AECL

Atomic Energy of Canada Limited

Annual Report 1997-1998

(Cover photograph)

Green energy for blue skies and future generations...

Children play in a park adjacent to one of Ontario Hydro's CANDU® nuclear reactors. The use of AECL's CANDU technology for electricity production in Canada has prevented the release of over 1 billion tonnes of greenhouse gases that cause global warming, over the last 30 years.

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Corporate Profile

Atomic Energy of Canada Limited (AECL) was established in 1952 as a Crown corporation and reports to Parliament through the Minister of Natural Resources. AECL develops, designs and markets CANDU® power reactors, MAPLE research reactors and MACSTOR™ waste storage facilities and manages the construction of nuclear reactor projects worldwide.

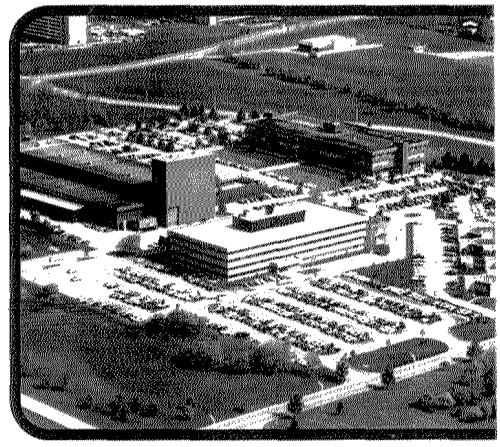
AECL's accomplishments also include the development of a variety of products and services that are now in use around the world. The flagship product, the CANDU reactor, supplies about 15 per cent of Canada's electricity and is an important component of energy programs on four continents.

The corporation continues to build upon these achievements by advancing the research and engineering that underlie the reactor products and by supplying R&D and engineering services to CANDU plants at home and abroad. The science and technology that support the reactor business have made significant contributions that are recognized internationally. They have also enhanced national science and energy objectives and contributed to the evolution of Canada's nuclear policies.

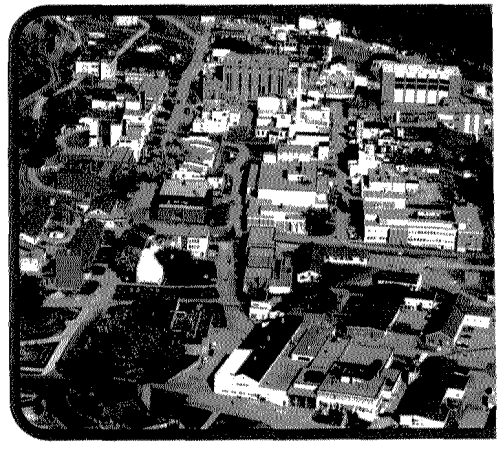
AECL's product development strategy continues to consolidate the corporation's position as a leading supplier of full-scope nuclear power capabilities. This gives it the capacity, in collaboration with Canadian and international partners, to capture a substantial share of the emerging global nuclear power market with a competitive and superior product.

AECL is dedicated to meeting its customers' needs, and to continuous improvement and sustainable development. The CANDU success is a result of close collaboration with utilities and the private sector, and continues to make an important contribution to job and wealth creation.

As of March 31, 1998, the corporation employed 3,652 people full-time at sites in Canada and overseas.



Sheridan Park, Mississauga



Chalk River Laboratories

Letter of Transmittal

The Honourable Ralph Goodale, P.C., M.P.
Minister of Natural Resources
House of Commons
Ottawa, Canada

Dear Mr. Goodale:

In accordance with subsection 150(1) of *The Financial Administration Act,* I am pleased to submit the Annual Report of Atomic Energy of Canada Limited (AECL) for the fiscal year ended March 31, 1998.

AECL's CANDU technology has long been a leader in delivering safe, economic electricity without contributing to global warming. The United Nations' *Third Conference of the Parties* held in Kyoto, Japan in December 1997 reaffirmed the important contribution that nuclear power has made and can continue to make in reducing the production of greenhouse gases. Ambitious new targets were set in Kyoto for industrialized countries to reduce greenhouse gas emissions. This past year AECL continued in its efforts to be part of the solution to this global issue.

On September 11, 1997, I attended a ceremony in the Republic of South Korea to mark the completion of the Wolsong 2 reactor. This 700 MWe-class CANDU reactor, which began commercial operation on July 1, 1997, has performed exceedingly well, achieving a 97 per cent capacity factor in calendar 1997. Wolsong Unit 3, which achieved its first sustained nuclear reaction on February 20, 1998, was connected to the Korean power grid on March 25. Work continues on Wolsong Unit 4, which is expected to go into service in 1999.

In China, two 700 MWe-class CANDU reactors are under construction at the Qinshan site. The units, expected to go into service in 2003, will help to meet China's growing energy requirements and its desire to find alternative sources of supply. Furthermore, this project is creating or sustaining approximately 27,000 person years of employment in Canada, and over 125 private sector Canadian companies are expected to provide goods and services for construction.

AECL was one of the major sponsors and organizers of the 11th Pacific Basin Nuclear Conference (PBNC '98), which was held in Banff, Alberta, May 3 to 7. PBNC '98 highlighted the advantages, needs and issues associated with the growth of nuclear power in the Pacific Rim in the 21st century, and the role of international cooperation in facilitating this growth.

In the past year, AECL continued to meet the challenge of reduced R&D funding. The corporation completed the implementation of all financial reductions required by the Government of Canada's Program Review and has modified its programs to ensure a healthy future for the CANDU business, MAPLE reactors and reactor services.

While this report covers the period to March 31, I wish to draw your attention to a change which has since taken place in AECL's presidency. On July 31, 1998, Reid Morden retired from his position as president and CEO, after 35 years of dedicated public service. Under Mr. Morden's tenure, the corporation experienced unprecedented market success and was restructured

into a single, integrated organization focused on the CANDU business. On behalf of the Board of Directors, I extend my sincere appreciation to him for his efforts and the success that AECL enjoyed under his leadership.

I am pleased to advise that Allen Kilpatrick was appointed to succeed Mr. Morden as the corporation's president and CEO, effective August 1, 1998. Mr. Kilpatrick most recently served as AECL's vice-president, Marketing and Sales. His appointment will ensure both continuity and uninterrupted focus on AECL's immediate and future business objectives.

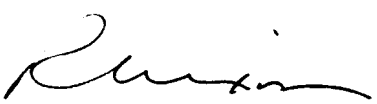
This year, I was also pleased to welcome Pierre Fortier, J. Raymond Frenette and Jean-Pierre Soublière as new members of the Board of Directors. I wish to thank outgoing members Lino J. Celeste, Pierre Linteau and W. Steven Vaughan for their valuable contributions. Mr. Celeste, a member of AECL's Board of Directors since 1982, was its longest serving member.

AECL's Board of Directors is committed to ensuring that the corporation has an effective corporate governance system which adds value and assists the corporation in achieving its public policy and commercial objectives. In 1997, the Board established the Committee on Corporate Governance and approved corporate governance guidelines, which are outlined in a special section in this report, along with governance activities undertaken during the year in review.

Overall accountability for environmental protection within AECL lies with AECL's Board of Directors, acting through the Environment Committee. The Environment Committee is charged with the continuing responsibility to ensure that the corporation maintains high environmental standards for all of its activities. In 1997-1998, the Committee satisfied itself, with independent verification, that the corporation's environmental activities and site practices met or exceeded all legal and regulatory requirements, that the corporation's staff charged with implementing its environmental activities are highly trained, competent and conscientious, and that all of the corporation's activities are planned and executed with a high level of sensitivity to their environmental implications. The Committee also satisfied itself that the corporation is currently allocating the required human and monetary resources to its environmental activities.

The Board of Directors will continue to work with its shareholder to ensure that AECL maintains its international reputation and continues to create a beneficial and sustained contribution to Canada.

Respectfully,



Robert F. Nixon
Chairman of the Board

Corporate Governance

The Board of Directors of Atomic Energy of Canada Limited is committed to ensuring that the corporation has an effective corporate governance system which adds value and assists the corporation in achieving its public policy and commercial objectives.

The Committee on Corporate Governance was established by the Board of Directors in 1997, and approved the following guidelines, which are the foundation of AECL's corporate governance procedures and policies.

1. The Board of Directors of AECL shall explicitly assume responsibility for the stewardship of the corporation.
2. The Board of Directors of AECL shall examine its public policy objectives and periodically the legislated mandate to ensure their continuing relevance.
3. The Board of Directors of AECL shall ensure that the corporation communicates effectively with the Crown, other stakeholders and the public.
4. The Board of Directors and management shall develop an effective working relationship.
5. The Board of Directors shall ensure that the Board can function independently.
6. In recognition of the importance of the position of the President and Chief Executive Officer, the Board of Directors of AECL shall periodically assess the President and Chief Executive Officer's position and evaluate the President and Chief Executive Officer's performance.
7. The Board of Directors of AECL shall assess its effectiveness and initiate renewal of the Board.
8. Directors of AECL shall receive orientation and education programs appropriate to their needs.
9. The Board of Directors shall review the adequacy and form of compensation for directors.
10. The Board of Directors shall assume responsibility for developing AECL's approach to governance issues.

The Board has undertaken to report on its governance activities each year in the corporation's Annual Report.

Integral to the Board's responsibility for stewardship of the corporation is the development and approval of the Corporate Plan. The Corporate Plan was approved at the meeting of the Board held in January of this year, and subsequently forwarded to the Minister of Natural Resources. The Corporate Plan sets out the business horizon for the corporation for the ensuing five-year period, and also, during the course of its development, directly and indirectly ties the commercial objectives for the corporation to its public policy objectives, and its legislated mandate. It also serves as an important communications vehicle between the Board and its shareholder, the Crown.

As part of its governance activities, the Board is committed to maintaining an effective working relationship with management, while at the same time ensuring the Board can function independently. Effective working relationships, as well as independence, are predicated on information exchange and communications. Board members were surveyed this year as to their relationship with management, the quality of information received by the Board, the timeliness of its delivery to enable informed decisions to be taken, and the overall effectiveness of the Board. The Board was satisfied with its relationship with management, and the quality of the materials it received, and that its decisions were made both independently and on an informed basis.

At a recent meeting of the Board, the International Code for Business Ethics was adopted in principle, and referred to the Committee on Corporate Governance for development of procedures for its implementation in the coming year.

