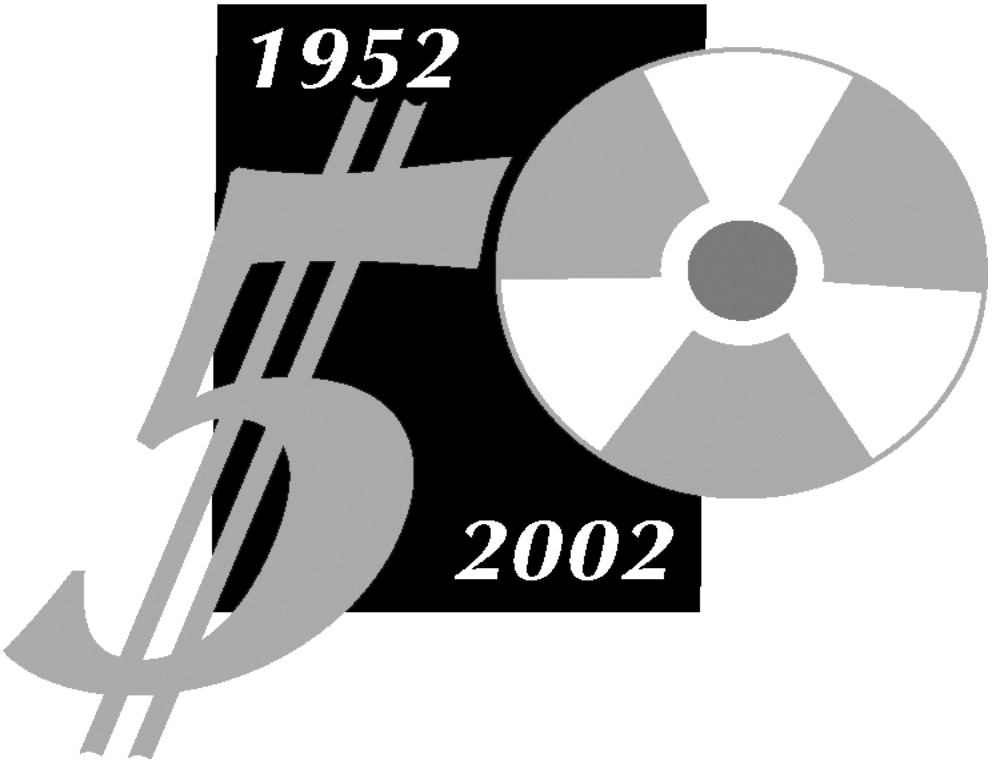
Canadian Nuclear Subsidies

Fifty Years of Futile Funding



by
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Campaign for Nuclear Phaseout

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Fifty Years of Futile Funding

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Campaign for Nuclear Phaseout (CNP) is a non-profit alliance of safe-energy and environmental groups from across the country, founded in 1989. CNP is dedicated to the phaseout of nuclear power in favour of safer, cleaner energy alternatives. With a base of support from 300 endorsing organizations, CNP has carried out an extensive educational program.

Additional copies of *Canadian Nuclear Subsidies: Fifty Years of Futile Funding* are available from the Campaign for Nuclear Phaseout.

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Executive Summary

Atomic Energy of Canada Limited (AECL) is the federal crown corporation that designs and markets CANDU reactors. On AECL's 50th anniversary President Robert Van Adel ranted in the propaganda style of the 1950s about the "unending promise of nuclear power". He confuses wishful thinking with fact, and hope with reality. **Fact:** AECL is a financial basket case that has received $17.5 billion in subsidies already, and they want more. **Reality:** after a 50 year track record of technical and financial failure, it's safe to assume this pattern will not change.

In 2001-2002 the federal government increased AECL's annual subsidy to $211.2 million — the largest amount in 15 years. AECL employment has grown to 4000, the highest level in since 1994. This is a dramatic rejection of the government's *1996 Budget Plan*, which capped AECL subsidies at $100 million per year. Prime Minister Chrétien has evidently made the restoration of nuclear subsidies one of his parting legacies for Canadian taxpayers. No wonder AECL describes Chrétien as "an enthusiastic and long-time supporter of AECL and CANDU".

AECL President Van Adel is reorganizing the company on an "enterprise model". But a crown corporation dependent on massive government subsidies cannot really be based on a free enterprise model, or have a truly commercial culture. Van Adel talks about the "sustained investment" needed to turn AECL around. Unfortunately for Canadian taxpayers, "sustained investment" means more public subsidies.

Nuclear industry propaganda has recently focused on the false claim of a "nuclear renaissance". Following the introduction of electricity competition in the United States, utilities could write off much of their nuclear debt as 'stranded costs', allowing older nuclear plants to sell at a fraction of their cost and continue operating. The "nuclear renaissance" was really a nuclear bailout. Ratepayers are still being forced to pay for stranded costs, and there are no firm proposals in the U.S. for any ***new*** nuclear plants. The reason is simple: new nuclear plants are twice the cost of natural gas plants.

High cost is not the only argument against nuclear power. Nuclear power is a security nightmare. Terrorists don't need nuclear bombs if they can cause a meltdown at a nuclear power plant. Nuclear power is not a "clean" technology -- radioactive emissions and radioactive waste cause cancer and birth defects; there is always the risk of a catastrophic accident like Chernobyl; and nuclear weapons proliferation is a constant danger. Nuclear power was also rejected as a solution to climate change at the 2001 Climate Change Conference in Bonn. Nuclear power is in conflict with Canada's commitment to the Kyoto Protocol -- renewable energy and efficiency technologies are cheaper, cleaner, and safer.

With no public debate, the Cabinet has given AECL over $200 million to design a new reactor prototype called the Advanced CANDU Reactor (ACR). AECL claims it will be cheaper and find a ready market. We've heard this before over AECL's 50-year history of foul-ups... the **Organic Cooled Reactor** in Manitoba was a technological dead-end; the **CANDU-Boiling Light Water Reactor** at Gentilly, Québec, used ordinary water as coolant like the ACR -- it was a disaster that operated less than 200 days and cost taxpayers $126 million plus design costs; the **Slowpoke Energy System** cost $45 million to design, but nobody wanted a small reactor for a furnace; the **CANDU 3** design cost $75 million for a 'smaller and cheaper' reactor (like the ACR), but nobody wanted to risk

an untested design; the **CANDU 9** design costs were kept secret, but it was never built after South Korea canned its CANDU program; and the two **MAPLE** reactors at Chalk River have been another AECL fiasco, with start-up delayed over four years. AECL's next proposal for a publicly funded nuclear mega-project is the $500 million Canadian Neutron Facility (CNF) reactor to replace the aging NRU reactor in 2005. There is no real need for the CNF reactor because research can be conducted at other international facilities. Given AECL's unparalleled history of incompetence and failure, it is throwing good money after bad to provide $200 million in public funds for the Advanced CANDU Reactor, or $500 million for the CNF reactor.

