning for nuclear emergencies; preparation and revision of safety codes and standards for nuclear facilities, for radiation and environmental protection, for training in the nuclear industry, and for radioactive waste management; and review of the international regulations for safe transport of radioactive materials. Additionally, staff continued to provide the IAEA with computer programming assistance for its transportation database.

During the reporting period, AECB staff provided technical assistance to the South Korean regulatory agency with respect to the Canadian-designed Wolsong reactor and to the Romanian regulatory agency concerning the Cernavoda nuclear generating station.

The AECB is actively involved in the exchange of nuclear safety and regulatory information with other foreign regulators, and has formal agreements on such matters with the American, Argentine, British, Chinese, French, German, Indonesian, South Korean, Swiss, Romanian and Russian nuclear regulatory agencies. The AECB is also a member of the CANDU regulators group, set up under the auspices of the IAEA, to verify safety activities in countries that have CANDU reactors in operation or under construction.

During the reporting period, AECB staff continued to meet regularly with regulators from the UK, USA and France on the use of computerized instrumentation, and control and protection systems. The participants in these meetings are now preparing a consensus report on regulatory assessment of safety-critical software.

Public Information

As part of the reorganization that took effect on January 1, 1998, a new Communications Division was created to take over the functions previously carried out by the Office of Public Information. This change was made in recognition of the need for the AECB to enhance its communications function and to take a more proactive role in identifying communications opportunities.

The division has a lead role in assembling and producing communications material for internal and external audiences. It responds to enquiries from the public and the news media, and issues news releases, notices and information bulletins. It also publishes information about the AECB's regulatory role, responsibilities and mission-oriented research, as well as reports prepared by the Board's Advisory Committees. A full-time staff of ten is devoted to dealing with enquiries, orders for publications and other information materials, and to planning and developing communications programs.

A *Catalogue of Publications* is published annually. Anyone may have their name placed on the mailing list to receive this publication, as well as news releases, consultative documents (proposed regulations, policies and guides), the quarterly regulatory journal *Reporter*, the *Annual Report*, and Board meeting agendas, minutes and related documents.

During the reporting period, the Communications Division handled an average of 80 calls or e-mail messages per day, received over 1,500 requests for documents and videos, and sent out over 14,000 items in response. There were close to 60 new titles added to the publications catalogue, and over 40 research reports were made available. The division issued 31 news releases, and dealt with well over 450 news media contacts.

Four years ago, the AECB launched a new information bulletin in the Durham region of Ontario to inform the local public of the radiation exposures from the operation of the nearby Pickering and Darlington nuclear generating stations. As a result of comments and suggestions received from local residents, the *Radiation Monitor* underwent changes in its title, to *Radiation Index*, and in its graphic presentation. The *Radiation Index* is updated and produced every three months by the AECB.

In 1997-98, the five-member Board continued its practice of having meetings in communities that have a special interest in one or more nuclear facilities, visiting Kincardine, Ontario (Bruce Nuclear Power Development facilities), Saskatoon, Saskatchewan (uranium mines in northern Saskatchewan), and Oshawa, Ontario (Pickering and Darlington Nuclear Generating Stations). Public interest in the Board's decision-making process has increased dramatically in recent years, and the dissemination of related documentation has become a sizable function. The division now handles all requests for Board meeting documentation, and maintains mailing lists for persons interested in receiving documents on some or all of the subject matters with which the Board deals.

The AECB has also continued to expand its public notification and consultation activities related to the Board's regulatory and licensing process. Proposals for licensing actions are routinely distributed to local officials, interested groups and organizations. Through notices published in local newspapers, the public is also given opportunities to make its views known. Comments received are taken into consideration by the Board in its decision making.

The AECB expanded its presence on the "information highway" by preparing 15 documents for its website (www.gc.ca/aecb) which consists of an array of information about the Board, several publications, and links to other nuclear-related sites. The AECB intends to make increasing use of this communication tool.

The Communications Division may be reached toll-free at 1-800-668-5284. The regular phone number is (613) 995-5894, and the fax number is (613) 992-2915. The electronic mail address for public information matters is info@atomcon.gc.ca.

Corporate Administration

Cost Recovery

The AECB recovered 82% of its $40.9 million recoverable licensing costs through fees charged for licences and permits. In addition, costs of $4.2 million were incurred to licence publicly-funded health care institutions, educational institutions and federal departments. As these organizations are exempted from the fees, their licensing costs are covered by Parliamentary appropriation.

All AECB funding is voted by Parliament. The funds recovered through fees are returned directly to the Consolidated Revenue Fund.

Emergency Preparedness

The AECB must be prepared for emergencies involving AECB licensed facilities, radioactive materials located outside of licensed facilities, or nuclear facilities outside of Canada that could affect the citizens or environment of Canada. In this capacity, the AECB must co-operate with its licensees, provincial and federal government agencies, and international organizations.

One area of federal co-operation involves the Federal Nuclear Emergency Plan (FNEP), which is led by Health Canada. The FNEP would be activated if federal support to a Canadian province or a foreign country was required as a result of any domestic, trans-boundary (Canada/United States) or international incident. The AECB is a core member of each of the FNEP's four organizational groups (Coordination, Operations, Technical Advisory and Public Affairs), and participates in emergency planning activities with other FNEP core agencies.

One area of international co-operation is the arrangement that the AECB and the United States Nuclear Regulatory Commission have to notify each other of significant events occurring in their respective jurisdictions, and to exchange information on those events. This arrangement is regularly tested when actual or simulated events (i.e. exercises) occur.

The AECB operates a duty officer program whereby anyone can seek emergency information, advice or assistance from the AECB, 24-hours a day, for incidents involving the actual or potential release of radioactive materials to the environment. During the reporting period, the AECB Duty Officer received calls for 160 separate occurrences: 55 for actual or potential incidents, 30 for simulated incidents, 19 for AECB administrative requirements, and 56 for non-emergency items.

The AECB participates in simulated incidents to check its emergency response capability and enhance its knowledge. During the reporting period, staff participated in one AECB-exclusive emergency exercise, one international exercise sponsored by the Nuclear Energy Agency of the Organization for Economic Co-operation and Development, and 23 checks of the AECB Duty Officer communications system. In addition, Board project officers, located at nuclear generating stations in Canada, participated in several licensee emergency drills at each site.

During the reporting period, the AECB continued implementation of a new emergency response plan. It is expected that full implementation should be completed by mid-1998.