As part of the Board's commitment to continuous development for directors, orientation sessions were conducted for new directors. Site tours of the corporation's Chalk River facility, and its Sheridan Park engineering laboratory were held.

A meeting of the Board was held in New Brunswick to enable members to meet with senior officials of New Brunswick Power and tour the Point Lepreau Nuclear Generating Station.

A reference manual for directors containing pertinent corporation information was developed, as was an integrated schedule for both the Board and its committees.

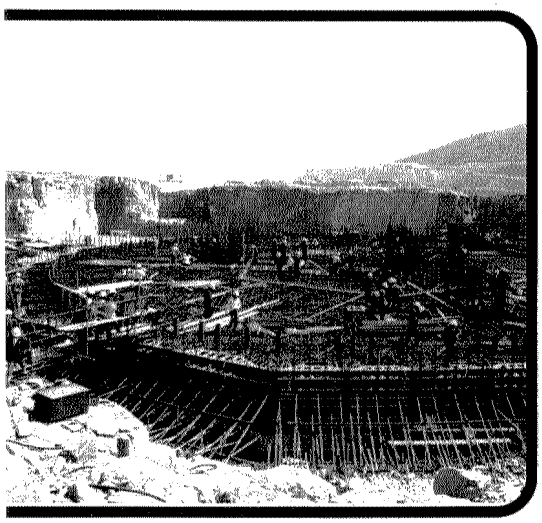
Terms of reference for the Chairman, the President and Chief Executive Officer and individual directors were developed, and a new committee, the Finance Committee, was established, with the responsibility for reviewing the risks related to all major proposals, prior to their review by the Board.

The Board of Directors will continuously seek to improve its governance activities in the context of the guidelines it has adopted, with a view to enhancing shareholder value.

President's Message

I am delighted to have the honour of succeeding Reid Morden as president and CEO of AECL and to report on some of the key events that occurred during the past year under his tenure.

The stage was set for serious action on global warming at the United Nations' *Third Conference of the Parties* held in Kyoto, Japan, in December 1997. Under the new legally binding Kyoto Protocol, industrialized countries must reduce their collective emissions of heat-trapping gases by 5.2 per cent below 1990 levels, by the period 2008 to 2012.



Qinshan, China

FOR NEARLY 30 YEARS, AECL HAS BEEN LEADING THE WAY IN HELPING TO CONTROL GREENHOUSE GAS EMISSIONS IN CANADA AND THROUGHOUT THE WORLD.

Meeting that ambitious target will be a major challenge considering that world demands for energy are expected to double in the next 25 years. Meeting this target will require actions in a variety of areas, but clearly nuclear power has to be part of the energy mix. For nearly 30 years AECL has been leading the way in helping to control greenhouse gas emissions in Canada and throughout the world. Since 1971, nuclear power in Canada alone has averted the atmospheric release of no less than a billion tonnes of CO_2.

In the Asia-Pacific region, electricity growth over the next 15 years is forecast to nearly equal the current world installed nuclear capacity, the current economic downturn notwithstanding. In 1997-1998, AECL made significant progress in establishing proven CANDU technology in this market to provide safe, clean and economical electricity, without contributing to global warming. Excavation work continued in China at the Qinshan site, 125 kilometres south of Shanghai, in preparation for two 700 MWe-class CANDU reactors. First concrete was poured on June 8, 1998. In the Republic of Korea, Wolsong Unit 2 entered commercial operation on July 1, 1997. Wolsong Unit 3 achieved first criticality on February 20, 1998 and was connected to the Korean power grid on March 25, 1998. Wolsong Unit 4 will go into service in 1999.

In Europe, AECL and its partner ANSALDO continued negotiations to complete a second CANDU unit at the Cernavoda nuclear power station, in Romania. This project, deemed a national priority by the Government of Romania, will further reduce the country's dependency on imported oil for energy production.

AECL submitted a competitive bid in October 1997 to supply two CANDU reactors to Turkey. TEAS, the Turkish utility, is evaluating three bids and we are awaiting a decision. Before a decision is made to proceed, Turkish environmental law requires that an environmental assessment of the project be conducted. If AECL is selected, it will participate in this assessment using well-developed Canadian methodologies and practices.

Countries implementing and considering the CANDU option, are cognizant of the fact that AECL considers the environment and safety in every phase of the design, manufacturing, construction and commissioning of each CANDU reactor. In 1997-1998, AECL continued to build on the demonstrated strengths of its CANDU technology, through its ongoing development of products that will compete with other nuclear plants, as well as with fossil-fueled plants well into the next millennium.

In Canada, AECL's commitment to the environment and safety is applied to the products, services, and assistance that it provides to Canadian utilities in maintaining the performance of their reactors. AECL continued to provide services to Ontario Hydro, during a year of major changes in the utility's nuclear operations. The corporation is one of many suppliers from within and outside Canada helping Ontario Hydro improve the performance of its operating units and return other units to service.

AECL's commitment to the environment and safety also is reflected in the management of its sites. AECL initiated a $12 million program in 1997 to upgrade Chalk River Laboratories' waste treatment centre. The project reinforces AECL's commitment to the safe management of the Chalk River site, to continued protection of the environment, and to the health and safety of AECL's workers and neighbors. When completed in the year 2000, the centre will not only treat all low-level liquid wastes generated by the laboratories, it will provide additional treatment capacity for new facilities such as the two MAPLE reactors currently under construction for the MDS Nordion Medical Isotopes Reactor Project (MMIR).

In April 1997, following public consultation, the Atomic Energy Control Board (AECB) approved the environmental assessment for the MMIR project. The project, dedicated to medical isotope production, will be built and operated to meet requirements that ensure the health and safety of AECL staff and the public and that adequately protect the environment. MMIR project progress is detailed in the Commercial Operations section of this report.

To demonstrate the importance that AECL places on the role of Canadian industry in safeguarding the environment, in 1997-1998 AECL sponsored one of the *Financial Post Environment Awards for Business*. The *Education Award* recognizes an educational or awareness program designed to educate students or consumers about specific environmental issues.

In 1997-1998, AECL partnered with the YTV television network and the Toronto Public Library to undertake initiatives that promote science education. AECL sponsored for the first time the *YTV Achievement Award for Innovation, Science and Technology*, which aims to demonstrate the value of science literacy by recognizing a young person's special achievement in science. AECL is also funding the Toronto Public Library's *Science Net*, a Canadian Web site that will provide students, educators and the general public with easy and thorough access to authoritative science information on the Internet. The Marketing and Sales section of this report contains additional detail on these projects.

AECL furthered scientific endeavor during the year through its participation in two important undertakings. The corporation is co-funding McMaster University's Brockhouse Chair in the Physics of Materials, in honor of Dr. Bertram Brockhouse, who shared the 1994 Nobel Prize in Physics. Dr. Brockhouse worked at Chalk River in the 1950s and in 1962 went to Hamilton, Ontario to begin a distinguished program at McMaster University in which many outstanding young scientists were trained as skilled researchers.

AECL is also supporting an experimental project of international scientific interest, with its loan of 1,100 tonnes of heavy water to the Sudbury Neutrino Observatory Institute. The water is vital to the heart of the observatory's detector which will detect sub-atomic particles called neutrinos in research into how the sun works and the origin and future fate of the universe.

The federal government's Program Review, announced in 1996, was aimed at determining how AECL can maintain a viable CANDU business, while reducing the cost to the shareholder. In the past year, AECL completed the implementation of all financial reductions required by the Review. As a result, the federal government's funding of AECL drops to $100 million in 1998-1999 from $174 million in 1996-1997. This budget dictates that only research and development that support the CANDU business will continue and that AECL be increasingly dependent on commercial revenues.

Throughout the year, the Canadian Government continued to seek opportunities to commercialize Whiteshell Laboratories in Manitoba. The process has been much more complex and difficult than anyone had anticipated. Delay in its completion has constrained AECL's planned consolidation of activities to Sheridan Park and Chalk River.

During a period of significant change in the corporation, the employees of AECL have continued to display the diligence, dedication and expertise that ensures AECL's competitiveness in the global market place.

R. Allen Kilpatrick
President and Chief Executive Officer

Marketing and Sales

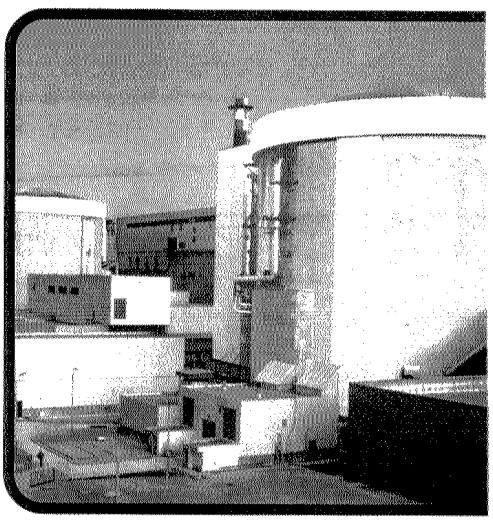
The United Nations' *Third Conference of the Parties* held in Kyoto, Japan, in December 1997, focused attention on the growing concern about global warming caused by greenhouse gases. Nuclear power was identified as part of the solution to this global issue. In this regard, Canada's CANDU technology has been leading the way in controlling greenhouse gas emissions. Since 1962, use of CANDU technology in Canada has prevented the release of no less than one billion tonnes of CO_2 into the atmosphere.

Following the Kyoto conference, increasing recognition that nuclear power has a role to play in controlling greenhouse gas emissions augurs well for future CANDU sales. AECL is confident that the corporate target it set in 1996 of selling 10 CANDU reactors in 10 years remains achievable. The corporation's research and development activities continue to focus on improved economics and product enhancements that further increase CANDU competitiveness and benefit AECL's international marketing efforts.

China and the Republic of Korea continue to be important markets to AECL. As part of the "10 in 10" sales target, AECL concluded a contract with the China National Nuclear Corporation in November 1996 for the sale of two 700 MWe-class CANDU reactors. Since then, excavation work has been under way at the Qinshan site, 125 kilometres south of Shanghai. During the year, significant progress also was made on Wolsong Units 2, 3 and 4. Further detail on these projects is provided in the Commercial Operations section of this report.