CANDU reactors have been breaking down far earlier than their expected 40 year lifetimes. After 20 years or less, major refurbishment is needed that costs as much or more than the original cost of the plant. As a primary consultant, AECL has been blamed for yet another fiasco in the refurbishment of Ontario Power Generation's Pickering A Nuclear Station. The start-up of the first reactor has been delayed three years, and costs have escalated from $800 million to $2.5 billion for all four reactors.

AECL devised a refurbishment plan for New Brunswick Power's Point Lepreau nuclear plant. In September 2002 the New Brunswick Public Utilities Board recommended against the $845 million proposal, saying that it was too risky and too expensive. Federal taxpayers carry of the risk if AECL fouls up the project. Yet in order to push the project ahead, AECL is now asking the federal government to accept even more risk or become an equity partner. The Cabinet should just say no to yet another nuclear money pit. The Hydro-Québec Board of Directors is expected to decide in 2003 on whether to refurbish its Gentilly 2 reactor.

AECL has always promised financial salvation through CANDU exports, but only 12 reactors have been sold -- less than 3% of the world total. In 1996, AECL said "our goal is to secure ten CANDU sales over the next ten years". Since then, only three reactors have been sold -- two to China in 1996, and one to Romania in 2003. Cernavoda-2 was just the completion of a 1980 deal, but it still required a $328 million guarantee through the Canada Account of Export Development Canada -- a direct hit for Canadian taxpayers. The two Qinshan reactors sold to China also received $1.5 billion in Canada Account financing. Reactor sales are too big and too risky for private sector institutions, so why should the government risk public funds? AECL's recent loss of sales in Turkey, Australia and South Korea underscore that CANDU exports are a dead-end. There is no possibility of further reactor sales in the foreseeable future.

AECL's deadly legacy for Canada is radioactive waste and contamination. The Province of Manitoba has protested the extended length of AECL's 60-year clean-up of the Whiteshell Laboratories. AECL won't even release its clean-up plans for the Chalk River Laboratories in Ontario's Ottawa valley, and the government refuses to conduct an environmental assessment on the overall decommissioning plan for the site. Radiation contamination from 50 years of sloppy practices has spread to the Ottawa River, source of recreation and drinking water for millions in Québec and Ontario.

AECL celebrated its 50th Anniversary in 2002 along with MAD Magazine and Sugar Frosted Flakes. Unlike those two profitable businesses, AECL's most notable achievement in 50 years has been its ability to suck up huge subsidies from the federal government like a nuclear-powered vacuum cleaner. After fifty years of futile funding, it's time to pull the plug.

1. Government Subsidies to AECL

Atomic Energy of Canada Limited (AECL) is a federal crown corporation that designs and markets CANDU reactors, and conducts other nuclear-related activities. AECL receives its taxpayer subsidy (known as a 'parliamentary appropriation') through Natural Resources Canada, and reports to the Minister of Natural Resources.

Along with MAD Magazine and Sugar Frosted Flakes, AECL celebrated its 50th Anniversary in 2002. It is ironic that AECL also reached an unprecedented peak of taxpayer subsidies in that year, topping $17 billion for the first time in history. As shown in Table 1, government subsidies to AECL from 1953 to 2002[1] total $17.5 billion ($2001). Subsidies at the end of the 2001 fiscal year totaled $16.987 billion ($2000).

This is a real cash subsidy to AECL, with the figures taken from AECL's own annual reports. The subsidy is calculated in 2001 dollars based on the Gross Domestic Price Index (see Note 20 to Table 1). Conversion to 2001 dollars gives an accurate picture of the real historic value of the subsidies that have been given to AECL by the federal government over the last 50 years. AECL prefers to distort the historic reality by totaling its subsidies in nominal, as-spent dollars (also known as dollars-of-the-year).

In 1993, AECL released a commissioned study of historic government subsidies that it had received. The study, done by the consulting firm of Ernst & Young, was entitled *The Economic Effects of the Canadian Nuclear Industry*, October 1993. At that time, Ernest & Young reported total subsidies to AECL for the years 1952-53 to 1992-93 of $4.754 billion (nominal dollars, or 'dollars-of-the-year'). To get this figure, Ernst & Young offset several billion dollars of additional subsidies by assuming that the federal treasury would be 'rewarded' by the sale of 'assets' such as the heavy water inventory. This has not happened.

Because of the inaccuracies and misrepresentations in the Ernst & Young study, in February 1996 the Campaign for Nuclear Phaseout (CNP) released a study entitled *Nuclear Sunset: The Economic Costs of the Canadian Nuclear Industry*, by David H. Martin and David Argue. The study looked at a variety of issues including government subsidies and nuclear industry employment. AECL subsidies for the years 1952 to 1995 totaled $12.919 billion ($1995).

The Campaign for Nuclear Phaseout subsequently published several updates:

- *Nuclear Budget Watch 1997*, February 1997, by David H. Martin and David Argue
  AECL subsidies for the years 1952 to 1997 totaled $15.2 billion ($1997).

- *Federal Nuclear Subsidies: Time to Call a Halt*, November 1998, by David H. Martin
  AECL subsidies for the years 1952 to 1998 totaled $15.8 billion ($1998)

- *Financial Meltdown: Federal Nuclear Subsidies to AECL*, November 2000, by David H. Martin
  AECL subsidies for the years 1952 to 2000 totaled $16.6 billion ($2000)

1. In the table and throughout this report, we use the end-year of the fiscal years 1952-1953 to 2001-2002, ending on March 31st.

In an attempt to manipulate the public perception of massive nuclear subsides, Natural Resources Canada (the department of the Canadian government responsible for AECL, nuclear energy and uranium mining) funded a study in 1998 entitled *Nuclear Energy Policy in Canada 1942 to 1997*. The study was written for the Carleton Research Unit on Innovation Science and Environment (CRUISE) by Robert Morrison, former Director of the Nuclear Energy Division at Natural Resources Canada. Morrison's study included tables of government subsidies to AECL from1953 to 1997, which virtually duplicated the 1953-1993 table produced by Ernst & Young in its 1993 study *The Economic Effects of the Canadian Nuclear Industry*. Morrison then added on subsidies from 1994 to 1997. Morrison reported total subsidies to AECL from 1953 to 1997 of $5.480 billion (nominal, as-spent dollars, or 'dollars-of-the-year').