Plans for fiscal year 1998-99 are to continue implementation of the new emergency response plan, increase AECB participation in drills and exercises, enhance operational effectiveness of the emergency operations centre, and work with federal and provincial agencies and licensees in improving overall nuclear emergency preparedness in Canada.

Training Centre/Technical Training Group

The AECB's Training Centre was responsible for developing and delivering training programs for AECB staff and for selected representatives of foreign regulatory organizations. As part of the AECB reorganization announced on October 31, 1997, the Training Centre was disbanded. Instead two groups were created, one for technical training and one for non-technical training. The Technical Training Group

is in the Directorate of Environmental and Human Performance Assessment and is responsible for the design, development, delivery, evaluation and management of technical training programs for AECB staff and foreign clients. The other group is responsible for all the same aspects of management, administrative, and non-technical training programs for AECB staff, and is in the Directorate of Corporate Services, in the Human Resources Division.

In preparation for the proclamation of the new *Nuclear Safety and Control Act*, five courses were presented to AECB staff during the year to familiarize them with the new Act. A larger number of short introductory sessions on the new Act were also presented.

During the reporting period, 70 customized courses were delivered to AECB staff, resulting in 877 person-days of training. Another 263 courses from external sources were coordinated for AECB staff.

In the next fiscal year, the main training priorities will be to develop further and to deliver training modules on the diverse implications of the *Nuclear Safety and Control Act* and its Regulations, and to significantly strengthen the training in management and supervisory skills given to AECB staff having supervisory responsibilities. Planning and development for this training was started during the latter part of the reporting period. Development of training policies, standards and procedures was also started and will continue at an increased level in the next fiscal year.

During the reporting period, a five-year program of assistance to the Romanian regulatory body was concluded. The on-site licensing and safety compliance advisor completed this assignment at the end of June 1997, and a final scientific visit by the Romanian regulatory agency officials was held in Canada, also in June 1997, to conclude the program and to assist in preparing the final report for the project.

Five major training programs were developed and delivered for regulators from China, Korea, Lithuania, Russia and Slovakia. Two scientific visits were undertaken involving representatives from the Philippines and Vietnam.

A "training for the trainer" course was presented to a large group of regulators from Russia, Ukraine and Lithuania, in Novovoronezh, Russia, in June 1997.

Two programs of assistance to review the preliminary safety assessment report (PSAR) for the Third Qinshan Nuclear Power Plant were provided to NNSA, the Chinese regulator, as well as two series of lectures on specific topics related to the Canadian regulatory philosophy and approach, as it applies to licensing CANDU reactors.

During 1997–98, the AECB continued its agreement with the Canadian International Development Agency (CIDA), under the Canadian Nuclear Safety Initiative of the Department of Foreign Affairs and International Trade. Further cooperation with Ukrainian, Russian and Lithuanian regulators will continue under this initiative next fiscal year.

Nuclear Liability

The AECB is responsible for the administration of the *Nuclear Liability Act*, designating nuclear installations and, with the approval of Treasury Board, prescribing the amount of basic insurance to be maintained by the operator. Annex XII lists the designated installations and the amounts of basic insurance prescribed.

During the reporting period, the AECB continued to assist Natural Resources Canada in its policy role with respect to the Act, and in its review of the Act. This review, which was initiated by Natural Resources Canada, is consistent with renewed interest and efforts in the international nuclear community toward improved legislation and international agreements in the area of third-party liability.

Project 96 and Beyond

The efficient and effective discharge of the AECB regulatory mandate is clearly linked to the management framework which prevails in the organization. During the reporting period, the President and Executive Committee continued to implement the recommendations stemming from the thorough review of the AECB's internal management policies and practices, which was completed in 1996 as a special initiative called *Project 96 and Beyond*. Some of the major recommandations that were implemented include the adoption of an activity-based planning and budgeting system, the development of a strategic plan, and the launching of a comprehensive reform of human resources policies and programs. Other initiatives included the development of a core set of fundamental corporate documents on the AECB's mandate, corporate values, priority-setting, and work management systems.

Internal Audit

The AECB put in place several years ago an Audit and Evaluation Group to examine corporate management accountability and program performance issues, and to make recommendations for improvement. The group reports directly to the President, and works under the guidance of a corporate Audit and Evaluation Committee, which is chaired by the President. While the group at first focussed mostly on audit issues, it has recently broadened its attention to include assessment of program effectiveness. It also assists management in selected corporate reviews, and in identifying lessons learned and best practices.

Considerable effort was made during the past year to diagnose ways to improve the assignment and management of multidisciplinary analysis and assessment projects carried out by AECB staff. The Audit and Evaluation Group helped management to successfully complete this diagnostic process, and the project participants were recognized with a President's Award in December 1997.

A report on an audit of Translation Services was completed during the year. The audit focussed on management of the contractual relationship with an external service provider, and on the quality of translated documents intended for internal distribution. A management action plan responded to the findings and recommendations.

A major initiative during the reporting period was a corporate review of compliance inspections, enforcement and other related follow-up actions. The AECB spends about $7 million per year on these functions. The review looked at management framework, success and alternatives issues. The draft report has now been submitted to management for review.

Environmental Assessment

The *Canadian Environmental Assessment Act* (CEAA) was promulgated in January 1995. It places a range of obligations on the AECB relating to the conduct of environmental assessments (EA). These obligations are clearly defined in the CEAA.

One of the underlying principles of the CEAA is that the public should be given ample opportunity to participate in EAs. To support this objective, a Public Registry was established by the Canadian Environmental Assessment Agency to provide public access to information upon which EAs are based. The AECB has established electronic links with the Agency for the purpose of recording information in the Public Registry with respect to projects for which the AECB is required to conduct an EA. All such projects are listed in the Federal Environmental Assessment Index (FEAI), which offers the public a single point of reference, with electronic access, for all EAs conducted by federal departments and agencies.

During the reporting period, the AECB filed eight EAs with the FEAI: seven screenings and one comprehensive study. Seven of these are completed and one is ongoing. Environmental assessments begun under the *Environmental Assessment and Review Process Guidelines Order* (EARPGO), the precursor to the CEAA, are not registered in the FEAI.

The AECB, in concert with other federal departments and agencies, is working closely with the Agency to develop appropriate regulations and procedures to facilitate the application of the CEAA. The AECB is also working to harmonize its regulatory process and its obligations under the *Atomic Energy Control Act* with the requirements of the CEAA.