AECL continues to pursue other opportunities in the rapidly growing Asia-Pacific market for electrical generation capacity. Despite the current regional economic downturn, Indonesia, the Philippines, Thailand and Vietnam are planning for the future in examining the nuclear option and anticipate the introduction of nuclear energy in the next 10 to 15 years. To further international cooperation and the growth of nuclear power in the Pacific Rim, Canada hosted the 11th Pacific Basin Nuclear Conference (PBNC) in Banff, Alberta, May 3 to 7, 1998. AECL collaborated with other key members of the Canadian nuclear industry in planning the event that drew more than 600 international participants.

IN CANADA, IMPROVING THE SCIENCE CULTURE IS KEY TO PUBLIC UNDERSTANDING AND ACCEPTANCE OF THE IMPORTANT ROLE THAT THE NUCLEAR INDUSTRY PLAYS IN MEETING DOMESTIC AND WORLD ENERGY NEEDS IN AN ENVIRONMENTALLY SUSTAINABLE AND RESPONSIBLE MANNER.



Cernavoda, Romania

AECL places a high priority on the education and training of current and prospective customers. The corporation's sponsorship and staffing of a chair of nuclear engineering at Chulalongkorn University in Bangkok from 1995 to 2000 demonstrate AECL's commitment. This program has been supplemented by the Canadian International Development Agency's human resources

development program to link Canadian and Thai academic institutions and staff and by the support of the Thai utility, Electricity Generating Authority of Thailand, for a public education program conducted jointly by the university and AECL. The Master's degree class at Chulalongkorn includes two Vietnamese students supported by AECL scholarships. AECL has also sponsored seminars and short courses in Indonesia, the Philippines and Vietnam in such subjects as nuclear waste management, reactor safety, regulation of nuclear power and health and environmental science, as well as training attachments and courses in Canada.

Thanks to the extensive collaborative efforts of its staff, AECL submitted a very competitive bid in October 1997 to supply two CANDU 6 reactors to Turkey. TEAS, the Turkish utility, is evaluating three bids and AECL is awaiting a decision.

In Europe, AECL is pursuing possible projects in Hungary and Romania. In May 1997, AECL completed a feasibility study for two 700 MWe-class CANDU 6 reactors to be constructed at the Paks site in Hungary. Subsequently, MVMrt, the Hungarian utility, issued an Invitation to Bid for the installation of one reactor. The bid proposal is a two-phase process representing technical and commercial components. In October 1997, AECL responded to the first phase of bidding and was selected to submit a full commercial proposal for the second phase. AECL submitted a bid, together with the Paks Nuclear Power Company, to MVMrt on October 9, 1998.

During the year, AECL and its partner ANSALDO continued negotiations to complete a second CANDU unit at the Cernavoda nuclear power station, in Romania. The Government of Romania has deemed this project a national priority. AECL opened a marketing office in Bucharest during the year, to further support its ongoing activities in the country.

AECL's president and CEO and vice-president, Marketing and Sales, accompanied Canada's Prime Minister on the Team Canada trade mission to South America in January 1998. They met with government and utilities representatives in Brazil and Chile to discuss future needs for generating capacity in these countries. In Argentina, where the Embalse CANDU 6 reactor continues to operate very well and where AECL provides services, AECL signed two agreements with the *Comisión Nacional de Energia* to cooperate in technological areas and research and development.

The Government of Australia has authorized the construction of a multi-purpose nuclear research reactor, subject to a successful environmental assessment, to replace the country's Hi-Flux Australian Reactor (HIFAR). Located in Lucas Heights, outside Sydney, HIFAR will be shut down and decommissioned by 2003. AECL submitted its qualification statement in accordance with the Invitation to Bid document on October 11, 1998.

AECL continues to strengthen its capabilities in identifying, analyzing and meeting the needs of current and potential overseas markets. In 1997-1998, AECL launched the *Energy for the Next Millennium* campaign. Central to this campaign was a 62-page marketing book to provide information on AECL, its products and services, and its business approach to AECL's

customers and potential customers worldwide. An international advertising and publicity campaign in nuclear and energy-related trade journals was launched in tandem. AECL developed brochures and videos in support of all products and markets, and produced exhibits for trade shows in China, Korea, Turkey, Australia and Canada.

In Canada, improving the science culture is key to public understanding and acceptance of the important role that the nuclear industry plays in meeting domestic and world energy needs in an environmentally sustainable and responsible manner. In the past year, AECL undertook public education initiatives, with the goal of enhancing science literacy, particularly among youth. These initiatives included AECL's partnership with the YTV television network and with the Toronto Public Library.

In 1997, AECL sponsored, for the first time, the *YTV Achievement Award for Innovation, Science and Technology.* The annual awards program, which is broadcast in April, celebrates individual accomplishments of Canadian youth and encourages and inspires other young people to make their own personal difference.

AECL also sponsored *Sci-Non-Fi* on the YTV News. This 13-week television series of science segments conveyed to young people the excitement and importance of science and technology, with a view to encouraging them to pursue careers in the field. The segments, which were watched by about 700,000 young people each week, covered a range of topics including nuclear energy, lasers, space travel, robotics, nutrition, medicine and bionics.

AECL is funding the Toronto Public Library's *Science Net,* a Canadian Web site that will provide students, educators and the general public with easy and thorough access to authoritative science information on the Internet. *Science Net* will not provide an exhaustive list of links to all available Web sites, rather it will feature reputable sites with accurate information. Library selection criteria similar to those currently used to choose books will be applied. Users will be able to browse through selected Web sites the same way that they would browse through books on a library shelf. *Science Net's* series of subject specific "gateways" will be tied to the science curriculum of schools across Canada. The first gateway was launched in the fall of 1998.

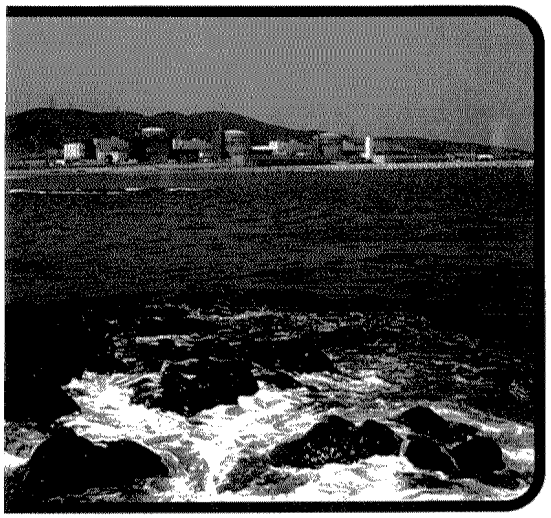
Commercial Operations

CANDU Projects

Republic of Korea

AECL continued to make significant progress on Wolsong Units 2, 3, and 4. Wolsong 2 was linked to the Korean grid on April 1, reached full power on April 28 and entered commercial operation on July 1. The reactor achieved a 97 per cent capacity factor in 1997.

Wolsong Unit 3 achieved its first sustained nuclear reaction on February 20, 1998 – a record 65 months from the effective contract date and the shortest duration for a CANDU 6 reactor to date. The reactor was connected to the Korean power grid on March 25. During the year, AECL also shipped 196 tonnes of heavy water to Korea for the Wolsong 3 reactor. Work continued on Wolsong Unit 4, which is expected to go into service in 1999.



Wolsong, Republic of Korea

WOLSONG UNIT 3 ACHIEVED ITS FIRST SUSTAINED NUCLEAR REACTION ON FEBRUARY 20, 1998 – A RECORD 65 MONTHS FROM THE EFFECTIVE CONTRACT DATE AND THE SHORTEST DURATION FOR A CANDU 6 REACTOR TO DATE.

Romania

Cernavoda Unit 1 has been in commercial operation since December 2, 1996, with the operation since July 1, 1997 under Romanian control. AECL is providing advisors to assist RENEL in key areas of operation, maintenance, technical support and simulator training. To the end of March 1998, the unit had achieved a capacity factor of 90 per cent since going into service.

AECL, with its Balance of Plant partner ANSALDO, performed limited work on Cernavoda Unit 2, under direct contract from RENEL. The work has concentrated on inspection and repair, preparation of the unit for the completion activities and engineering.

China

Two 700 MWe-class CANDU units are under construction at Qinshan, in Zhejiang Province, China. The effective contract date was February 12, 1997. First containment concrete for Unit 1 is now complete. Engineering and procurement are on schedule to support the construction program, which will see both units in service in 2003.

MDS Nordion Medical Isotopes Reactor (MMIR) Project

AECL is the main producer of medical isotopes, including molybdenum-99 (Mo-99), iodine-125, iodine-131 and xenon-133, for the global market. The National Research Universal (NRU) reactor at Chalk River Laboratories (CRL) currently produces approximately two thirds of the world's market demand for Mo-99 – the isotope most widely used in hospitals and clinics to diagnose various diseases. AECL produces these medical isotopes exclusively for MDS Nordion, which purifies the product and distributes the isotopes worldwide from its facilities in Kanata.

In August 1996, AECL and MDS Nordion signed agreements to secure the ongoing supply of isotopes, and to build and operate two MAPLE reactors and an isotope processing facility at CRL. MDS Nordion will own the facilities, but AECL will operate them.

In April 1997, following public consultations, the Atomic Energy Control Board (AECB) approved the environmental assessment for the MMIR project. The AECB granted construction approvals for the facilities in December 1997. Excavation has been completed and construction of the buildings for the second reactor and the isotope processing facility started in April 1998. The building for the first reactor was constructed in the early 1990s as part of the MAPLE-X10 project.

Start-up of the first MAPLE reactor continues to be scheduled for 1999 and start-up of the second reactor for the year 2000.

CANDU and Technical Services

The AECL Services Business continued to focus primarily on providing engineered products, support services and expert assistance to CANDU owners to maintain the performance of their reactors.

AECL continued to provide services to Ontario Hydro, during a year of major changes in the utility's nuclear operations. Ontario Hydro began implementation of a Nuclear Asset Optimization Plan recovery program, aimed at improving the performance of the 12 operating units at Pickering B, Bruce B and Darlington stations, while placing the units at Pickering A and Bruce A in a laid-up mode. The plan is to return the Pickering A units to service in the period from 2000 to 2002 and the Bruce A units from 2003 to 2009. AECL is providing competitive proposals as one of many suppliers from within and outside Canada who are helping Ontario Hydro to achieve their recovery. AECL's support is in areas of traditional strength, such as environmental qualification, seals and elastomers, safety analysis, configuration management and design basis restoration.