Table 1 Federal Government Subsidies to AECL ($ millions)

	< R&D >	< REACTORS					>< HEAVY WATER					>< FINANCIAL				
Fiscal End Year	R&D	Prototype Reactor Funding [2]	Pickering Pay-back	CANDU 3	Slowpoke	Decommiss'n'g [5]	Loans Forgiven	HWP Loans Payment [8]	HWP Support [11]	LaPrade [5] Maintenance	HWP [5] Closures	Dividends/ Guarantees/ Investments	Additional Subsidies	Subsidiaries Divested	Nominal TOTAL	$2001 Equivalent TOTAL
1953	21.4	-	-	-	-	-	-	-	-	-	-	44.7 [13]	-	-	66.1	428.3
1954	19.6	-	-	-	-	-	-	-	-	-	-	-	-	-	19.6	125.4
1955	29.5	-	-	-	-	-	-	-	-	-	-	-	-	-	29.5	188.7
1956	30.3	-	-	-	-	-	-	-	-	-	-	-	-	-	30.3	190.5
1957	30.5	0.5	-	-	-	-	-	-	-	-	-	-	-	-	31.0	189.3
1958	23.8	0.8	-	-	-	-	-	-	-	-	-	-	-	-	24.6	146.0
1959	26.6	2.1	-	-	-	-	-	-	-	-	-	-	-	-	28.7	168.3
1960	24.7	5.8	-	-	-	-	-	-	-	-	-	-	-	-	30.5	177.4
1961	26.5	11.7	-	-	-	-	-	-	-	-	-	-	-	-	38.2	220.5
1962	29.1	4.8	-	-	-	-	-	-	-	-	-	-	-	-	33.9	193.4
1963	37.1	-	-	-	-	-	-	-	-	-	-	-	-	-	37.1	206.8
1964	44.9	-	-	-	-	-	-	-	-	-	-	-	-	-	44.9	246.6
1965	45.2	-	-	-	-	-	-	-	-	-	-	-	-	-	45.2	242.8
1966	52.7	-	-	-	-	-	-	-	-	-	-	-	-	-	52.7	273.2
1967	58.0	-	-	-	-	-	-	-	-	-	-	-	-	-	58.0	288.5
1968	66.5	-	-	-	-	-	-	-	-	-	-	-	-	-	66.5	316.9
1969	68.6	-	-	-	-	-	-	-	-	-	-	-	-	-	68.6	313.8
1970	69.0	-	-	-	-	-	-	-	-	-	-	-	-	-	69.0	305.2
1971	68.9	-	-	-	-	-	-	-	-	-	-	-	-	-	68.9	297.7
1972	77.0	-	-	-	-	-	-	-	-	-	-	-	-	-	77.0	318.7
1973	78.2	-	-	-	-	-	-	-	-	-	-	-	-	-	78.2	304.0
1974	87.9	-	-	-	-	-	-	-	-	-	-	-	-	-	87.9	309.9
1975	85.9	-	-	-	-	-	-	-	-	-	-	-	-	-	85.9	273.5
1976	93.6	-	-	-	-	-	-	-	-	-	-	-	-	-	93.6	277.7
1977	96.8	85.5	-	-	-	-	-	-	13.3	-	-	-	-	-	195.6	541.2
1978	101.7	275.4 [3]	0.0 [4]	-	-	-	-	-	26.8	-	-	-	-	-	403.9	1,037.8
1979	110.3	8.9	0.0 [4]	-	-	-	-	-	-	-	-	-	-	-	119.2	282.2
1980	114.7	8.8	0.0 [4]	-	-	-	-	-	-	-	-	-	-	-	123.5	266.0
1981	123.1	10.2	0.0 [4]	-	-	-	816.9 [7]	9.3 [9]	65.0	8.6	-	-	-	-	1,033.1	2,000.5
1982	145.7	11.4	0.0 [4]	-	-	-	-	9.3	112.9	4.5	-	-	-	-	283.8	498.6
1983	169.9	12.7	0.0 [4]	-	-	-	-	11.3	118.3	3.1	-	-	-	-	315.3	521.0
1984	184.5	12.4	0.0 [4]	-	-	-	-	12.3	124.7	2.5	-	-	-	-	336.4	534.9
1985	192.4	11.1	-	-	2.6	-	-	12.3	104.6	2.5	-	-	-	-	325.5	499.4
1986	172.7	-	-	-	3.9	18.3	-	13.3	29.2	2.3	35.4	-	-	-	275.1	406.5
1987	176.8	-	-	-	4.9	11.9	-	3.3 [10]	-	1.9	18.8	-	-	-	217.6	309.1
1988	143.3	-	-	-	10.4	20.3 [6]	-	3.3 [10]	0.0 [12]	0.5	2.6	0.0 [14]	-	-	180.4	247.1
1989	135.9	-	-	44.4	11.1	10.3 [6]	-	4.5 [10]	0.0 [12]	-	-	-	-	-	206.2	269.6
1990	141.5	-	-	29.2	12.2	12.0 [6]	-	1.6 [10]	0.0 [12]	-	-	-	-	9.1	205.6	257.6
1991	154.3	-	-	-	-	11.4 [6]	-	1.8 [10]	0.0 [12]	-	-	-	-	-	167.5	200.4
1992	162.1	-	-	-	-	11.9 [6]	-	1.9 [10]	0.0 [12]	-	-	0.0 [14]	-	-	175.9	207.7
1993	167.3	-	-	-	-	10.9	-	2.1 [10]	0.0 [12]	-	-	-	-	-	180.3	209.4
1994	161.5	-	-	-	-	9.8	-	2.3 [10]	0.0 [12]	-	-	-	-	-	173.6	197.7
1995	169.5	-	-	-	-	10.5	-	-	-	-	-	-	-	-	180.0	201.7
1996	164.3	-	-	-	-	10.3	-	-	-	-	-	-	-	-	174.6	193.0
1997	167.4	-	-	-	-	-	-	-	-	-	-	1,500.0 [15]	19.9 [16]	-	1,687.3	1,828.5
1998	132.2 [1]	-	-	-	-	-	-	-	-	-	-	-	20.6 [17]	-	152.8	163.3
1999	102.4	-	-	-	-	-	-	-	-	-	-	-	8.0 [18]	-	110.4	116.1
2000	105.7	-	-	-	-	-	-	-	-	-	-	-	32.1 [19]	-	137.8	142.3
2001	108.9	-	-	-	-	13.0	-	-	-	-	-	-	-	-	121.9	123.9
2002	134.2	-	-	-	-	17.0	-	-	-	-	-	-	60.0	-	211.2	211.2
TOTAL	**4,934.6**	**462.1**	**0.0**	**73.6**	**45.1**	**167.6**	**816.9**	**88.6**	**594.8**	**25.9**	**56.8**	**1,544.7**	**140.6**	**9.1**	**8,960.3**	**17,469.9 [20]**

Notes to Table 1: Federal Government Subsidies to AECL

Some of the following notes refer to the Ernst & Young (E&Y), and Morrison studies cited in the text above. AECL has never directly challenged or refuted any of the subsidy tables published by the Campaign for Nuclear Phaseout.

[1] In 1998, AECL reported Research and Development funding of 142.386, but in 1999 changed it retroactively to $132.215 (*AECL Annual Report 1998-1999*, p. 44). See also Note 17 below.

[2] Subsidies from 1957 to 1962 were for the NPD reactor. Subsidies from 1977 to 1985 were for the Douglas Point and Gentilly-1 reactors.

[3] Includes non-cash contribution of $124.1 million respecting accrued interest on loans used to finance the prototype nuclear power reactors.

[4] Ernst & Young (E&Y) and Morrison assumed an "offset expenditures" principle concerning the Pickering payback agreement from 1977 to 1983 which totals $195.6 million. In other words, E&Y assumed that these payments from Ontario Hydro offset Federal Government funding that would have been available, if not for the Pickering payback agreement. This is not an appropriate assumption. In 1993, Ontario Hydro wrote off $410 million in amounts owed under this agreement from AECL and the Government of Ontario. This negative payback was accrued as a result of the poor performance of Pickering Units 1 and 2, particularly between 1984 and 1987.