Financial Statement

The audited financial statement for the fiscal year ending March 31, 1998, is shown in Annex XIII.

Annex I, March 31, 1998

The Board and Executive Committee

Board Members

A.J. Carty
President,
National Research
Council of Canada,
Ottawa, Ontario

Y.M. Giroux
Assistant to the Rector,
Université Laval,
Quebec, Quebec

A.J. Bishop
President of the Board
and Chief Executive
Officer of the AECB

C.R. Barnes
Director,
Centre for Earth and
Ocean Research,
University of Victoria,
Victoria, British Columbia

K.K. Ogilvie
President and
Vice-Chancellor,
Acadia University
Wolfville, Nova Scotia

Executive Committee

P. Marchildon
Director General,
Secretariat, and
Secretary of the Board

J.D. Harvie
Director General,
Reactor Regulation

R.M. Duncan
Director General,
Fuel Cycle and
Materials Regulation

J.G. Waddington
Director General,
Environmental and
Human Performance
Assessment

G.C. Jack
Director General,
Corporate Services

Annex II, March 31, 1998

Organization of the AECB

President and Chief Executive Officer		**A.J. Bishop**
Advisory Committee on Radiological Protection	Chairman	A.M. Marko
Advisory Committee on Nuclear Safety	Chairman	A. Pearson
Group of Medical Advisers	Chairman	S. Vlahovich
Legal Services Unit	Senior Counsel/Manager (A)*	A. Nowack
Audit and Evaluation Group	Manager	R. Maddocks
Secretariat	**Director General**	**P. Marchildon**
Secretary of the Board		P. Marchildon
Communications Division	Director (A)*	R. Potvin
External Relations and Documents Division	Director	C. Maloney
Non-Proliferation, Safeguards and Security Division	Director	H. Stocker
New Act Implementation Group	Manager	R. Brown
Board Services Group	Manager	B. Gerestein
Directorate of Reactor Regulation	**Director General**	**J. Harvie**
Power Reactor Operations Division	Director	R. Leblanc
Power Reactor Evaluation Division	Director	M. Taylor
Safety Evaluation Division (Analysis)	Director	P. Wigfull
Safety Evaluation Division (Engineering)	Director	K. Asmis
Directorate of Fuel Cycle and Materials Regulation	**Director General**	**M. Duncan**
Uranium Facilities Division	Director	T. Viglasky
Wastes and Decommissioning Division	Director	R. Ferch
Materials Regulation Division	Director	R. Thomas
Research and Production Facilities Division	Director	A. Aly
Directorate of Environmental and Human Performance Assessment	**Director General**	**J. Waddington**
Radiation and Environmental Protection Division	Director	M. Measures
Personnel Qualification Assessment Division	Director	G. Schwarz
Performance Evaluation Division	Director	K. Pereira
Technical Training Group	Manager	J. Didyk
Research and Support Group	Manager	I. Grant
Directorate of Corporate Services	**Director General**	**G. Jack**
Human Resources Division	Director	D. Vermette
Finance Division	Director	M. Dupéré
Information Management Division	Director	W. Goodwin

* Acting

Annex III, March 31, 1998

Advisory Committee on Radiological Protection

Dr. A.M. Marko (Chairman)	Consultant Deep River, Ontario
Dr. D.J. Gorman (Vice-Chairman)	Director, Office of Environmental Health and Safety University of Toronto Toronto, Ontario
Dr. D.B. Chambers	SENES Consultants Ltd. Richmond Hill, Ontario
Dr. G. Dupras	Chief, Nuclear Medicine Hôtel-Dieu de Saint-Jérôme Saint-Jérôme, Quebec
Dr. J.F. Lafortune	Science Applications International Corporation Ottawa, Ontario
Dr. D.K. Myers	Consultant Pembroke, Ontario
Mrs. L. Normandeau	Medical Physics Department Hôpital général de Montréal Montréal, Quebec
Dr. L. Renaud	Biomedical Engineering Unit Electromed International St-Eustache, Quebec
Dr. D.W.O. Rogers	National Research Council of Canada Ottawa, Ontario
Dr. J.B. Sutherland	Health Sciences Centre Winnipeg, Manitoba
Dr. B.L. Tracy	Radiation Protection Bureau Health Canada Ottawa, Ontario
Mr. M. White	Safety Management Services, Inc. Pickering, Ontario
Dr. R.J. Woods	Professor Emeritus, Department of Chemistry (Retired) University of Saskatchewan Saskatoon, Saskatchewan
Dr. A. Pearson (*ex officio*)	Chairman, Advisory Committee on Nuclear Safety
Mr. M.W. Lupien (Scientific Secretary)	Atomic Energy Control Board

Annex IV, March 31, 1998

Advisory Committee on Nuclear Safety

Dr. A. Pearson (Chairman)	Consultant Deep River, Ontario
Dr. A. Biron (Vice-Chairman)	Associate Director Centre de recherche en calcul appliqué (CERCA) Montréal, Quebec
Dr. A.H. Boisset	Responsible for Environment Office of Technology Transfer McGill University Montréal, Quebec
Dr. A.E. Collin	Consultant Ottawa, Ontario
Dr. M. Gaudry	Professor of Economics Université de Montréal Montréal, Quebec
Dr. J.R. Humphries	Consultant Nepean, Ontario
Dr. P.G. Mallory	Consultant Peterborough, Ontario
Dr. W.J. Megaw	Professor Emeritus York University North York, Ontario
Mr. A. Natalizio	Consultant Etobicoke, Ontario
Dr. R. Sexsmith	Department of Civil Engineering University of British Columbia Vancouver, British Columbia
Dr. A.M. Marko (*ex officio*)	Chairman, Advisory Committee on Radiological Protection
Mr. R.J. Atchison (Scientific Secretary)	Atomic Energy Control Board

Annex V, March 31, 1998

Medical Advisers

Dr. P. Hollett	Newfoundland and Labrador
Dr. D.J. Neilson	Prince Edward Island
Dr. O.S.Y. Wong Dr. D. Barnes	Nova Scotia
Dr. J.M. Daly Dr. J. Schollenberg Dr. M. Taha	New Brunswick
Dr. J. Morais Dr. G. Grenier	Quebec
Dr. A.A. Driedger Dr. M. McQuigge	Ontario
Dr. J.B. Sutherland Dr. K.D. Jones	Manitoba
Dr. S.K. Liem Dr. V. Trivedi	Saskatchewan
Dr. A.W. Lees	Alberta
Dr. A.S. Belzberg Dr. J.T.W. Lim	British Columbia
Dr. S. Vlahovich*	Health Canada
LCol. G. Cook Maj. R. Nowak	Department of National Defence
Dr. A.M. Marko Dr. A. Clarke	Atomic Energy of Canada Limited
Mr. M.W. Lupien (Scientific Secretary)	Atomic Energy Control Board