The CANDU 6 reactors operating in Canada and offshore recorded an average capacity factor of 85.7 per cent, led by Wolsong 1 in the Republic of Korea at 101.2 per cent in 1997, which ranked first in performance in the world (out of 423 reactors), according to *Nuclear Engineering International* figures. AECL continued to provide key products and services to each station, ranging from safety analysis to site services teams for SLARette and other on-site campaigns, which helped the utilities achieve these high performance levels.

With the withdrawal of one of AECL's major suppliers from the Qinshan project in China, AECL's services business assumed the responsibility for supplying and testing CANDU fuelling machines. In addition to supplying the fuelling machines for the Qinshan project, in October 1997 AECL was awarded a contract worth more than $20 million by the Korea Electric Power Corporation to supply spare fuelling machines and ram assemblies for Wolsong Units 2, 3 and 4. These machines will serve as back-up during routine servicing of the Wolsong reactors' regular fuelling machines. The fabrication of both sets of fuelling machines is in progress.

The experience and skills gained from the CANDU technology provides AECL's services business with some unique commercial advantages that it can apply in non-CANDU nuclear markets. AECL continued to provide a variety of products and services to numerous non-CANDU clients. AECL also continued to provide special expertise in executing various Government of Canada nuclear safeguards programs and completed a four-year nuclear safety study in Russia and Lithuania funded by the Canadian International Development Agency.

Spent Fuel Dry Storage

The future worldwide need for spent fuel storage services presents significant business opportunities for AECL. AECL is pursuing various opportunities for its MACSTOR (Modular Air-Cooled Storage) technology – a dry storage system which has passed stringent environmental and regulatory reviews and has been licensed and used in Canada since 1995. In 1996-1997, AECL was one of two companies competing for a contract to supply spent fuel storage capacity for Lithuania's Ignalina Nuclear Power Plant (NPP). In August 1998, AECL successfully completed negotiations to supply its MACSTOR technology to Lithuania's Ignalina NPP.

MOX Project

AECL continued to develop the option of burning weapons plutonium as MOX (mixed oxide) fuel in CANDU reactors. At the Nuclear Summit in Moscow in April 1996, world leaders encouraged international cooperation to assist Russia and the United States with their excess weapons plutonium disposition programs, through "further feasibility studies" and "small-scale demonstrations and tests." AECL has been working closely with the Russian Ministry of Atomic Power, Minatom, and the United States Department of Energy on both of these areas. The goal is to provide for transparent, parallel, draw down of excess weapons plutonium from the U.S. and Russia, such that the plutonium could never again be used for nuclear weapons – turning "swords into ploughshares."

Research and Product Development

CANDU Technology for the Next Century

AECL is committed to developing products that will compete with other nuclear plants, as well as with fossil-fuelled plants, well into the next century. Activities are focused on improved economics, further enhanced safety systems, and fuel cycle flexibility.

CANDU Reactors

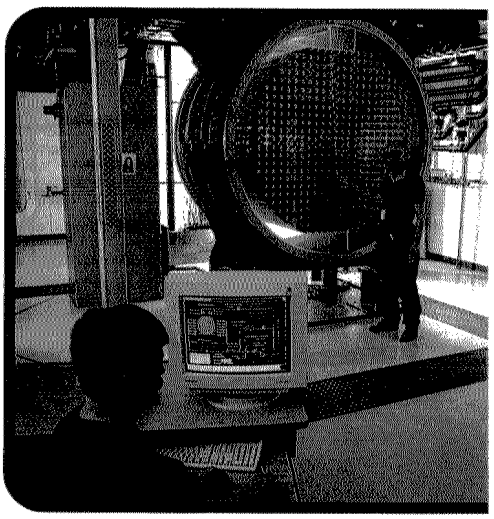
In 1997-1998, AECL submitted a major proposal for two CANDU 6 reactors at the Akkuyu site in Turkey. To increase the attractiveness of the bid, the product was enhanced in many ways. Key enhancements included a shorter project schedule (which was based on constructability studies), enhanced seismicity to meet Turkish requirements, upgrades to the control centre, and a number of additional features resulting from other AECL R&D programs.

During the year, a study to enhance CANDU 6 economics was successfully completed. Working with equipment suppliers and construction specialists and utilizing advanced engineering tools will result in major efficiencies in future CANDU projects.

The CANDU 9 is an evolutionary design that is based on currently operating CANDU plants. During 1997-1998, the CANDU 9 design team advanced the engineering to the point where a turnkey proposal could be developed. Such a proposal was submitted to the Korean utility KEPCO in November 1997.

Aging of nuclear power plants has gained prominence in the last few years. To address this issue for CANDU plants, a comprehensive plant life management program was undertaken in 1997-1998. As a part of this program, a "technology watch" initiative was launched with the objective of early identification of aging mechanisms.

AECL IS COMMITTED TO DEVELOPING PRODUCTS THAT WILL COMPETE WITH OTHER NUCLEAR PLANTS, AS WELL AS WITH FOSSIL-FUELLED PLANTS, WELL INTO THE NEXT CENTURY.



Yvan Lachance (foreground) and Pat Bindner prepare the Moderator Test Facility at Chalk River Laboratories for a test simulation of CANDU moderator coolant flow.

Research Reactors

The Canadian Neutron Facility (CNF) is proposed as a replacement for the National Research Universal (NRU) reactor to develop CANDU fuels and materials, and to support advanced materials research. In 1997-1998, a task force defined a CNF concept that can meet the needs of the CANDU development and neutron-scattering programs in a cost-effective way.

Fuel Channels

Over the past several years, improvements to CANDU calandria tubes have been developed that mitigate the consequences of various hypothetical accident scenarios. For example, if both normal and emergency core cooling were unavailable, the fuel would be protected since heat would be transferred passively to the moderator. To enhance this process, AECL has recently completed the development of a calandria tube surface treatment that allows even more effective transfer of heat to the moderator.

Pressure tube lifetime is being extended by elucidation of the various mechanisms that might lead to premature aging. Improvements to the control of such properties as texture, microstructure, and microchemistry are leading to enhanced pressure tubes that are capable of achieving long lifetimes.

Reactor Safety

BTF-105B, the latest in a series of severe-fuel-damage experiments, was successfully performed in the Blowdown Test Facility (BTF) in the NRU reactor. In this test, a single, previously-irradiated, CANDU fuel element was instrumented and subjected to a loss-of-coolant transient to assess fuel and fission product behavior under reactor accident conditions. Data from this, the most successful BTF experiment conducted to date, will be extremely valuable for the development and validation of reactor safety codes.

A new reference version of CATHENA, MOD-3.5b/Rev 1, has been released to users. CATHENA is an advanced thermalhydraulics code used for a wide range of safety and licensing applications. This version includes features required for licensing analysis of the MAPLE isotope reactor, and improved computational efficiency for analysis of CANDU operational transients.

Fuel and Fuel Cycles

Excellent neutron economy, on-power fuelling and simple fuel design provide a high degree of fuel-cycle flexibility in CANDU. This flexibility is an important strategic advantage. For example, the natural synergy between LWR (Light Water Reactors) and CANDU reactors positions CANDU as an indispensable component of an integrated nuclear generating system, rather than as a competitor to LWR technology.

A significant milestone has been achieved in the DUPIC program – **D**irect **U**se of Spent **P**ressurized Water Reactor (PWR) Fuel **I**n **C**ANDU. Several CANDU fuel elements have been successfully fabricated from spent PWR fuel using only a dry thermal/mechanical process. These elements will be irradiated in the NRU in 1998-1999, to confirm acceptable fuel performance. The DUPIC cycle is an important example of the natural synergism between CANDU and PWR reactors.

AECL moved significantly closer to commercializing the CANFLEX fuel bundle in 1997-1998. All out-reactor mechanical testing has now been completed; thermalhydraulic testing using newly-fabricated heater strings provided further confidence in the expected thermalhydraulics benefits; the bundle's design was confirmed in a formal industry-wide review; agreement was reached with New Brunswick Power for a demonstration irradiation of CANFLEX fuel in the Point Lepreau reactor, and all of the safety and licensing analysis and documentation required for this demonstration irradiation has been completed and submitted to the AECB for approval. The demonstration irradiation began September 1998. CANFLEX will provide greater thermalhydraulic operating margins, as well as lower power ratings. The strategic goal for CANFLEX is to facilitate the achievement of higher burnups with advanced fuel cycles.

Control Centre Design

AECL has been an acknowledged leader in digital control technology since the early 1970s. To meet evolving client and regulatory needs, AECL has adopted an evolutionary approach to the control centre design; one that retains proven features and systems while evolving the technology to meet current needs.

The CANDU Advanced Control Centre design provides enhanced safety through computerized plant safety state monitoring, features to protect against unplanned outages, and enhancements that will reduce the effort associated with performing routine tasks. Key evolutionary enhancements include a new control room layout that incorporates improved esthetics, an ergonomically designed operators' console and large central overview displays, advanced computerized annunciation, monitoring and control displays, and links to work management and other operational support systems.

The evolutionary enhancements of the CANDU control centre are represented in a mock-up at AECL's Sheridan Park laboratory, which is being used for operator and design evaluations. In addition, many of the proven enhancements were included in AECL's bid to supply two CANDU 6 reactors to the Akkuyu site in Turkey.

Plant Display Systems

Since the CANDU reactor first entered commercial operation nearly 30 years ago, the digital control computer (DCC) system has differentiated CANDU from the competition. Since then, computer technology has changed dramatically. AECL recognized the potential of these advances and in late 1995-1996 committed to the development of the Advanced Control Centre Information System (ACCIS).

ACCIS is a generic display system based on the latest in highly reliable, distributed, real-time system technology. The graphical user interface includes unique features that make possible the implementation of the advanced display and navigation capability

required by future control centre designs. The software engineering process to develop ACCIS is based on the latest developments in object-oriented technology. Once completed, ACCIS promises to:

- maintain CANDU's competitive edge by providing a basis for upgrading the CANDU control centre display systems, and by establishing an information system architecture that can be readily extended to support the advanced operations and maintenance system requirements of future CANDU plants (e.g., Akkuyu), and
- be the basis for a significant CANDU and non-CANDU control room upgrade service business.

This year, a significant milestone was achieved in the development of ACCIS. Initial releases of ACCIS were delivered in support of the CANDU 9 project, and ACCIS was used to implement the display system used to drive the CANDU 9 control centre mock-up. This mock-up demonstrates control centre improvements. In addition, the Qinshan Critical Safety Parameter Monitor system and the proposed Akkuyu control centre display systems were based on ACCIS.