[5] E&Y and Morrison combined LaPrade Heavy Water Plant (HWP) Maintenance with HWP Closures and Decommissioning under the column "Plant Closure/Safekeeping" (E&Y) and "Decommissioning" (Morrison). They also placed decommissioning figures from 1986 and 1987 under "NPR [Nuclear Power Reactor] /Funding". This table has listed figures separately for Reactor Decommissioning, LaPrade Maintenance, and HWP Closures — as they were reported annually by AECL. Reactor Decommissioning includes subsidies for the closing of Gentilly-1, NPD, Douglas Point, WR-1, and NRX.

[6] Lower figures were included in the E&Y and Morrison tables, although figures used in this table are clearly identified in AECL annual reports.

[7] Due to the inadequacy of future sales of heavy water, Parliament forgave Heavy Water Plant (HWP) loans and interest effective April 1, 1980 for the LaPrade, Glace Bay and Port Hawkesbury HWPs, in the amount of $816.948 million. E&Y and Morrison reported costs of $672.2 million directly and non-cash costs of $157.4 million, but only included $672.2 million in their tables of subsidies.

[8] Payments to the Province of Nova Scotia for purchase of the Glace Bay Heavy Water Plant.

[9] Review of AECL annual reports for this table reveals that E&Y and Morrison missed a taxpayer contribution of $9.3 million in fiscal year 1980-81.

[10] E&Y and Morrison overstated the value of "Loans Payment Support" from fiscal year 1989-1990 to fiscal year 1992-1993. Morrison also overstated the value in 1993-1994. These values were corrected in this table for the actual amounts included in AECL annual reports.

[11] The federal government provided subsidies to cover the on-going operating losses of the heavy water plants in operation.

[12] E&Y and Morrison assumed an "offset expenditures" principle concerning Heavy Water Production support. This was not an appropriate assumption. E&Y's valuation of the heavy water inventory as having a book value of $522.5 million at the end of fiscal year 1993, and Morrison's valuation of $520.1 million at the end of 1996, both assumed that the federal government could actually realize this value. This assumption has proven false. A non-cash contribution for the interest accruing on AECL production support should be calculated in order to fully describe taxpayer costs, and would likely exceed $50 million per year, but would require further information to confirm. In order not to overstate the taxpayer cost, this study assumes that these costs are zero. In 1996, AECL confirmed that an agreement had been reached with the Government, to "release the corporation from its obligation to repay parliamentary appropriations" *(AECL Annual Report 1995-1996*, p. 31). E&Y and Morrison assumed that the Government would indeed be repaid, in estimating the extent of Government support for AECL. The so-called Treasury Board Agreement, effective 1996-1997 directs AECL to hold the proceeds of heavy water sales or leases for use in decommissioning activities for ten years. This arrangement may be renewed after 2006 (*AECL Annual Report 1996-1997*, p. 33).

[13] As noted in the *AECL Annual Report 1953-54*, nominal values of $1.00 each were assigned in AECL's Balance Sheet to (1) research goods having a book value of $3,352,239; and (2) land, buildings and equipment having a book value of $41,357,693. As the Auditor General's Office noted at the time, "Since these constitute the essential stock in trade and equipment for the continuing research and development program of the Company [AECL], the nominal values shown may not be regarded as representing a true and fair view." In order to accurately reflect total subsidies to AECL, a total of $44.7 million was added to the 1953 fiscal year in this table.

[14] In 1988, AECL sold Nordion International Inc. (formerly the AECL division known as the Radiochemical Company) to the Canada Development Investment Corporation (CDIC) for eventual privatization. In 1991, CDIC sold Nordion to MDS Health Group Ltd. for $165 million, and it was reported that AECL received $150.5 million from CDIC, and that this, "together with interest earned thereon between the dates of receipt and disbursement, has been distributed to the Shareholder by way of dividends" (*AECL Annual Report 1991-1992*, p. 12). E&Y and Morrison noted a $152.5 million dividend in 1992 from the Nordion sale. The sale resulted in lengthy litigation by MDS and Nordion, with AECL, CDIC and the Attorney General of Canada named as liable parties. An out-of-court settlement was announced in July 1996, involving a payment of $5 million by the government, an interest-free loan of $100 million from the government to MDS/Nordion, and an additional payment of $12.5 million to MDS/Nordion by AECL. However, details including the total project cost, loan terms, long-term liability for waste management and decommissioning, and other terms of the settlement have not been disclosed. For these reasons, even if funds were advanced to the Receiver General, the amounts advanced will not offset liabilities.

[15] In support of AECL's exporting efforts to China, the Federal Government has assumed a guarantee liability for $1.5 billion. Since this sale could not be financed through conventional financing sources, it represents the largest single taxpayer funded obligation ever provided to AECL by the government. This guarantee is similar in nature to loan guarantees and financing

support provided for heavy water production in the amount of $816.9 million, which the government forgave, effective in 1980-81.

[16] In 1997, AECL reported a $30.039 million parliamentary appropriation for “Program Review”, also referred to as “Restructuring Costs”, for downsizing costs resulting from the government’s 1995 Program Review. Morrison reported a “Program Review” subsidy of $30 million. However, in 1998, AECL changed that amount retroactively for 1997 to $19.9 million, which was explained as “pass-through of the government’s contribution towards phasing out their investment in the Fusion Program” (*AECL Annual Report 1997-1998*, p. 36).

[17] In 1998, AECL included “termination costs” of $10.400 million in its parliamentary appropriations (*AECL Annual Report 1997-1998*, p. 36). In 1999, another item was added retroactively in the amount of $10.171 million for “Whiteshell commercialization” (*AECL Annual Report 1998-1999*, p. 44). These two items have been combined under the heading “Additional subsidies” for the year 1998.

[18] In 1999, AECL included $8.0 million in its parliamentary appropriations for “Year 2000" expenses, described as “...part of the government’s program to assist crowns and departments in defraying Year 2000 costs” (*AECL Annual Report 1998-1999*, p. 44).

[19] In 2000, AECL reported $24.5 million for “Year 2000" expenses and $15.6 million for “Termination costs” in its parliamentary appropriations. No detailed explanation was offered for the Termination costs appropriation, other than to say that it represents “...the release of a previously frozen allotment by the government to cover termination costs incurred during the Program Review implementation period” (*AECL Annual Report 1999-2000*, p. 44). In addition, the $8.0 million appropriation in 1999 for “Year 2000" is treated as an “advance” which is recorded in 2000 as a “reduction” of appropriations. This table records a net appropriation for these items in the amount of $32.1 million under the heading “Additional subsidies” for the year 2000.

[20] Based on the Gross Domestic Product Price Index. This index was chosen because it is an historically consistent set of data available back to 1952-53. Since this index is a composite of economic activity and pricing, it generally converts nominal to real values at rates less than the rate of inflation.