* AECB Medical Liaison Officer

Annex VI, March 31, 1998

Power Reactor Licences

Facility and Location (Licensee)	Type and Number of Units/Capacity	Start-Up	Current Licence Number	Current Licence Expiry Date
Pickering Generating Station A Pickering, Ontario (Ontario Hydro)	CANDU-PHW 4 × 500 MW(e)*	1971	PROL 4/98	1999.03.31
Bruce Generating Station A Tiverton, Ontario (Ontario Hydro)	CANDU-PHW 4 × 750 MW(e)**	1976	PROL 7/96	1998.06.30
Pickering Generating Station B Pickering, Ontario (Ontario Hydro)	CANDU-PHW 4 × 500 MW(e)	1982	PROL 8/98	1999.03.31
Gentilly-2 Nuclear Power Station Gentilly, Quebec (Hydro-Québec)	CANDU-PHW 600 MW(e)	1982	PER 10/96	1998.10.31
Point Lepreau Generating Station Point Lepreau, New Brunswick (New Brunswick Power Corporation)	CANDU-PHW 600 MW(e)	1982	PROL 12/96	1998.10.31
Bruce Generating Station B Tiverton, Ontario (Ontario Hydro)	CANDU-PHW 4 × 840 MW(e)	1984	PROL 14/97	1999.10.31
Darlington Generating Station A Bowmanville, Ontario (Ontario Hydro)	CANDU-PHW 4 × 850 MW(e)	1989	PROL 13/96	1998.11.30

MW(e) — megawatt (nominal electrical power output)
PER — Reactor Operating Licence (*Permis d'exploitation de réacteur*)
PHW — pressurized heavy water
PROL — Power Reactor Operating Licence
* PROL 4/98 requires the licensee to maintain all units in an approved shutdown state.
** PROL 7/96 requires the licensee to maintain Unit 2 in an approved shutdown state.

Annex VII, March 31, 1998

Research Reactor Licences

Licensee and Location	Type and Capacity	Start-Up	Current Licence	
			Number	Expiry Date
McMaster University Hamilton, Ontario	pool-type 5 MW(t)	1959	RROL 1/97	1999.06.30
École polytechnique Montréal, Quebec	subcritical assembly	1974	PERR 9/95	2000.09.30
University of Toronto Toronto, Ontario	SLOWPOKE-2 20 kW(t)	1976	RROL 6A/97	2000.06.30
École polytechnique Montréal, Quebec	SLOWPOKE-2 20 kW(t)	1976	PERR 9A/97	2000.06.30
Dalhousie University Halifax, Nova Scotia	SLOWPOKE-2 20 kW(t)	1976	RROL 17/97	2000.06.30
University of Alberta Edmonton, Alberta	SLOWPOKE-2 20 kW(t)	1977	RROL 18/97	2000.06.30
Saskatchewan Research Council Saskatoon, Saskatchewan	SLOWPOKE-2 20 kW(t)	1981	RROL 19/97	2000.06.30
Royal Military College of Canada Kingston, Ontario	SLOWPOKE-2 20 kW(t)	1985	RROL 20/97	2000.06.30

kW(t) — kilowatt (thermal power)
MW(t) — megawatt (thermal power)
PERR — Research Reactor Operating Licence (*Permis d'exploitation de réacteur de recherche*)
RROL — Research Reactor Operating Licence

Annex VIII, March 31, 1998

Nuclear Research and Test Establishment Licences

Licensee and Location	Type and Capacity	Current Licence Number	Current Licence Expiry Date
Atomic Energy of Canada Limited Chalk River Laboratories Chalk River, Ontario	Nuclear Research and Test Establishment	NRTE 1.2/96	1998.10.31
Atomic Energy of Canada Limited Chalk River Laboratories Chalk River, Ontario	New Processing Facility	RPCA 03/97	*
Atomic Energy of Canada Limited Chalk River Laboratories Chalk River, Ontario	MAPLE 1 and 2 Nuclear Reactors 2 × 10 MW(t)	NRCA 62/97	*
Atomic Energy of Canada Limited Whiteshell Laboratories Pinawa, Manitoba	Nuclear Research and Test Establishment	NRTE 2.1/96	1998.10.31

(Continued on the next page)

MW(t) — megawatt (thermal power)
NRCA — Nuclear Reactor Construction Approval
NRTE — Nuclear Research and Test Establishment
RPCA — Radioisotope Processing Construction Approval
* Construction approval expires when an operating licence is issued.

Annex VIII (Continued)

Nuclear Research and Test Establishment Licences

Chalk River Laboratories
(AECL)

Current Licence Number — NRTE 1.2/96
Expiry Date — 1998.10.31

Facility	Description
NRU Reactor	Nuclear research reactor, maximum power 135 MW thermal
NRX Reactor	Permanently shut down, to be decommissioned
Recycle Fuel Fabrication Laboratories	Fabrication of small quantities of mixed oxide fuel for physics tests and demonstration irradiations
PTR Reactor	Permanently shut down, to be decommissioned
ZED-2 Reactor	Research reactor, less than 200 W thermal
Universal Cells, Building 234	Three isolation cells for examining radioactive material up to 4.9 m in length
Molybdenum-99 Production Facility	Recovery of Mo-99
Industrial Materials Processing Electron Accelerator	Electron accelerator, 10 MeV, 50 kW beam
Pulsed High-Energy Linear Accelerator Facility	Electron accelerator, 13 MeV, 4.5 kW beam
Tandem Accelerator Superconducting Cyclotron	15 MeV Tandem accelerator and superconducting cyclotron
Health Physics Neutron Generator	Electrostatic accelerator, 150 KeV
Waste Treatment Centre	Treatment of solid and liquid waste
Fuels and Materials Cells Facility	12 isolation cells for examining radioactive material
Waste Management Areas	Storage and handling of waste
Nuclear Fuel Fabrication Facility, Building 405	Production of low-enriched uranium fuel for research reactors
Nuclear Fuel Fabrication Facility, Building 429	Production of low and high-enriched uranium fuel for research reactors
Heavy Water Upgrading Facility	Upgrading of activated heavy water
Combined Electrolysis, Catalytic Exchange Upgrading/Detritiation Test	Pilot scale facility to demonstrate means to treat downgraded heavy water