Operations Support Systems

Plant operations support systems have become a key focus in the evolution of CANDU computer technology. These systems, developed using the latest in advanced information technologies, support critical programs such as performance monitoring, plant operational configuration control, surveillance and diagnostics, condition based monitoring, and reliability-centred maintenance. The plant operations' support products provide an integrated environment that enable operations, maintenance, and technical support staff to assure high reliability, availability, and safety of the plant in a cost-effective manner.

In the past year, significant gains were made in the development and integration of a number of plant operations' support systems. A key component, the development of historical data systems for plant process and alarm data, enables the life-of-plant storage of data, with user tool kits, for efficient data retrieval, display, and interpretation. In addition, initial prototype systems have been developed in the areas of equipment and systems health monitoring. Early indications are that these systems, once fully operational, will reduce the lifetime unit energy cost significantly.

Engineering Tools

Work on the development of engineering tools for the CANDU 9, as well as CANDU 6 plants focused on developing tools that will assist both design engineering and construction site activities. The main thrusts have been in providing tools that greatly increase the quality of engineering deliverables, construction site productivity and provide project participants immediate and accurate access to information which traditionally required significant effort and time to obtain. Work completed includes:

- automated identification of material demand from the three-dimensional computer-aided design and drafting model,
- development of an automated pipe support design system,
- construction of a three-dimensional mechanical model of the CANDU 6 fuelling machine, and
- implementation of a fully electronic project document management and control system.

Heavy Water

AECL and Air Liquide Canada have signed an agreement for demonstrating the Combined Industrial Reforming and Catalytic Exchange (CIRCE) process for heavy water production. The prototype CIRCE plant is expected to be operational in 2000.

Major progress has been made in the design and construction of the facility to demonstrate advanced technologies for upgrading and detritiation of heavy water in future CANDU reactors. Construction of the upgrading phase has been completed and commissioning is almost complete. Upgrading phase demonstration is expected to be completed in 1998-1999.

Waste Management and Nuclear Sciences

Nuclear Fuel Waste Management Program

In 1978, the Canadian and Ontario governments established the Nuclear Fuel Waste Management Program to develop a concept to safely and permanently dispose of Canada's nuclear fuel waste. AECL was tasked with carrying out the research and development of the concept of "disposal in a deep underground repository in intrusive igneous rock." In 1989, an Environmental Assessment Panel was appointed by the Minister of the Environment to examine AECL's disposal concept. AECL submitted an Environmental Impact Statement to the panel in October of 1994, and on March 11 of this year the panel submitted its report.

With the end of the environmental review, AECL has completed the task given to it by the governments. The panel's report concludes that, from a technical perspective, the safety of the concept has been adequately demonstrated and that it is likely that a significant number of technically suitable sites could be identified in the Canadian Shield. The report, however, recommends that siting of a disposal facility not proceed until broad public acceptance is demonstrated. AECL is now awaiting the response of the Canadian Government to the panel's report and the Government's decision on the next steps to take in continuing to safely manage Canada's nuclear fuel waste.

Pending the Government's consideration of the panel's report, Ontario Hydro has assumed responsibility for continued technical direction and financial support to develop further the disposal technology and to maintain key areas of technical expertise. During 1997, AECL worked in partnership with Ontario Hydro to develop the required R&D work scope, and AECL performed this work for Ontario Hydro on a contractual basis. The R&D included work on the geosciences, particularly as it relates to site characterization, engineered barriers, geotechnical studies including the operation of the Underground Research Laboratory, performance assessment, and disposal facility conceptual engineering. Work was also carried out for clients in Japan, France, Hungary and the U.S.A..

Low-Level Radioactive Waste Management

The Low-Level Radioactive Waste Management Office (LLRWMO), operated by AECL through a cost-recovery arrangement with Natural Resources Canada (NRCan), continued the clean-up and interim storage of historic wastes on behalf of the federal government. Monitoring and maintenance are carried out at all interim storage sites until a permanent disposal facility is available to the LLRWMO. Technical and administrative support were continued for the Surrey Siting Task Force, an independent task force established by the Minister of Natural Resources Canada to locate a permanent disposal site for two specific historic waste inventories

located in Surrey, B.C. Technical support was also provided to NRCan in its discussions with communities willing to host a disposal facility/facilities for much of the historic wastes located in the Port Hope area of Ontario.

Health and Environmental Sciences

Much of the research in health and environmental sciences is directed to improving the accuracy with which we can predict how radionuclides are dispersed in the environment, how they behave biologically, and what biological effects there may be from their radiation. In atmospheric studies this year, field measurements, wind tunnel tests and mathematical analyses, in combination, have led to a clearer understanding of atmospheric dispersion close to nuclear power stations. The validity of the models for radionuclide behavior in the atmosphere, hydrosphere and biosphere, from which release limits are estimated, has been improved, thus providing the scientific basis for evaluating the impact of reducing the exclusion area boundary. The current understanding of the complex biokinetics of radionuclides has been incorporated in the model used for estimating radiation doses. Studies have started in a new facility, the Biological Research Facility, designed especially for work on the biological effects of low levels of radiation from both incorporated radionuclides and external radiation. An important emphasis of this work is on understanding the influence of genes on radiation risks and on the ability of biological tissues to adapt to low rates of radiation exposure.

More effective and accurate ways of measuring radiation and radionuclides continue to be developed and applied. New methods that allow better discrimination between different kinds of radiation in the CANDU nuclear power plant are based on the physics of absorption of energy at the microscopic level. Increased precision in methods of measuring very low concentrations of radionuclides in environmental media, such as noble gases in air, is resulting in lower estimates of emissions.

Environmental Management

As in past years, AECL operations during calendar 1997 were in compliance with environmental regulations. In addition, there were measurable improvements in environmental performance that related to both radiological and non-radiological operations.

Implementation of AECL's Environmental Protection Program, issued in 1996 and generally based on the draft ISO-14000 international standards, continued in 1997. The objectives of this program are to ensure AECL continues to meet or exceed all applicable environmental laws and regulations and, where appropriate, international standards, and to continually improve its environmental performance. The first annual management review of this program was carried out, resulting in improvements to several of the 20 program elements.

Staff from the Environmental Research Branch of Chalk River Laboratories routinely sample and analyze streams, as part of the site's environmental monitoring program. (Above) Todd Chaput at work.

OPERATION OF AECL'S CANADIAN SITES AND FACILITIES CONTINUED TO BE CAREFULLY CONTROLLED AND MONITORED, SO AS TO COMPLY WITH REGULATIONS GOVERNING PROTECTION OF THE ENVIRONMENT AND HEALTH AND SAFETY.

Operation of AECL's Canadian sites and facilities continued to be carefully controlled and monitored, so as to comply with regulations governing protection of the environment and health and safety. AECL continued to manage effectively the radioactive wastes generated by its own operations, and continued to provide a national service which manages low-level radioactive wastes generated by various Canadian institutions and industries such as hospitals, universities, and suppliers of medical radioisotopes.

The majority of the design work was completed on the first phase of upgrading the Waste Treatment Centre at CRL. The project reinforces AECL's commitment to the safe management of the CRL site, to continued protection of the environment, and to the health and safety of AECL's workers and neighbors. Preparatory work for construction was started, pending regulatory approval.

AECL also improved its environmental performance in non-nuclear aspects of its operations, including modifications to systems and operating procedures. For example, plans were developed and construction work begun to replace two large industrial boilers used for site-wide building heating at CRL, in order to increase fuel efficiency and reduce emissions of gases that cause global warming and acid rain.

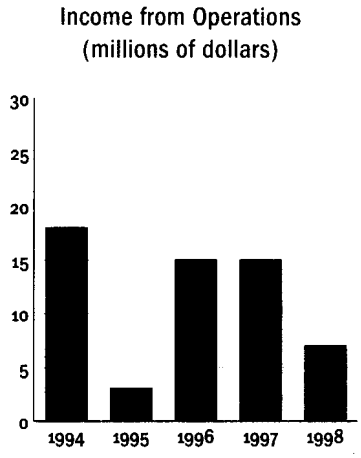
During the year, AECL continued to undertake community relations and public information programs and activities designed to foster awareness and understanding of the company's activities at its various sites. The objective of these programs is to further the development of mutually effective working relationships with neighboring stakeholders, including elected and appointed officials, business associations, service groups and the community at large. The programs include tours, briefing sessions, public education, partnership with local schools, distribution of information materials, and participation in open houses and many community events. The activities are designed to provide information and to seek feedback in order to identify public issues related to AECL's operations, including environmental performance.

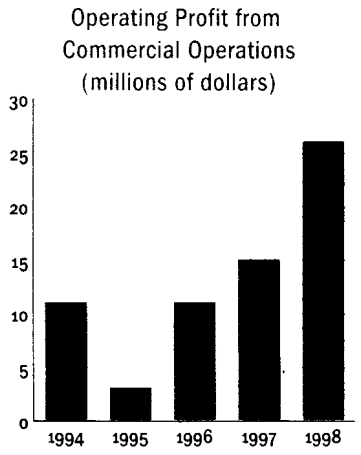
Site Refurbishment

Last year, AECL completed and reviewed a Master Infrastructure Refurbishment Plan and commenced a 10-year implementation strategy based on that plan. Initial projects undertaken have focused on AECL's immediate priority – energy efficiency improvements to serviceable buildings, particularly at CRL, that are aimed at improving site quality, while reducing operating costs. Energy efficiency projects initiated in 1996 were completed in 37 CRL buildings and in three buildings at Sheridan Park during 1997-1998. The energy efficiency improvements in lighting retrofits and building automation have reduced ongoing energy costs by approximately $1 million a year.

Three new projects were approved and in progress in 1997-1998. They address upgrades to the CRL powerhouse, active area exit monitoring and a major building refurbishment, and are consistent with the corporation's longer-term implementation strategy that focuses on replacing and refurbishing major facilities to meet business needs.