1.1. Government Betrayal of 1996 Budget Commitment

In the federal budget presented by Paul Martin in March 1996, the Liberal government announced that it would continue subsidies for Atomic Energy of Canada Limited (AECL) indefinitely, but that the level of funding would be reduced from historic levels. The 1996 *Budget Plan* stated,

> AECL's federal funding will be $174 million in 1996-97, and is scheduled to fall to $132 million by 1997-98. As a result of Program Review, an additional $32 million in direct federal funding will be eliminated by 1998-99.[2]

In other words, under the terms of the March 1996 budget, the government committed to cap AECL subsidies at $100 million per year, beginning with the 1998-1999 fiscal year. The government has completely reneged on its commitment to reduce nuclear subsidies. Table 2 compares the March 1996 budget promise to the actual direct subsidies. In the six years since the budget decision, government funding has on average been 30.4% above its promise, or $214.6 million in excess – about half of it in the 2001-2002 fiscal year. The average funding over the six-year period was $153.4 million. This was $214.6 million, or 30.4% above the amount that the government had committed to in the March 1996 budget.

The 1996 budget decision was the result of a federal 'program review' of AECL subsidies initiated in June 1995, and conducted jointly by an interdepartmental committee of representatives from Natural Resources Canada, Finance, Treasury Board, Foreign Affairs & International Trade, Industry Canada, and the Privy Council Office. Natural Resources Canada also commissioned a business analysis from the firm of Nesbitt Burns that was entitled *Project Atom*.

The government and AECL refused to release the reports by the committee and Nesbitt Burns, although the decisions based on them have multi-billion dollar implications for taxpayers. There was absolutely no consultation with the Canadian public outside of the nuclear industry, despite the fact that fundamental public policy decisions were being made about the future of the nuclear industry in Canada. The environmental group *Nuclear Awareness Project* filed an Access to Information request for the two reports, and on February 17, 1997, Natural Resources Canada refused to supply the documents. Following an appeal to the Information Commissioner of Canada, the appeal was rejected on April 24, 1998.

Since the 1996 budget, AECL has regrouped and forged a new basis of support behind closed doors in Ottawa's corridors of power. This astonishing comeback has only been accomplished with the strong support of Prime Minister Jean Chrétien, whom AECL has described as "an enthusiastic and long-time supporter of AECL and CANDU".[3] Chrétien has supported AECL throughout his long political career, earning him the sobriquet of 'the CANDU man'. Although yesterday's man in Canadian politics, Chrétien has remained today's man for AECL, and tragically, has made the restoration of nuclear subsidies one of his departing legacies for Canadian taxpayers.

In the spring of 2001, a media report disclosed that the federal cabinet was secretly deciding whether to give $200 million more to AECL for the development of the new Advanced CANDU Reactor (the Advanced CANDU Reactor, or ACR, was then still known as 'CANDU-Next Generation'). The

2. Department of Finance (Canada), *Budget Plan*, Tabled in the House of Commons by the Hon. Paul Martin, Minister of Finance, March 6, 1996, p. 45.

3. ""50th Anniversary Fold-out", *AECL Annual Report 2001-2002*, inside back cover.

report stated that the government had devised a "restructuring" of the Canadian nuclear industry in three stages. The first stage was legislation to allow the nuclear industry to proceed with its plans for radioactive waste disposal. The second stage was a commitment to financially support design of the ACR, and the third stage was to provide financing for the Canadian Neutron Facility -- a reactor to replace the NRU reactor at Chalk River.[4] The first two stages of the nuclear plan have been carried out.

Table 2.
Subsidies to AECL 1997 to 2002
Government Promise Vs. Actual Subsidy
($ million dollars-of-the-year)

Fiscal Year (to Mar 31)	March 1996 Budget Promise	Direct Subsidies	% above promise
1996-1997	$174	$187.3	7.6%
1997-1998	$132	$152.8	15.8%
1998-1999	$100	$110.4	10.4%
1999-2000	$100	$137.8	37.8%
2000-2001	$100	$121.9	21.9%
2001-2002	$100	$210.4	110.4%
6-year average = $153.4 million = $214.6 million, or 30.4% above promise			

Sources: (1) Department of Finance (Canada), *Budget Plan*, March 6, 1996, p. 45.
(2) AECL Annual Reports 1997 to 2002

The 2001-2002 federal budget *Estimates* showed total subsidies of $121.604 million for AECL.[5] However, the *2001-2002 Supplementary Estimates (A),* tabled in the House of Commons on November 1, 2001[6], contained a new appropriation for $82 million, including $47 million for "additional working capital"; $25 million for "Additional funding to support nuclear research and development"; and $10 million to "refurbish and modernize the Chalk River laboratories". This raised the total AECL subsidy at that time to $203.604 million.[7]

The *2001-2002 Supplementary Estimates (B),* tabled in the House of Commons on February 28, 2002, showed that AECL had received a further subsidy in the amount of $6.868 million for "public security and anti-terrorism initiatives". This raised the total AECL subsidy at that time to $210.472

4. Peter Calamai, "Federal cabinet weighs funding for AECL", *Toronto Star*, June 4, 2991, p. A13.

5. Government of Canada, *2001-2002 Estimates, Parts I and II, The Government Expenditure Plan and The Main Estimates*, Natural Resources, Atomic Energy of Canada Limited, March 2001.

6. Treasury Board of Canada Secretariat, *Tabling of the 2001-2002 Supplementary Estimates (A)*, News Release November 1, 2001.

7. Treasury Board of Canada Secretariat, *Supplementary Estimates (A),2001-2002, November 1, 2001, p.* 117.

million [8]. This is the amount that is cited as the total parliamentary appropriation in the *AECL Annual Report 2001-2002* [9]

The *Public Accounts of Canada 2001-2002*, tabled in the House of Commons on October 24, 2002, showed a further subsidy to AECL under "adjustments and transfers" in the amount of $768,000, resulting in a total subsidy $211.240 million [10] Anticipating an adjustment in a subsequent annual report, we have recorded a total AECL subsidy of $211.2 million in Table 1. This is the largest direct subsidy that AECL has received in 15 years -- since 1987. This is a significant shift in direction for the federal government and represents a re-commitment to its futile funding of nuclear power.

The 2002-2003 federal budget *Estimates* showed total subsidies of $135.872 million for AECL.[11] Given the increase of last year's estimate from $121.6 million to final $211.2 million, it is safe to assume that AECL is in for another record subsidy year in 2002-2003.

This fundamental re-positioning of the federal government to renew its support for nuclear power is revealed in the change of a twenty year pattern of annual staff reductions in AECL. As can be seen from Table 3, employment at AECL reached a peak in 1981 with a total of 7,871 employees. Since that time, a reduction in offshore and domestic reactor sales has resulted in a steady decline of staff levels. This trend seems now seems to be reversed with staff increases taking place in the 2000 and 2002 fiscal years -- rising to 3,456 in 2001-2002 and 3,970 at March 31, 2002[12] – higher than any time since 1994.