(continued on the next page)

Annex VIII (Continued)

Nuclear Research and Test Establishment Licences

Chalk River Laboratories (AECL)

Current Licence Number — RPCA 03/97 — NRCA 62/97

Facilities	Description
MDS Nordion Medical Isotope Reactor Project	
Maple 1 and 2	Two 10 MW reactors (under construction)
New Processing Facility	To produce radioisotopes for medical use (under construction)

(continued on the next page)

Annex VIII (Continued)

Nuclear Research and Test Establishment Licences

Whiteshell Laboratories (AECL)

Current Licence Number — NRTE 2.1/96
Expiry Date —1998.10.31

Facility	Description
WR-1	Organically cooled experimental reactor. Undergoing decommissioning, phase 1 complete, remaining radioactive components in long-term storage with surveillance
WL Concrete Canister Storage Facilities	Storage of irradiated fuel
Van de Graaff Accelerator	Proton accelerator, current less than 30 microAmps
14 MeV Neutron Generator	Shut down and mothballed
Active Liquid Waste Treatment Centre	Processing of liquid waste
WL Shielded Facilities	Post-irradiation examination of fuels, reactor core components and other radioactive material
WL Waste Management Area	Storage and handling of waste
SLOWPOKE Demonstration Reactor	2 MW pool-type reactor. Decommissioned
Whiteshell Irradiator	Electron beam accelerator, less than 1 kW, 9.3 MeV

Annex IX, March 31, 1998

Uranium Mine/Mill Facility Licences

Facility and Location (Licensee)	Licensed Capacity or Activity	Current Licence Number	Current Licence Expiry Date
Kiggavik-Scissons Schultz Baker Lake Area Northwest Territories (Urangesellschaft Canada Limited)	ore removal	MFRL-157-3.3	indefinite
Cigar Lake Project Saskatchewan (Cigar Lake Mining Corporation)	underground exploration	MFEL-152-4.1	1998.07.31
McArthur River Project Saskatchewan (Cameco Corporation)	construction	MFEL-171-0	indefinite
Midwest Joint Venture Saskatchewan (Minatco Limited)	suspended operations	MFEL-167-0.3	indefinite
Cluff Lake Saskatchewan (Cogema Resources Inc.)	2,020,000 kg/a uranium	MFOL-143-6.1	1998.12.31
Key Lake Operation Saskatchewan (Cameco Corporation)	5,700,000 kg/a uranium	MFOL-164-4	1999.09.30
McClean Lake Project Saskatchewan (Cogema Resources Inc.)	construction and operation	MFOL-170-0.1	1999.03.11
Rabbit Lake Operation Saskatchewan (Cameco Corporation)	6,500,000 kg/a uranium	MFOL-162-4	1998.10.31

(continued on the next page)

kg/a — kilogram per year
MFRL — Mining Facility Removal Licence
MFEL — Mining Facility Excavation Licence
MFOL — Mining Facility Operating Licence

Annex IX (Continued)

Uranium Mine/Mill Facility Licences

Facility and Location (Licensee)	Licensed Activity	Current Licence Number	Current Licence Expiry Date
Rayrock Northwest Territories (Indian and Northern Affairs Canada)	decommissioning	PSL-208/98	1998.06.30
Stanrock Mine Elliot Lake, Ontario (Denison Mines Limited)	shut down	MFOL-135-2.6	indefinite
Stanleigh Mine Elliot Lake, Ontario (Rio Algom Limited)	decommissioning	MFDL-352-0.1	indefinite
Beaverlodge Mining Operations* Beaverlodge, Saskatchewan (Cameco Corporation)	decommissioning	MFDL-340-0.1	indefinite
Dawn Lake Project Saskatchewan (Cameco Corporation)	decommissioning	MFDL-347-0.1	indefinite
Denison Mine Elliot Lake, Ontario (Denison Mines Limited)	decommissioning	MFDL-349-0.3	indefinite
Dubyna Mine* Uranium City, Saskatchewan (Cameco Corporation)	decommissioning	MFDL-340-0.1	indefinite
Panel Mine Elliot Lake, Ontario (Rio Algom Limited)	decommissioning	MFDL-346-0.8	indefinite
Quirke Mine Elliot Lake, Ontario (Rio Algom Limited)	decommissioning	MFDL-345-0.9	indefinite
Madawaska Mine Bancroft, Ontario (Madawaska Mines Limited)	decommissioning	DA-139-0.5	indefinite

DA — Decommissioning Approval
MFOL — Mining Facility Operating Licence
MFDL — Mining Facility Decommissioning Licence
PSL — Prescribed Substance Licence
* These two facilities are included under the same licence.

Annex X, March 31, 1998

Uranium Refinery, Conversion Facility and Fuel Fabrication Plant Licences

Licensee and Location (tonnes/year uranium)	Licensed Capacity Number	Current Licence Expiry Date	
General Electric Canada Incorporated Toronto, Ontario	1,300 (fuel pellets)	FFOL-221-5	1998.12.31
General Electric Canada Incorporated Peterborough, Ontario	1,200 (fuel bundles)	FFOL-222-5	1998.12.31
Earth Sciences Extraction Company Calgary, Alberta	70 (uranium oxide)	FFOL-209-10	1998.11.30
Cameco Corporation Blind River, Ontario	18,000 (UO_3)	FFOL-224-5	1999.12.31
Cameco Corporation Port Hope, Ontario	12,500 (UF_6) 2,000 (U) — (natural and depleted metal and alloys) 3,800 (UO_2) 1,000 (ADU)	FFOL-225-4	1999.12.31
Zircatec Precision Industries Incorporated Port Hope, Ontario	1,500 (fuel pellets and bundles)	FFOL-223-5	1999.12.31

ADU — ammonium di-uranate
FFOL — Fuel Facility Operating Licence
U — uranium
UF_6 — uranium hexafluoride
UO_2 — uranium dioxide
UO_3 — uranium trioxide