Financial Review and Analysis

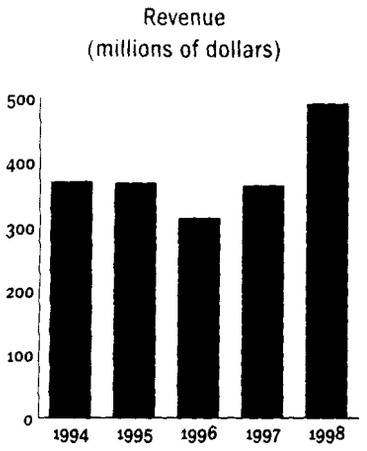


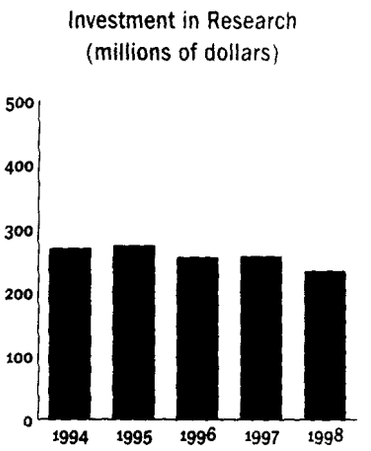


In 1997-1998, the corporation's earnings reflected the continuing success of its commercial operations while absorbing the impact of the first of two scheduled reductions in parliamentary appropriations announced by the government in March 1996. Operating profit from commercial operations increased by 74 per cent to $26 million. The corporation continued its commitment to product evolution, spending $28 million on product development, as well as $232.2 million on research ($29.2 million net of associated funding). Consequently, after investments in research and product development, net income for the year was $7 million.

Commercial Operations

Revenue increased by 35 per cent during 1997-1998, largely as a result of the ramp up in both the CANDU project in China where two reactors will be built at the Qinshan site and in the MAPLE project where two reactors designed for the production of medical isotopes are under construction. This, combined with heavy water deliveries in support of reactors under construction and revenue from services, resulted in revenue reaching a five-year high of $489.7 million.





Operating profit from commercial operations at $26 million increased by $11 million over the prior year. Marketing efforts included responses to international bids for nuclear reactors which resulted in increased marketing and administration costs in 1997-1998.

Research

The corporation spent $232.2 million on research with a continued focus on development of CANDU technology for the benefit of Canada; provision of technical support to the Canadian nuclear utilities and industry to ensure a high level of performance for existing CANDU generating stations; and development of technology for the safe disposal of used CANDU fuel. Funding for the corporation's 1997-1998 research activities of $203 million included an investment by the government (in the form of parliamentary appropriations) of $142.4 million and cost-sharing with the Canadian utilities of $52.2 million. The net research cost of $29.2 million was absorbed by earnings from operations.

As identified in the government's 1996 Program Review, the corporation expects the second phase reduction of $32 million in relation to funding towards CANDU technology research to occur in 1998-1999.

Decommissioning Activities

The corporation's decommissioning program continues to focus on ensuring that safety and environmental protection needs are met both in the near term and the longer term. Important progress achieved in the year included the commencement of construction of an advanced waste treatment centre; further decontamination of the NRX fuel bays; completion of decommissioning of the corporation's first nuclear reactor (ZEEP); commissioning of a full-scale waste segregation facility; the submission to the AECB of preliminary decommissioning plans for a variety of nuclear facilities which will require decommissioning in the future; and all documentation for the IRUS disposal facility licensing review. Total decommissioning costs for 1997-1998 amounted to $15.4 million, $4.4 million higher than the previous year.

For a 10-year period, that began last year, the government has directed that funding for decommissioning activities be sourced from the net proceeds received on the sale or lease of government funded heavy water inventory. To the extent that net proceeds from the sale or lease of heavy water were used in the year to fund decommissioning, this was recorded as decommissioning funding in the statement of operations. The unused portion is included in segregated cash and reflected as deferred decommissioning funding on the balance sheet.

Changes in Financial Position

The corporation generated cash of $15.6 million during 1997-1998, ending the year at $148.6 million in cash, advances and short-term investments. Operating activities contributed $52.5 million through earnings, the sale of government funded heavy water and receipt of customer advances. This was offset by the transfer of $15.4 million to the decommissioning segregated cash fund which was spent on 1997-1998 decommissioning activities and the $15.6 million expenditure on restructuring and other provisions. Investing activities primarily involved the acquisition of capital assets. Funds received in 1996-1997 were used to finance certain of the 1997-1998 Program Review actions.

Impact of the Year 2000

The corporation is addressing the Year 2000 Issue as a priority and with great diligence, both internally and externally. The "Year 2000 Issue" is a general term used to refer to certain technological and business implications of the arrival of the new millennium. This could result in a system failure or miscalculations causing disruptions of operations, including, among other things, a temporary inability to process transactions, send invoices or engage in other normal business activities.

AECL has initiated formal communications with all of its significant suppliers and customers to determine the status of their Year 2000 program to enable the corporation to assess the impact, if any, on its operations. However, there can be no assurance that the products or systems of other companies which AECL or its customers utilize or on which they rely will be converted in a timely and effective manner, or that a failure to convert by another company, or a conversion that is incompatible with AECL's systems, would not have material adverse effects on AECL or its customers.

As in the case of most corporations, the challenge is formidable. Management presently believes it can achieve its Year 2000 Plan and the Board of Directors is monitoring progress closely. The corporation is addressing the Year 2000 Issue in two ways:

Internal focus areas

- Infrastructure upgrades and replacements for hardware and integrated software used to operate mainframes and mini computers, network devices, personal computers and other technology hardware
- Business application software
- Product development systems and engineering tools

External focus areas

- Imbedded technologies in existing products & related software
- Providing information feedback from internal focus areas to customers
- Relationships with suppliers

The corporation has already installed new employee records and payroll related systems and is currently implementing a new financial system. All are Year 2000 compliant.

AECL will utilize both internal and external resources to reprogram, replace and test its software and hardware changes for the Year 2000 modifications. In addition, an external consulting firm with a strong track record and a Year 2000 transition methodology has been engaged to assist in monitoring and assessing progress. The total remaining cost of the Year 2000 systems and related hardware modifications and/or replacements is estimated at $14 million. Costs not qualifying as capital under the corporation's capital policy will be expensed as incurred.

The costs of necessary actions and the plan schedule are based on management's best estimates. Actual results may differ materially from those anticipated as a result of certain risks and uncertainties, including but not limited to, the availability and cost of personnel trained in this area, the ability to locate and correct all relevant computer codes and other similar uncertainties.

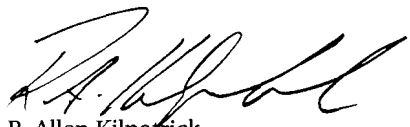
Management Responsibility

The consolidated financial statements, all other information presented in this Annual Report and the financial reporting process are the responsibility of the management and the Board of Directors of the corporation. Except for the non-recognition of future decommissioning costs, which is explained in the notes to the consolidated financial statements, these statements have been prepared in accordance with generally accepted accounting principles and include estimates based on the experience and judgment of management. In the case of decommissioning costs, the corporation has chosen, in the interest of what it considers to be a fairer overall presentation, to continue its established policy of expensing such costs as decommissioning activities take place.

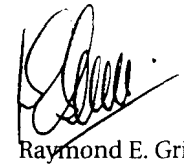
The corporation and its subsidiaries maintain books of account, financial and management control, and information systems, together with management practices designed to provide reasonable assurance that reliable and accurate financial information is available on a timely basis, that assets are safeguarded and controlled, that resources are managed economically and efficiently in the attainment of corporate objectives, and that operations are carried out effectively. These systems and practices are also designed to provide reasonable assurance that transactions are in accordance with Part X of the *Financial Administration Act* and its regulations, as well as the *Canada Business Corporations Act*, the articles, and the by-laws and policies of the corporation and its subsidiaries. The corporation has met all reporting requirements established by the *Financial Administration Act*, including submission of a corporate plan, an operating budget, a capital budget and this Annual Report.

The corporation's internal auditor has the responsibility for assessing the management systems and practices of the corporation and its subsidiaries. AECL's auditors conduct an independent audit of the consolidated financial statements of the corporation and report on their audit to the Minister of Natural Resources.

The Board of Directors' audit committee, composed of directors who are not employees of the corporation or its subsidiaries, reviews and advises the Board on the consolidated financial statements, AECL's auditors' report thereto and the plans and reports related to special examinations, and oversees the activities of internal audit. The audit committee meets with management, the internal auditor and AECL's auditors on a regular basis.



R. Allen Kilpatrick
President and Chief Executive Officer



Raymond E. Grisold
Vice-President Finance, Treasurer
and Chief Financial Officer

May 15, 1998

Auditors' Report

To the Minister of Natural Resources

We have audited the consolidated balance sheet of Atomic Energy of Canada Limited as at March 31, 1998 and the consolidated statements of operations, deficit, contributed capital and changes in financial position for the year then ended. These financial statements are the responsibility of the Corporation's management. Our responsibility is to express an opinion on these financial statements based on our audit.

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

There are significant costs associated with decommissioning the Corporation's facilities and remediating its sites, including costs of residual waste storage and disposal. Generally accepted accounting principles require that these costs be recognized in a rational and systematic manner over the estimated useful lives of the corresponding facilities. However, the Corporation expenses these costs as the activities take place and has not recorded a liability for them. Government funding of these costs is similarly recorded. Failure to record a liability for these costs is not in accordance with generally accepted accounting principles. The estimated net present value of this unrecorded liability, together with information on related assumptions and management plans, is disclosed in Note 10 to the consolidated financial statements.

In our opinion, except for the failure to record the liability for decommissioning and site remediation as described in the preceding paragraph, these consolidated financial statements present fairly, in all material respects, the financial position of the Corporation as at March 31, 1998 and the results of its operations and the changes in its financial position for the year then ended in accordance with generally accepted accounting principles. As required by the *Financial Administration Act*, we report that, in our opinion, these principles have been applied on a basis consistent with that of the preceding year.

Further, in our opinion, the transactions of the Corporation and of its wholly-owned subsidiaries that have come to our notice during our audit of the consolidated financial statements have, in all significant respects, been in accordance with Part X of the *Financial Administration Act* and regulations, the *Canada Business Corporations Act* and the articles and by-laws of the Corporation and its wholly-owned subsidiaries.

We wish to draw your attention to Note 1 to the consolidated financial statements which indicates the Governor in Council has not approved the Corporation's Corporate Plans since 1994-95, and the Corporation continues to work with the government to address budget and policy issues affecting the Corporation, including the future of the Whiteshell Laboratories.