The recent expansion of AECL's bureaucracy has included the opening of a new office in Calgary, in the western Canadian province of Alberta. The purpose of the office is unclear. The Canadian infrastructure is mainly in Ontario, with large facilities at the Chalk River Nuclear Laboratories in the Ottawa Valley near Pembroke, and Sheridan Park in Mississauga, west of Toronto, which includes the head office. There is a small presence still maintained at the Whiteshell facility in Manitoba, and for good measure, offices are also located in Ottawa and Gloucester in Ontario, and Montréal, Québec. AECL has two wholly-owned subsidiaries: AECL Technologies Inc., based in Washington and incorporated in the United States in 1998, and AECL Technologies B.V., based in Rotterdam in the Netherlands, where it was incorporated in 1995. Also part of AECL's elaborate CANDU marketing operation are offices in Buenos Aires, Argentina; Beijing, China; Seoul, South Korea; and Bucharest Romania, for a total of six offshore countries [13]

8. Treasury Board of Canada Secretariat, *Supplementary Estimates (B),2001-2002, February 28, 2002, p.* 114.

9. *AECL Annual Report 2001-2002*, p. 56.

10. Receiver General for Canada, *Public Accounts of Canada 2002*, Vol. II, Part 1, October 24, 2002, p. 17.6. The $768,000 additional subsidy is described as a "compensation adjustment" under Treasury Board Vote 15.

11. Government of Canada, *2002-2003 Estimates, Parts I and II, The Government Expenditure Plan and The Main Estimates*, Natural Resources, Atomic Energy of Canada Limited, March 2002.

12. *AECL Annual Report 2001-2002,* p. 2.

13. *AECL Annual Report 200*1-2002, p. 61.

Table 3.
AECL Employment 1979-2003

Year	Jobs	Year	Jobs
1979	7075	1992	4503
1980	7512	1993	4431
1981	7871	1994	4287
1982	7327	1995	3943
1983	6978	1996	3881
1984	6767	1997	3675
1985	5540	1998	3652
1986	5007	1999	3384
1987	4877	2000	3423
1988	4892	2001	3306
1989	4274	2002	3456
1990	4337	2003*	3970
1991	4531		

* As at March 31, 2002
Source: AECL Annual Reports 1979 to 2002

2. The 50th Anniversary and AECL Reorganization

AECL is celebrating its 50th anniversary in 2002. The crown corporation was created in 1952, and is primarily responsible for the CANDU design, engineering, research, marketing, and some project management for reactor construction. Unlike other reactor vendors, AECL does not have any in-house manufacturing capability, so AECL has acted as a marketer, negotiator, contractor, designer and procurer of equipment, with general responsibility for projects.

AECL's new President and Chief Executive Officer, Robert Van Adel, believes that AECL can solve all the world's problems through the miracle of nuclear power...

> As we seek to build on the great accomplishments of AECL over the past 50 years, humanity will continue to reap the benefits as innovative, Canadian nuclear technology is used to cure disease, mitigate global warming, power our economy and enhance our quality of life. As a world leader, AECL will continue to play a key role in realizing the unending promise of nuclear technology.[14]

AECL employees are understandably extravagant in their praise of AECL -- they have a vested interest. However, the true history of AECL is actually a long story of technological incompetence, commercial failure, crass corruption, bureaucratic bungling, accidents and environmental disasters — all funded by Canadian taxpayers. While AECL has claimed economic benefits for its activities, the indisputable testament to its financial failure has been a 50-year dependence on government subsidies, which have reached an astronomical total of over $17 billion in 2002.

AECL has continued to promote the myth that its commercial operations are self-supporting and that it is "profitable". Thus AECL claimed a "record profit" of $51.7 million in 2001-2002.[15] To maintain this myth, AECL claims that its commercial operations are separate from its research operations. In reality however, there is no real financial, managerial, or physical demarcation between commercial operations and other activities. In the same year that AECL posted a "profit" of $51.7 million, it received a direct subsidy from Canadian taxpayers of $211million. Thus, based on it real income, AECL actually experienced a loss of over $159 million.

AECL is unable to support itself because of the abysmal failure of its reactor sales at home and abroad. Robert Van Adel is only the latest of a series of company Presidents who have announced dramatic new plans to make AECL profitable. In 1996, former AECL President Reid Morden stated that "our goal is to secure ten CANDU sales over the next ten years"[16]. Only three reactors were subsequently sold -- two to China in November 1996, and one to Romania in January, 2003. Only 12 CANDU reactors have been sold abroad [17] — less than 3% of the 2001 total of 437 operable power reactors in the world.[18] Canadian utilities are not interested in building any more expensive and poorly performing CANDU reactors – there have been no reactor orders in Canada since 1974.

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14. Robert Van Adel, "President's Message", *AECL Annual Report 2001-2002*, p. 6.
15. Terry Myers, "AECL posts record profit", *North Renfrew Times*, November 15, 2002. See also: *AECL Annual Report 2002-2002*, p. 49.
16. Reid Morden, *Information Notice for Employees*, AECL, March 7, 2996, p. 2.
17. Those reactors include: Argentina 1; China 2; India 2; Korea 4; Pakistan 1; and Romania 2.
18. Nuclear Engineering International, *World Nuclear Industry Handbook 2001*, pp. 20-21.

In an attempt to rationalize continuing public subsidies, AECL has perennially held out the promise of more reactor sales. When a few reactor sales were achieved, AECL demanded more subsidies in order to capitalize on this limited success. When sales were *not* achieved, then more subsidies were requested in order to develop new technology 'to compete more effectively'.

Typically AECL has argued that it needs to design new reactors in order to compete internationally. Thus it has received billions of taxpayer dollars for new reactor designs such as the Organic Cooled Reactor, the CANDU-Boiling Light Water Reactor, the Slowpoke Energy System, the CANDU 3, the CANDU 9, and the 'CANDU Next Generation', now known as the Advanced CANDU Reactor (ACR). Ironically, AECL has sold only two basic reactor types, one the early 200 MW CANDU design to India, and versions of its standard CANDU 6. This is discussed below under the ACR.

Rather than admit that nuclear power is not viable, AECL has repeatedly tried to blame its commercial failure on administrative and managerial problems, pretending that reorganization is the solution. For example, in January 1995, AECL merged its two separate Research and CANDU Operations units into one entity, emphasizing a focus on the CANDU business [19]. In 1996, after the Program Review threatened to lower AECL funding, another restructuring initiative was implemented that eliminated several science-oriented research programs, as well as the phasing out and decommissioning the Whiteshell research facility in Manitoba [20].

Robert Van Adel was appointed President and CEO of AECL in February 2001. He has predictably initiated yet another reorganization of AECL based on what he calls an "enterprise model". This model has important variations from the 1996 corporate direction which emphasized a commercial orientation towards CANDU sales. Van Adel has pushed AECL backwards in time under the 'new' slogan that AECL is "The Total Nuclear Solutions Company™". Rather than focusing on sales, Van Adel has returned AECL to its original broad-ranging nuclear role in which "AECL is committed to provide full support and partner with its customers through the life cycle of nuclear power technology management."[21]. The range of activities includes: R&D support, nuclear services, design and engineering, reactor sales, construction management, specialist technology, waste management and decommissioning [22]. Increased subsidies have made possible Van Adel's approach of allowing AECL to 'do everything', and have made strict commercial priorities less important.