Annex XI, March 31, 1998

Waste Management Licences

Facility and Location (Licensee)	Treatment/ Type of Waste	Current Licence Number	Expiry Date
Radioactive Waste Operations Site 1 Bruce Nuclear Power Development Tiverton, Ontario (Ontario Hydro)	storage of old solid wastes from Ontario Hydro nuclear generating stations (no new waste)	WFOL-320-9.1	indefinite
Radioactive Waste Operations Site 2 Bruce Nuclear Power Development Tiverton, Ontario (Ontario Hydro)	incineration, compaction and storage of wastes from Ontario Hydro nuclear generating stations	WFOL-314-9	1998.05.31
Douglas Point Radioactive Waste Storage Facility Douglas Point, Ontario (Atomic Energy of Canada Limited)	storage of old solid wastes from Douglas Point Generating Station (no new waste)	WFOL-332-4	indefinite
Gentilly-2 Radioactive Waste Management Facility Gentilly, Quebec (Hydro-Québec)	storage of solid wastes from Gentilly-2 Nuclear Power Station and old solid wastes from Gentilly-1 Nuclear Power Station	WFOL-319-9	1999.12.31
Gentilly-1 Radioactive Waste Storage Facility Gentilly, Quebec (Atomic Energy of Canada Limited)	storage of old solid wastes from Gentilly-1 Nuclear Power Station (no new waste)	WFOL-331-4	indefinite
Point Lepreau Solid Radioactive Waste Management Facility Point Lepreau, New Brunswick (New Brunswick Power Corporation)	storage of solid wastes from Point Lepreau Generating Station	WFOL-318-9.1	1999.01.31
Pickering Used Fuel Dry Storage Facility Pickering, Ontario (Ontario Hydro)	storage of spent fuel from Pickering Nuclear Power Station	WFOL-350-1	1998.12.31
Edmonton, Alberta (University of Alberta)	incineration of low-level combustible liquid wastes and storage of aqueous and solid wastes from the University and Edmonton area	WFOL-301-10	1998.11.30
Port Granby, Ontario Newcastle, Ontario (Cameco Corporation)	storage of wastes from Cameco refinery and chemical treatment of drainage and run-off water	WFOL-338-3.2	indefinite

(continued on the next page)

WFOL — Waste Management Facility Operating Licence

Annex XI (Continued)

Waste Management Licences

Facility and Location (Licensee)	Treatment/ Type of Waste	Current Licence Number	Expiry Date
Suffield, Alberta (Department of National Defence)	storage of old solid wastes from the Department of National Defence	WFOL-307-6.1	indefinite
Toronto, Ontario (University of Toronto)	storage and handling of wastes from the University and Toronto area	WFOL-310-12	2000.01.31
Welcome, Ontario (Cameco Corporation)	storage of old wastes from previous Cameco Port Hope operations and chemical treatment of drainage and run-off water	WFOL-339-2.1	indefinite
Bruce Nuclear Power Development, Central Maintenance Facility Tiverton, Ontario (Ontario Hydro)	handling of wastes from decontamination of equipment and tools, and general maintenance activities at BNPD	WFOL-323-8	1999.08.31
Mississauga, Ontario (Monserco Limited)	storage and handling of wastes from the Toronto area	WFOL-335-5	1999.12.31
Saskatoon, Saskatchewan (University of Saskatchewan)	storage and handling of wastes from the University and Saskatoon area	WFOL-336-4.1	1998.07.31
NPD Waste Management Facility Rolphton, Ontario (Atomic Energy of Canada Limited)	storage of solid wastes from the partial decommissioning program	WFOL-342-2.5	indefinite
Port Hope, Ontario (Atomic Energy of Canada Limited)	storage of wastes from the remedial program	WFOL-344-1.1	indefinite
Oakville, Ontario (Canatom Radioactive Waste Services)	temporary storage of radioisotope waste awaiting shipment to AECL Chalk River Laboratories	PSL-205/99	1999.06.30
Port Hope, Ontario (Low-Level Radioactive Waste Management Office, Pine St. Extension)	contaminated soil storage	PSL-182/99	1999.06.30
(Floating Locations) (Low-Level Radioactive Waste Management Office, decontamination projects)	decontamination of historic waste sites	PSL-202/99	1999.11.30

PSL — Prescribed Substance Licence
WFOL — Waste Management Facility Operating Licence

Annex XII, March 31, 1998

Nuclear Liability Basic Insurance Coverage

Designated Nuclear Installation (Operator)	Basic Insurance
Bruce Generating Station A (Ontario Hydro)	$75,000,000
Bruce Generating Station B (Ontario Hydro)	$75,000,000
Darlington Generating Station (Ontario Hydro)	$75,000,000
Gentilly-2 Nuclear Power Station (Hydro-Québec)	$75,000,000
Pickering Generating Station A and B (Ontario Hydro)	$75,000,000
Point Lepreau Generating Station (New Brunswick Power Corporation)	$75,000,000
Port Hope Refinery (Cameco Corporation)	$4,000,000
Port Hope Fuel Fabrication Plant (Zircatec Precision Industries Incorporated)	$2,000,000
Research Reactor (McMaster University)	$1,500,000
SLOWPOKE Reactor (University of Alberta)	$500,000
SLOWPOKE Reactor (Dalhousie University)	$500,000
SLOWPOKE Reactor (École polytechnique)	$500,000
SLOWPOKE Reactor (Saskatchewan Research Council)	$500,000
SLOWPOKE Reactor (University of Toronto)	$500,000
Douglas Point Waste Storage Facility (Atomic Energy of Canada Limited)	*
Gentilly-1 Waste Storage Facility (Atomic Energy of Canada Limited)	*
Chalk River Laboratories (Atomic Energy of Canada Limited)	*
Whiteshell Research Laboratories (Atomic Energy of Canada Limited)	*
SLOWPOKE Reactor, Royal Military College (Department of National Defence)	*

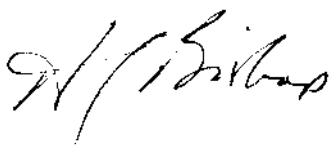
* Installation excepted from carrying insurance under Section 32 of the *Nuclear Liability Act*.

Annex XIII
Management Report

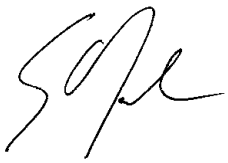
The management of the Atomic Energy Control Board is responsible for the preparation of all information included in its annual report. The financial statement has been prepared in accordance with the reporting requirements and standards established by the Receiver General for Canada for departmental corporations. The financial statement includes estimates that reflect management's best judgements. Financial information included elsewhere in the annual report is consistent with the financial statement.

Management is also responsible for developing and maintaining a system of internal control designed to provide reasonable assurance that all transactions are accurately recorded and that they comply with the relevant authorities, that the financial statement reports the Atomic Energy Control Board's results of operations and that the assets are safeguarded.