Ernst & Young
Chartered Accountants

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

Ottawa, Canada
May 15, 1998

Consolidated Statement of Operations

For the year ended March 31

(thousands of dollars)	1998	1997
Commercial operations		
Revenue	$ 489,701	$ 361,775
Expenses		
Cost of sales	409,263	298,035
Marketing and administration	26,404	18,675
Product development	28,022	30,078
	463,689	346,788
Operating profit from commercial operations	26,012	14,987
Research		
Expenses	232,244	256,301
Less:		
Parliamentary appropriations (Note 3)	142,386	167,415
Cost recovery from third parties	52,175	72,793
Amortization of deferred capital funding	8,492	11,850
Net research expense	(29,191)	(4,243)
Decommissioning activities (Note 10)		
Expenses	15,384	10,976
Less:		
Decommissioning funding	15,384	8,175
Asset sales & other	-	2,801
Net decommissioning	-	-
Other income (Note 3)	10,400	19,868
Interest income and other (expense)	(217)	(15,224)
Net income	$ 7,004	$ 15,388

Amortization disclosure (Note 6)
See accompanying notes to the consolidated financial statements

Consolidated Balance Sheet

As at March 31

(thousands of dollars)		1998		1997
Assets				
Current				
Cash, advances & short-term investments (Note 8)	$	**148,561**	$	132,996
Segregated cash (Note 4)		**26,401**		24,410
Accounts receivable (Note 8)		**111,613**		116,501
Due from Receiver General		**10,400**		23,400
Inventory		**11,171**		11,708
		308,146		309,015
Heavy water inventory (Note 5)		**589,570**		622,381
Capital assets (Note 6)		**107,806**		100,395
	$	**1,005,522**	$	1,031,791
Liabilities				
Current				
Accounts payable, advances and accrued liabilities	$	**305,519**	$	265,125
Current portion of restructuring and other provisions (Note 12)		**30,483**		16,077
Current portion of deferred decommissioning funding (Note 9)		**22,800**		13,284
Current portion of long-term debt (Note 7)		**1,283**		4,639
		360,085		299,125
Restructuring and other provisions (Note 12)		**58,134**		84,118
Deferred decommissioning funding (Note 9)		**3,307**		-
Deferred revenue		**12,147**		45,481
Deferred capital funding (Note 6)		**71,922**		81,496
Accrued employee termination benefits		**53,395**		52,492
Long-term debt (Note 7)		**9,650**		10,994
		568,640		573,706
Shareholder's equity				
Capital stock				
Authorized – 75,000 common shares				
Issued – 54,000 common shares		**15,000**		15,000
Contributed capital (Note 9)		**557,744**		585,951
Deficit		**(135,862)**		(142,866)
		436,882		458,085
	$	**1,005,522**	$	1,031,791

See accompanying notes to the consolidated financial statements

Approved by the Board:

Mary C. Arnold, Director

R. Allen Kilpatrick, Director

Consolidated Statement of Contributed Capital

For the year ended March 31

(thousands of dollars)		1998		1997
Balance at beginning of the year	$	585,951	$	607,410
Transfer to deferred decommissioning funding (Note 9)		(28,207)		(21,459)
Balance at end of the year	$	557,744	$	585,951

See accompanying notes to the consolidated financial statements

Consolidated Statement of Deficit

For the year ended March 31

(thousands of dollars)		1998		1997
Balance at beginning of the year	$	(142,866)	$	(158,254)
Net income		7,004		15,388
Balance at end of the year	$	(135,862)	$	(142,866)

See accompanying notes to the consolidated financial statements

Consolidated Statement of Changes in Financial Position

For the year ended March 31

(thousands of dollars)	1998	1997
Operating activities		
Net income	$ 7,004	$ 15,388
Adjustment for non-cash items		
Amortization of capital assets	10,951	14,388
Amortization of deferred capital funding	(8,492)	(11,850)
Amortization of deferred decommissioning funding	(15,384)	(8,175)
	(5,921)	9,751
Heavy water inventory	32,811	(47,734)
Restructuring and other provisions	(15,584)	(22,283)
Accrued employee termination benefits	903	(281)
Deferred revenue	(33,334)	(5,715)
Change in non-cash working capital amounts	73,657	84,659
	58,453	8,646
Cash from operating activities	52,532	18,397
Investing activities		
Segregated cash	(1,991)	(24,410)
Proceeds on disposal of capital assets	396	2,635
Acquisition of capital assets	(19,840)	(17,054)
Cash used in investing activities	(21,435)	(38,829)
Financing activities		
Parliamentary appropriations received/(used) for Program Review activities including interest	(10,832)	11,126
Reduction in long-term debt	(4,700)	(3,667)
Cash from (used in) financing activities	(15,532)	7,459
Cash, advances & short-term investments:		
Change	15,565	(12,973)
Balance at beginning of year	132,996	145,969
Balance at end of year	$ 148,561	$ 132,996

See accompanying notes to the consolidated financial statements

Notes to the Consolidated Financial Statements

For the year ended March 31

1. The Corporation

Atomic Energy of Canada Limited (AECL) was incorporated in 1952 under the provisions of the *Canada Corporations Act* (and continued in 1977 under the provisions of the *Canada Business Corporations Act*) pursuant to the authority and powers of the Minister of Natural Resources under the *Atomic Energy Control Act*.

The corporation is a Schedule III Part I Crown corporation under the *Financial Administration Act* (FAA) and an agent of Her Majesty the Queen in right of Canada. The corporation is exempt from income taxes in Canada. As required by the FAA, the corporation submits annually its Corporate Plan, and operating and capital budgets to the government for its review and approval. The Treasury Board has approved an annual operating and capital budget for the corporation each year up to, and including, the 1997-1998 fiscal year.

The Governor in Council has not approved the corporation's Corporate Plan since 1994-1995 and, as a result, the related Corporate Plan Summaries have not been tabled in Parliament as contemplated by the FAA.
The government and the corporation have been considering budget and policy issues affecting the corporation, including the future of the Whiteshell Laboratories. The corporation continues to work with the government to address these issues.

These financial statements include the accounts of the corporation's wholly-owned subsidiaries, AECL Technologies Inc., incorporated in the state of Delaware, U.S.A. in 1988, and AECL Technologies B.V., incorporated in the Netherlands in 1995.

2. Significant Accounting Policies

a) Use of Estimates

The corporation's financial statements include estimates and assumptions that affect the amounts reported in the financial statements and accompanying notes. The more significant areas requiring the use of estimates are in relation to estimation of future contract costs; establishing reserves for restructuring and other provisions; and assessments of future decommissioning costs. The corporation reviews these estimates annually and does not expect the current assumptions to vary significantly in the near term.

b) Foreign Currency Translation

Monetary assets and liabilities denominated in foreign currencies are translated into Canadian dollars at rates prevailing on the balance sheet date. Income and expenses are translated at the daily rate at the time of the transaction. Translation gains and losses are recorded in income when realized.

c) Inventory

Heavy water is valued at the lower of average cost and net realizable value. Supplies are valued at cost.

d) Capital Assets

Capital assets are recorded at cost and this cost is amortized on a straight-line basis over the estimated useful life of the asset as follows:

Machinery and equipment	- 3 to 20 years
Buildings, reactors and land improvements	- 20 to 40 years

e) Decommissioning Activities

As further explained in Note 10, costs of decommissioning nuclear facilities and site remediation are expensed as the activities take place.

f) Long-term Contracts

Revenue and costs on long-term contracts are accounted for by the percentage of completion method based on expenses incurred and applied on a conservative basis to recognize the absence of certainty on these contracts. Full provision is made for estimated losses, if any, to completion of contracts in progress.

g) Parliamentary Appropriations

The Government of Canada, through parliamentary appropriations, funds certain operations of the corporation as outlined in Notes 3, 9 and 10. Except as noted below, parliamentary appropriations are recorded separately in the consolidated statement of operations as used.

Parliamentary appropriations used to acquire capital assets in years prior to 1995-1996 have been recorded as deferred capital funding on the consolidated balance sheet and are amortized on the same basis as the related capital assets. For 1996-1997 and subsequent years, the corporation finances capital acquisitions from its overall operations.

Effective in 1996-1997, and pursuant to the 10-year arrangement for funding decommissioning activities, the corporation retains net proceeds from the sale or lease of certain heavy water and these proceeds are recorded in the consolidated statement of operations as decommissioning funding as expenditures are made.

h) Cost Recoveries from Third Parties

The corporation and the Canadian nuclear utilities (Ontario Hydro, New Brunswick Power and Hydro Québec) have a common interest in the safe, efficient and economical use of power utilizing CANDU technology. Research programs aligned with these objectives are undertaken by the corporation and cost-shared with the utilities. Funding under these arrangements is included in cost recovery from third parties and is recognized as the related expenses are incurred.

i) Pension Plan

Employees are covered by the Public Service Superannuation Plan administered by the Government of Canada. The corporation's contributions to the Plan are limited to contributions made by both the employees and the corporation on account of current service. These contributions represent the total pension obligations of the corporation and are charged to income on a current basis. The corporation is not required under present legislation to make contributions with respect to actuarial deficiencies of the Public Service Superannuation Account.

j) Employee Termination Benefits

Employees are entitled to specific termination benefits as provided for under collective agreements and conditions of employment. The liability for these benefits is charged to income as benefits accrue to the employees. The accumulated liability is based on an actuarial determination and reviewed on a periodic basis.

k) Workers' Compensation

In accordance with the *Government Employees' Compensation Act*, the corporation reimburses Human Resources Development Canada for current payments for workers' compensation claims and pensions billed by the provincial compensation boards. The benefit payments are recognized as an expense in the year paid to the provincial compensation boards.

3. Parliamentary Appropriations and Other Government Funding

Government funding and its use by the corporation is as follows:

(thousands of dollars)		1998		1997
Research operating costs	$	142,386	$	167,415
Funds committed for termination costs (Note 12)		10,400		-
Program Review		-		19,868
	$	152,786	$	187,283

In the prior year, the $19.9 million pertains to the pass-through of the government's contribution towards phasing out their investment in the Fusion Program. The offsetting expenditure is included in interest income and other (expense) in the consolidated statement of operations.

4. Segregated Cash

Included in segregated cash is the unused portion of proceeds available for future decommissioning activities (Note 10). In the prior year, segregated cash also included the unused portion of funds received from the government to assist in the funding of certain costs associated with Program Review actions.

5. Heavy Water Inventory

Heavy water inventory includes amounts leased to customers with expiry dates occurring in 1999 and 2000, as well as 1,100 megagrams loaned to the Sudbury Neutrino Observatory Institute, the majority of which is scheduled for return in 2001. In addition, the corporation has contractual commitments to sell heavy water in support of ongoing reactor projects.