As part of this approach, AECL's operations were divided into two new units in 2001, called "Nuclear Products & Services" and "Technology".[23] Despite an ostensible intent to make AECL self sustaining, Van Adel's forward-to-the-past approach has apparently been the basis for almost doubling federal subsidies in 2002. So it comes as no surprise that the objective of becoming "self-sustaining" is only a "long-term" objective. The Corporate Plan states,

> AECL needs to be similar to other commercial enterprises. A strong commercial management culture is required in order to leverage the synergies between the continuing nuclear science and technology requirements arising from Canada's past

19. *Information Notice for Employees from Reid Morden*, AECL, March 7, 1996, p. 5.
20. *Information Notice for Employees from Reid Morden*, AECL, March 7, 1996, pp. 3- 5.
21. *AECL Corporate Plan Summary 2001-02 to 2005-06*, November 28, 2001, p. 5.
22. *AECL Corporate Plan Summary 2001-02 to 2005-06*, November 28, 2001, p. 5.
23. *AECL Corporate Plan Summary 2001-02 to 2005-06*, November 28, 2001, p. 6.

nuclear business, and the current commercial opportunities. [24]

There are several obvious problems with this plan. First, diffuse activities will detract from a focus on sales and commercial services. A crown corporation perennially dependent on massive government subsidies cannot have a truly commercial culture. Van Adel notes that AECL's commercial competitors "aggressively market selective services". The reason for this is evident -- AECL's competitors are expected by their shareholders to turn a profit. By contrast, Van Adel suggests that AECL is "...prepared to make the sustained investment needed to maintain the full spectrum of products and services the customers require." [25]. Unfortunately for Canadian taxpayers, AECL's "sustained investment" depends on federal government subsidies.

Accountability has been an ongoing problem with AECL. In the *Report of the Auditor General — December 1998*, it was noted that the government had not approved AECL's annual five-year corporate plan since 1994-95. The Auditor General noted that this was a violation of the accountability framework set out Financial Administration Act.[26] This had resulted in a statement on this issue by the auditors in AECL's financial statements since 1998. It was not until July 2002 that the Cabinet finally approved AECL's 2002-03 to 2006-07 corporate plan, thus meeting the requirements of the Financial Administration Act for 2002-03.[27]

24. *AECL Corporate Plan Summary 2001-02 to 2005-06*, November 28, 2001, p. 7.

25. *AECL Corporate Plan Summary 2001-02 to 2005-06*, November 28, 2001, p. 8.

26. Auditor General of Canada, *Report of the Auditor General of Canada — December 1998*, Chapter 29, pp. 29.8-29.10.

27. Auditor General of Canada, *Report of the Auditor General of Canada — December 2002*, Chapter 11, pp. 36-37.

3. Nuclear Renaissance: False Hope for a Failed Industry

In 2001 and 2002 the international nuclear industry attempted to revive its failing fortunes with a orchestrated public relations campaign. The campaign focused on the claim that the world is experiencing a "nuclear renaissance". The rationale for this false claim originates in the restructuring of the electricity sector in the United States, which saw the introduction of wholesale electricity competition in the 1990s and the partial introduction retail electricity competition in 17 states.[28] Restructuring has resulted in a significant consolidation of the American nuclear power industry through plant purchases and corporate mergers.

Initially, the American electrical utilities faced with restructuring viewed their nuclear plants as liabilities. However, the U.S. federal government and most restructuring states approved stranded cost recovery – relieving nuclear plants of their debt and decommissioning liabilities, and forcing consumers to pick up the tab. Stranded costs are typically defined as the debt and liabilities that cannot be serviced by new commercial companies in a competitive environment. Utilities are allowed to restart their commercial lives with the windfall profit of debt relief for their unprofitable nuclear plants. The stranded costs typically remain in the rate base, and all ratepayers are forced to pay off this debt at a standard negotiated rate.

Stranded cost allocations were essentially a bailout for nuclear power plants, which allowed the utilities to sell the plants at far less than their original cost. Beginning in 1998 a series of nuclear plant purchases began at bargain basement prices. First on the block was the Three Mile Island I reactor, sold by GPU Nuclear to PECO/Amergen at a derived purchase price of $29/kW.[29] That deal was announced in July 1998, and throughout 1998 and 1999, prices remained extremely low, as nine plants changed hands for prices even lower than Three Mile Island. However, by March 2000, when Entergy announced the purchase of the Fitzpatrick and Indian Point 3 plants from the New York Power Authority, the purchase price had risen to $280/kW[30] (higher, but still relatively low compared to original capital costs). By November 2001, consolidation had resulted in 68% of US nuclear generating capacity being owned by 12 companies.[31] The consolidation process may continue with the creation of operating companies in addition to mergers and purchases.

This process has resulted in the continued operation of several nuclear plants that otherwise would likely have been shut down. However, the consolidation process has serious drawbacks and only limited potential. First, this so-called 'successful nuclear renaissance' has only been achieved on the backs of consumers through stranded cost allocations in the states with retail competition. An estimated one third of capital investment stranded costs have been for nuclear plants. Further stranded costs are being allowed for the *future* cost of decommissioning nuclear plants once they have reached the end of their useful lives. Since these costs are unknown, this represents a huge potential liability for ratepayers. Decommissioning costs may be as much *or more* than the original capital cost of the nuclear plants. The US Nuclear Regulatory Commission has estimated that the unfunded decommissioning liabilities for the nuclear industry are about $40 billion, of which $22.5

28. Michael Chinworth, R. Lee Clanton, Chris Rusch & Audrey Taucher, "Deregulation in the USA", *Nuclear Engineering International*, December 2001, p. 21.

29. Michael Chinworth, R. Lee Clanton, Chris Rusch & Audrey Taucher, "Deregulation in the USA", *Nuclear Engineering International*, December 2001, p. 20.

30. Michael Chinworth, R. Lee Clanton, Chris Rusch & Audrey Taucher, "Deregulation in the USA", *Nuclear Engineering International*, December 2001, p. 20.

31. Michael Chinworth, R. Lee Clanton, Chris Rusch & Audrey Taucher, "Deregulation in the USA", *Nuclear Engineering International*, December 2001, p. 20.

billion has been collected from customers and spent.[32] Thus, nuclear plants purchased in 1998 and 1999 were obtained for a tiny fraction of their real cost. This does not mean that nuclear power is 'profitable', it means that ratepayers were forced to underwrite the nuclear industry takeovers through stranded costs, and will continue to be ripped off for nuclear-generated electricity through decommissioning costs.