The Auditor General of Canada conducts an independent audit and expresses an opinion on the financial statement.



A.J. Bishop, M.D.
President



G.C. Jack
Director General of Corporate Services

Ottawa, Canada
May 28, 1998

Annex XIII (Continued)
Auditor's Report

To the Atomic Energy Control Board
and the
Minister of Natural Resources Canada

I have audited the statement of operations of the Atomic Energy Control Board for the year ended March 31, 1998. This financial statement is the responsibility of the Board's management. My responsibility is to express an opinion on this financial statement based on my audit.

I conducted my audit in accordance with generally accepted auditing standards. Those standards require that I plan and perform an audit to obtain reasonable assurance whether the financial statement is free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statement. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation.

In my opinion, this financial statement presents fairly, in all material respects, the results of operations of the Board for the year ended March 31, 1998 in accordance with the accounting policies set out in Note 2 to the financial statement.

John Wiersema, CA
Assistant Auditor General
for the Auditor General of Canada

Ottawa, Canada
May 28, 1998

Annex XIII (Continued)

Statement of Operations for the Year Ended March 31, 1998

Expenditures	**1998**	**1997**
Operations		
Salaries and employee benefits	$31,170,659	$30,478,634
Professional and special services	6,803,170	7,802,528
Accommodation	3,881,636	3,693,980
Travel and relocation	2,348,793	2,840,544
Furniture and equipment	1,393,285	1,632,105
Communication	796,509	755,142
Utilities, materials and supplies	696,850	857,890
Board Members' expenses	376,628	348,538
Information	270,972	375,513
Repairs	223,586	189,982
Equipment rentals	112,450	114,798
Miscellaneous	34,595	34,783
	48,109,133	49,124,437
Grants and contributions		
Safeguards Support Program	476,938	502,166
Other	91,381	147,585
	568,319	649,751
Total expenditures	48,677,452	49,774,188
Non-tax revenue		
Licence fees	33,551,979	30,072,647
Foreign training (Note 9)	1,700,924	1,248,243
Refunds of previous years' expenditure	93,928	193,061
Design assessment for foreign sales	8,203	2,678,326
Capital assets disposal	3,618	4,133
Fines and penalties	—	2,650
Miscellaneous	17,428	14,374
Total non-tax revenue	35,376,080	34,213,434
Net cost of operations (Note 3)	$13,301,372	$15,560,754

The accompanying notes are an integral part of this statement.

Approved by:

A.J. Bishop, M.D.
President

G.C. Jack
Director General of Corporate Services

Annex XIII (Continued)

Notes to the Statement of Operations

1. Authority, Objective and Operations

The Atomic Energy Control Board (AECB) was established in 1946, by the *Atomic Energy Control Act*. It is a departmental corporation named in Schedule II to the *Financial Administration Act* and currently reports to Parliament through the Minister of Natural Resources Canada.

The objective of the AECB is to ensure that nuclear energy in Canada is only used with due regard to health, safety, security and the environment, and to support Canada's participation in international measures to prevent the proliferation of nuclear weapons. The AECB achieves this objective by controlling the development, application and use of nuclear energy in Canada, and by participating on behalf of Canada in international measures of control.

The AECB administers the *Nuclear Liability Act*, including designating nuclear installations and prescribing basic insurance to be carried by the operators of such nuclear installations, and the administration of supplementary insurance coverage premiums for these installations. The sum of the basic insurance and supplementary insurance totals $75 million for each designated installation (Note 10). The number of installations requiring insurance coverage is 14.

The AECB's expenditure is funded by a budgetary lapsing authority. Revenue, including licence fees, is deposited to the Consolidated Revenue Fund and is not available for use by the AECB. Employee benefits are authorized by a statutory authority.

On April 1, 1990, the AECB *Cost Recovery Fees Regulations* came into effect. The general intent of these regulations is the recovery of all operating and administration costs of the AECB's regulatory activities relating to the commercial use of nuclear energy from the users of such nuclear energy. Educational institutions, publicly funded non-profit health care institutions and federal government departments are exempt from these regulations. The AECB costs associated with exempt organizations and costs related to its international safeguards and import/export activities are to remain as a cost to the Government.

Fees for each licence type have been established based on the AECB's cost of carrying out its regulatory activities. These include the technical assessment of licence applications, compliance inspections to ensure that licensees are operating in accordance with the conditions of their licence, and the development of licence standards. Revised fees were implemented on August 21, 1996 and continue to be based on 1992/93 regulatory activities.

On March 20, 1997, the federal *Nuclear Safety and Control Act* received Royal Assent. It will replace the *Atomic Energy Control Act*, but will not come into effect until proclamation by order of the Governor in Council, which must await the development and approval of regulations that will be applied under the new statute. It is anticipated that this will be completed by early 1999. On proclamation of the new Act, the AECB will become the Canadian Nuclear Safety Commission (CNSC).

The *Nuclear Safety and Control Act* mandates the CNSC to establish and enforce national standards in the areas of health, safety and environment. It establishes a basis for implementing Canadian policy and fulfilling Canada's obligations with respect to the non-proliferation of nuclear weapons. Enactment will also provide CNSC compliance inspectors with enforcement powers along with penalities for infractions in line with current legislative practices. The CNSC will be a court of record with powers to hear witness, take evidence and control its proceedings. It will be empowered to require financial guarantees, to order remedial action in hazardous situations and to require responsible parties to bear the costs of decontamination and other remedial measures. As well, the *Nuclear Safety and Control Act* provides for the recovery of costs of regulation from persons licensed under the Act.

Annex XIII (Continued)
Notes to the Statement of Operations

2. Significant Accounting Policies

The Receiver General for Canada specifies the reporting requirements and standards for departmental corporations. The AECB's most significant accounting policies are as follows:

a) Expenditure recognition

i) Expenditures are recorded on an accrual basis in the year they are charged to the Board's appropriation, with the exception of employee termination benefits and vacation pay which are recorded on a cash basis.

ii) Estimates of amounts for services provided without charge by Government departments are included in expenditure and are measured at the provider's cost.

b) Revenue recognition

i) Licence fees are recorded as revenue on a straight-line basis over the life of the licence (normally one or two years), except for licence fees regarding an application for a construction approval of a nuclear reactor in which case they are recognized over the period of the work performed by the AECB.

ii) Revenue for foreign training and design assessment for foreign sales is recognized over the period of the work performed by the AECB.

iii) Refunds of previous years' expenditure are recorded as revenue when received and are not deducted from expenditures.

c) Capital purchases

Acquisitions of capital assets are charged to operating expenditures in the year of purchase.

d) Contributions to superannuation plan

AECB employees participate in the superannuation plan administered by the Government of Canada and contribute equally with the AECB to the cost of the plan. Contributions by the AECB are charged to expenditure when disbursed.