6. Capital Assets

(thousands of dollars)	1998		1997	
	Cost	Accumulated Amortization	Cost	Accumulated Amortization
Commercial operations				
Land and improvements	$ 949	$ 245	$ 963	$ 245
Buildings	10,339	8,248	9,961	7,731
Machinery and equipment	12,969	8,730	10,617	7,414
	24,257	17,223	21,541	15,390
Research				
Land and improvements	16,287	11,758	15,699	11,516
Buildings	79,436	44,772	71,078	43,314
Reactors and equipment	217,199	173,450	232,681	184,637
Construction in progress	17,830	-	14,253	-
	330,752	229,980	333,711	239,467
	$ 355,009	$ 247,203	$ 355,252	$ 254,857
Net book value		$ 107,806		$ 100,395

Amortization of capital assets for the year ended March 31, 1998 amounted to $11.0 million (1997 - $14.4 million) in part funded by amortization of deferred capital of $8.5 million (1997 - $11.9 million).

7. Long-term Debt

(thousands of dollars)		1998		1997
Loans from Government of Canada				
To finance leased heavy water and other assets, maturing through 2008 at interest rates varying from 3.525% to 8.45%	$	10,933	$	12,090
Loans from third parties				
To finance the purchase of the Glace Bay heavy water plant, maturing through 1998 at an imputed interest rate of 8.875%		-		3,543
		10,933		15,633
Current Portion		1,283		4,639
	$	9,650	$	10,994

Repayments of loan principal amounts required over succeeding years are as follows (millions of dollars): 1999 - $1.3; 2000 - $1.1; 2001 - $1.0 ; 2002 - $1.0 ; 2003 - $1.0 and subsequent to 2003 - $5.5.

8. Financial Instruments

Unless otherwise specified, the fair value of the corporation's financial instruments approximates cost.

a) Cash, Advances & Short-term Investments

Bank deposits are maintained at levels required to meet daily operating needs. Any surplus deposits are invested in the short-term money market. The investing strategy is based on a conservative risk assessment. All instruments are rated R1 Low or higher by the Dominion Bond Rating Service and the portfolio is diversified by limiting investments in any one issuer and balancing the fund amongst Canadian federal and provincial government guaranteed, financial and commercial paper issuers. The terms of instruments within the portfolio range from one day to one year. Short-term investments are carried at the lower of cost or market.

b) Foreign Currencies

The corporation enters into foreign exchange forwards to reduce the risk associated with the purchase and sale of goods in foreign currencies (primarily $US). Forward contracts in effect as at March 31, 1998 amount to $28.8 million (1997 - $68.1 million). The majority of these contracts are to sell $US at rates which do not vary significantly from market and which will expire upon completion of the underlying transaction. Contract expiry dates range from one month to three years, with the majority maturing in 1998-1999. All forwards are offset by contracts with third parties for payment in foreign currencies. Realized gains and losses are recorded in other income when the underlying transactions have been completed.

c) Accounts Receivable

Accounts receivable include $20.7 million receivable from Canada Development Investment Corporation (CDIC). Of this amount, $10.7 million relates to the corporation's 1988 sale of its shares in Theratronics to CDIC for eventual privatization. Under the sale agreement, the corporation is to receive the proceeds from the sale less CDIC's expenses associated therewith.

The balance of accounts receivable represents normal trade instruments. Three customers, each representing greater than 10 per cent of the total accounts receivable, comprise an aggregate 54 per cent of total accounts receivable. No substantial amounts are due in foreign currency. The corporation does not believe it is subject to any significant credit risk.

9. Contributed Capital and Deferred Decommissioning Funding

Included in contributed capital is approximately $364 million (1997 - $392 million) related to parliamentary appropriations received for the production of heavy water inventory. Up to and including 1995-1996, the corporation was required to repay the government, by way of a dividend, the net proceeds from the sale of government funded heavy water. A 1997 Decision of the Treasury Board directs the corporation to hold the proceeds received over the 10-year period following the sale or lease of government funded heavy water in a segregated fund for use in decommissioning activities. Commencing in 1996-1997, as government funded heavy water is sold or leased, the net proceeds are transferred from contributed capital to deferred decommissioning funding which is used to fund ongoing decommissioning activities. The corporation continues to account for these transactions as a reversal of the originally established contributed capital. Subsequent to 2005-2006, unless renewed, the prior arrangement will apply whereby net proceeds would be repayable to the government and decommissioning activities would be funded through parliamentary appropriations. The balance of the contributed capital remaining related to the parliamentary appropriations received for heavy water production remains in contributed capital.

10. Decommissioning Activities

When prototype reactors, heavy water plants, nuclear research, development and other facilities have no further commercial or research value to the corporation, they are retired and subsequently decommissioned in accordance with Atomic Energy Control Board regulations. Due to the variety of facilities, the decommissioning process may differ in each case. In some situations decommissioning activities are carried out in stages with intervals of several decades between them to allow radioactivity to decay before moving on to the next stage. Activities include dismantling, decontamination, residual waste storage and disposal.

The corporation has not recorded the liability for these future costs because, historically, the government has funded decommissioning activities on an annual basis through parliamentary appropriations. Starting in 1996-1997, and for a period of 10 years, the government has requested the corporation to use the proceeds from government funded heavy water, which was previously returned to the government, to fund decommissioning activities (Note 9). The government is currently reviewing its overall environmental policy, which will include the decommissioning activities of the corporation's facilities and waste storage on its property. As part of this policy

review, the government has proposed that the corporation and the government work jointly on a comprehensive management strategy. The corporation expects that this strategy will include determination of a financial framework to address funding of future decommissioning activities with an expectation of implementation for the fiscal year commencing April 1, 1999. Accordingly, the corporation expects that the government will continue to finance these activities and has continued its policy of expensing decommissioning costs as they take place.

The estimated future decommissioning and site remediation costs require that judgments be made about the regulatory environment, health and safety considerations, the desired end-state technology to be employed and, in some cases, research and development for these activities that extend well into the future. The corporation has prepared a broad plan of activities to be carried out over the next 100 years. This time-frame recognizes that its major nuclear facilities at Chalk River will remain a managed and active site for a minimum of 75 years into the future. The current estimated discounted cost of these activities, based on management's best estimate, is approximately $400 million (1997 -$400 million). A conservative discount rate has been used reflecting long-term borrowing rates. The corporation is in the second year of the 10-year funding arrangement in which an expenditure of $200 million over the 10-year period was projected.

11. Related Party Transactions

In addition to the transactions disclosed elsewhere in these financial statements, the corporation had the following transactions with the Government of Canada:

(thousands of dollars)		1998		1997
Repayment of loans:				
Principal	$	1,163	$	1,178
Interest		195		816
	$	1,358	$	1,994
Payments to the Public Service Superannuation Plan	$	13,349	$	13,122

In the normal course of business, the corporation also enters into various transactions with the Government of Canada, its agencies and other Crown corporations.

12. Restructuring and Other Provisions

The corporation carries provisions for restructuring as well as other commercial reserves. Implementation of program reductions and related actions pursuant to the federal government's 1996 Program Review are expected to continue into next year. The charge to earnings for the estimated cost of undertaking the actions was made in 1995-1996 and the unused portion continues to be held for ongoing actions. In 1997-1998, the government authorized funding of up to $26 million from the Central Reserve for Downsizing to be used for termination costs associated with employees at the Whiteshell Laboratories. Of this, $10.4 million has been received which was recorded as funding in the consolidated statement of operations. The remainder of the $26 million is not available to the corporation at this time. Also during the year, $10.4 million was added to provisions in relation to restructuring actions taken in March 1998. The corporation judges its provisions to be adequate for known actions.

13. Sales Agents' Remuneration

In 1997-1998, remuneration and expenses paid to the following sales agents and representatives aggregated $5.5 million (1997 - $3.9 million): Marubeni Corporation, Japan; Oxford Health Care Ltd., U.K.; PII-PED International Inc., U.S.A.; Samchang Corporation, Korea; Sumta Sanayi Urunleri Musavirlik Ve Ticaret A.S., Turkey; and Thai-Nor Industry Ltd., Thailand.

14. Uncertainty Due to the Year 2000 Issue

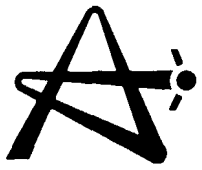
The Year 2000 Issue arises because many computerized systems use two digits rather than four to identify a year. Date-sensitive systems may recognize the year 2000 as 1900 or some other date, resulting in errors when information using year 2000 dates is processed. In addition, similar problems may arise in some systems which use certain dates in 1999 to represent something other than a date. The effects of the Year 2000 Issue may be experienced before, on, or after January 1, 2000, and, if not addressed, the impact on operations and financial reporting may range from minor errors to significant systems failure which could affect a corporation's ability to conduct normal business operations. It is not possible to be certain that all aspects of the Year 2000 Issue affecting the corporation, including those related to the efforts of customers, suppliers, or third parties, will be fully resolved.

15. Comparative Figures

Certain 1996-1997 amounts have been reclassified to conform with the current year's presentation.

Five-Year Consolidated Financial Summary

(millions of dollars)	**1998**	1997	1996	1995	1994
Operations					
Revenue	**490**	362	312	366	368
Income from operations	**7**	15	15	3	18
Net income (loss)	**7**	15	(10)	7	(139)
Research expenses	**232**	256	254	272	268
Cost recovery from third parties	**52**	73	81	87	88
Financial position					
Cash, advances & short-term investments	**149**	133	146	141	115
Heavy water inventory	**590**	622	584	584	586
Capital expenditures	**20**	17	10	8	17
Capital assets	**108**	100	109	113	121
Total assets	**1,006**	1,032	993	980	952
Long-term debt	**10**	11	15	19	23
Shareholder's equity	**437**	458	464	474	467
Other					
Parliamentary appropriations for research operations	**142**	167	164	170	162
Export revenues	**396**	285	235	291	285
Number of full-time employees	**3,652**	3,675	3,881	3,943	4,287



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Printed in Canada on domestically-produced
chlorine-free stock with vegetable-based inks.
Fully recyclable.

Le présent rapport est publié aussi en français.
Veuillez appeler le (905) 823-9040.

AECL – 11964
Supply & Services Canada – Cat. No. CC1-1998E
ISBN – 0-662-27234-X
ISSN – 0067-0383