Notes to the Statement of Operations

3. Use of Parliamentary Appropriations

		1998	1997
Vote 20 — Atomic Energy Control Board		$42,103,733	$43,611,550
Less:	Frozen allotment*	(1,106,109)	(41,068)
	Lapsed	(1,281,304)	(2,840,369)
		39,716,320	40,730,113
Add:	Statutory contributions to employee benefit plans	4,107,000	3,831,000
Total appropriations used		43,823,320	44,561,113
Add:	Services provided without charge by other Government departments:		
	Accommodation	3,408,932	3,387,140
	Employee benefits	1,377,000	1,476,000
	Other	68,200	349,935
		4,854,132	5,213,075
Total expenditures		48,677,452	49,774,188
Less:	Non-tax revenue	(35,376,080)	(34,213,434)
Net cost of operations		$13,301,372	$15,560,754

* Funds not available for use in the year.

4. Accounts Receivable

	1998	1997
As of March 31, the amounts for accounts receivable are as follows:		
Licence fees	$1,214,364	$371,124
Foreign training	304,941	230,771
Design assessment for foreign sales	—	588,921
Total accounts receivable	$1,519,305	$1,190,816

5. Licence Fees — Deferred Revenue

As of March 31, 1998, there are unearned licence fees received in the amount of $17,667,771 (1997 — $20,364,094).

Notes to the Statement of Operations

6. Liabilities

As of March 31, the amounts of liabilities are as follows:

	1998	1997
Accounts Payable and Accrued Liabilities	$4,155,016	$4,723,021
Salaries payable	1,586,571	1,245,935
Contractors' holdbacks	154,608	332,424
Total accounts and salaries payable	5,896,195	6,301,380
Vacation pay	2,152,180	2,017,877
Employee termination benefits	2,340,512	2,236,413
Total other liabilities	4,492,692	4,254,290
Total liabilities	$10,388,887	$10,555,670

Liabilities for vacation pay and employee termination benefits are not reflected in the statement of operations.

7. Licences Provided Free of Charge

The value of licences provided free of charge to educational institutions, publicly funded non-profit health care institutions and federal Government departments for the year ended March 31, 1998, amounted to $2,429,126 (1997 — $2,315,150).

8. Contingent Liabilities

At March 31, 1998, the AECB was defendant in a lawsuit amounting to $250,000. The lawsuit seeks damages for breach of statutory duties related to radioactively contaminated soil. The plaintiffs have not taken any action in this litigation for the past several years. Therefore, no provision has been made in the accounts for this contingent liability. Any settlement resulting from the resolution of this case will be paid from the Consolidated Revenue Fund.

9. Related Party Transactions

The Corporation enters into transactions with other Government departments, agencies and Crown corporations in the normal course of business. The AECB is related to Atomic Energy of Canada Limited (AECL) by virtue of common ownership by the Government of Canada.

AECB administers a special program for research and development in support of the safeguards program of the International Atomic Energy Agency. Atomic Energy of Canada Limited is the major contractor for this work by virtue of a contract that expires on March 31, 1999, which calls for annual payments of up to $2.3 million a year. For 1998, AECB paid $616,252 (1997 — $1,094,584) to AECL under this program.

On behalf of AECL, the AECB continues to develop, deliver and administer regulatory services for Chinese and Korean regulatory staff over a period of five years ending March 31, 2001. In accordance with the terms of the contract, the cost of the service is recovered from AECL. For 1998, the AECB recognized revenue of $1,070,537 from this project (1997 — $665,368).

Notes to the Statement of Operations

10. Nuclear Liability Reinsurance Account

Under the *Nuclear Liability Act*, all premiums paid by the operators of nuclear installations for supplementary insurance coverage are credited to a Nuclear Liability Reinsurance Account in the Consolidated Revenue Fund. Any claims against the supplementary insurance coverage are payable out of the Consolidated Revenue Fund and charged to the Account. There have been no claims against or payments out of the Account since its creation. The balance of the Account as at March 31, 1998, is $547,321 (1997 — $545,821).

The supplementary insurance coverage provided by the Government of Canada under the *Nuclear Liability Act*, as of March 31, 1998, is $590,000,000 (1997 — $590,000,000). Insurance coverage, by the Government of Canada, also includes a class of risks excluded as a liability of the principal insurers.

Annex XIII (Concluded)

Revenue and Cost of Operations by Activity for the Year Ended March 31, 1998

	1998				1997
	Revenue	Licences Provided Free of Charge	Total Value of Licences and Other Revenue	Cost of Operations	Cost of Operations
Regulatory Activities					
Nuclear reactors and heavy water plants	$22,682,401	$ —	$22,682,401	$26,620,699	$24,186,903
Research reactors	16,200	159,162	175,362	584,257	497,643
Nuclear research and test establishments	2,746,678	—	2,746,678	2,983,190	1,921,062
Uranium mines	3,114,866	—	3,114,866	3,111,417	3,182,038
Nuclear fuel facilities	856,120	—	856,120	806,075	926,934
Prescribed substances	31,672	9,315	40,987	79,177	139,415
Accelerators	114,700	343,372	458,072	447,169	357,185
Radioisotopes	3,111,220	1,788,824	4,900,044	8,433,035	7,733,322
Transportation	137,202	4,140	141,342	446,543	634,003
Waste management and decommissioning	709,042	114,450	823,492	1,504,575	1,769,416
Dosimetry	31,878	9,863	41,741	85,143	143,216
Import/export	—	—	—	443,569	402,340
	33,551,979	2,429,126	35,981,105	45,544,849	41,893,477
Non-Regulatory Activities					
Design assessment for foreign sales	8,203	—	8,203	5,508	4,993,927
Foreign training	1,700,924	—	1,700,924	1,521,663	1,178,405
Other	114,974	—	114,974	1,605,432	1,708,379
	1,824,101	—	1,824,101	3,132,603	7,880,711
Total	$35,376,080	$2,429,126	$37,805,206	$48,677,452	$49,774,188