3.1. The High Cost of New Nuclear Plants

The big lie of the "nuclear renaissance" is revealed by the fact that no ***new*** nuclear plants are being built (or *will* be built) under competitive market conditions. This is because they are so much more expensive than alternative means of generation. In addition to having safety and performance problems, high cost has been a feature of all major reactor designs. The nuclear industry has long argued that while nuclear power plants may have very high capital (construction) costs, the operating costs (primarily fuel costs) are very low, leading to an overall low lifetime unit energy cost. In fact, despite lower fuel costs, lifetime unit energy costs for nuclear power plants are relatively high. A study by the Institute for Energy and Environmental Research (IEER) found that nuclear power typically costs about twice as much as combined cycle natural gas-fired generation. Under several scenarios, nuclear total lifetime cost ranged from 4.58 cents/kWh to 8.79 cents /kWh, while combined cycle gas plants ranged from 2.26 cents/kWh to 3.897 cents/kWh.[33]

A cost accounting of Canadian generating alternatives has corroborated the IEER findings. A study conducted for the Independent Power Producers' Society of Ontario found that CANDU nuclear stations were about twice the cost of gas-fired industrial cogeneration plants, both before and after environmental externalities were factored in. The study found that nuclear costs (based on Ontario Power Generation's most modern plant, the Darlington Nuclear Station) were 11.708 cents/kWh ($1997 CDN), and gas-fired industrial cogeneration was 5.521 cents/kWh. When mid-range environmental externalities were added, the corresponding costs were 14.989 cents/kWh for CANDU nuclear and 6.621 cents/kWh for gas-fired industrial cogeneration.[34]

In its final Annual Report,[35] Ontario Hydro stated that its average cost of nuclear generated electricity had reached an all-time high of 7.721 cents/kWh. Ontario Hydro's massive debt and liabilities of $38 billion were largely incurred through its ill-considered nuclear program. This figure includes some provision for the future (as yet unfunded) liabilities associated with the radioactive waste management and decommissioning of reactors of about $2.3 billion.[36] In fact, Ontario Hydro had already identified total future liabilities for reactor decommissioning and nuclear waste management of $18.7 billion ($1998).[37] The Province of Ontario has identified a total Stranded Debt of $20.9 billion, remaining after the restructuring of the utility, which does not include the

32. Michael Chinworth, R. Lee Clanton, Chris Rusch & Audrey Taucher, "Deregulation in the USA", *Nuclear Engineering International*, December 2001, p. 19.

33. Arjun Makhijani, "Reducing Greenhouse Gases and Creating a Sustainable Energy Supply", *Science for Democratic Action*, Institute for Energy and Environmental Research (IEER), March 1998, p. 7.

34. David Argue Consulting, *A Review of the Economic Cost of Power in Ontario*, Independent Power Producers' Society of Ontario (IPPSO), May 1997.The cost comparisons were based on a standard 20 year life with a 10% discount rate, and a 65% load factor.

35. Ontario Hydro ceased to exist on March 31, 1999, and its generating assets were turned over to Ontario Power Generation.

36. Ontario Ministry of Finance, *Stranded Debt Fact Sheet*, April 1, 1999.

37. Ontario Hydro, "Nuclear Waste Management Booklet Update", 1 page, March 1, 1999.

future liabilities for decommissioning and waste management. This stranded debt is largely a measure of how uneconomic nuclear power has been in Ontario, since it represents in part the amount of the debt that cannot be serviced by Ontario Power Generation, formerly Ontario Hydro.

Capital costs for existing nuclear plants range from $1750/kW to $2000/kW (US), but it is generally accepted that in order to be competitive with coal and natural gas, nuclear construction costs will have to be reduced to at least $1000/kW (US).[38] AECL states that the capital cost for the current CANDU 6 reactor is about $1,850/kW (US), and it believes that a 46% reduction in costs will be necessary for the Advanced CANDU Reactor (ACR) if it is to compete successfully (see below).[39]

It remains to be seen if the next generation reactors of reactors being proposed by nuclear companies will be able to cut their capital costs in half. Based on past experience, the nuclear industry has typically had very poor cost control. In Canada, for example, the cost of the Darlington nuclear generating station (the most recent station) experienced a disastrous cost overrun from an original estimates of $2.5 billion in 1973, and $7.4 billion in 1981 [40] to a final cost of over $14 billion by the time all four reactors were operational in 1993. As energy analyst Amory Lovins stated, “After a half-century of nuclear power, the verdict of the marketplace is in. Nuclear power has flunked.”[41] The high economic and environmental costs of nuclear power have been recognized around the world. There have been nuclear phase-out policies implemented in Italy, Austria, Sweden, Germany and Belgium.

Despite wishful thinking by the nuclear industry, and vociferous nuclear boosterism from the Bush/Cheney White House, even government analysts in the United States Department of Energy do not think there is much chance of a nuclear comeback. In its 2002 long-term international forecast, the Energy Information Administration (EIA) of the US Department of Energy, suggested under its low-growth scenario that nuclear power capacity would decline 20.3% between 2000 and 2020.[42] Even the EIA Reference Case projects only a slight increase from 349.9 gigawatts (GW) to 359.4 GW. In its domestic forecast for the United States, the EIA predicted in its reference case that ten per cent of current nuclear capacity will be taken out of service by 2020, “...primarily as a result of the high costs of maintaining the performance of older nuclear units as compared with the cost of constructing the least expensive alternative.” This amounts to 10 GW of the 98 GW currently operational. The EIA also stated that,

> No new nuclear units are expected to become operable between 2000 and 2020 [in the United States], because natural gas and coal-fired units are projected to be more economical. [43]

The nuclear “renaissance” public relations campaign has been sustained largely by support from the Republican White House. On May 17, 2001 Vice President Dick Cheney released his National Energy Policy which recommended “...that the President support the expansion of nuclear energy in

38. Michael Chinworth, R. Lee Clanton, Chris Rusch & Audrey Taucher, “Deregulation in the USA”, *Nuclear Engineering International*, December 2001, p. 22.

39. *AECL Corporate Plan Summary 2001-02 to 2005-06*, November 28, 2001, p. 30.

40. Ontario Hydro, *Darlington G.S. History Summary*, March 1992, Demand Supply Plan Hearing Exhibit 539.

41. Amory and Hunter Lovins, “The Nuclear Option Revisited: Too Expensive and Unacceptably Risky”, *Los Angeles Times*, July 8, 2001.

42. US Department of Energy, Energy Information Administration, *International Energy Outlook 2002*, p. 93. This is a decline of 71 Net Gigawatts, from 349.9 GW to 278.8 GW.

43. US Department of Energy, Energy Information Administration, *Annual Energy Outlook 2002*, p. 76.

the United States..."[44] In particular, the policy supported expedited re-licensing for old existing plants, as well as licensing for new reactor designs. It also supported 'upgrading' of capacity at existing nuclear plants.

The US Department of Energy is already promoting the design and construction of new nuclear plants by 2010. However, new nuclear plants will confront the insuperable issue of high nuclear cost in the context of a competitive electricity market – there are cheaper alternatives, including high-efficiency natural gas plants and even wind energy. As high as the sticker price of nuclear power is, it does not reflect the total real cost, which includes massive subsidies. In the United States, government subsidies to the nuclear industry amounted to $83 billion ($1990US) from 1968 to 1990. [45]

3.2 Nuclear Power is not Secure or Clean

As part of the 'renaissance' public relations campaign, the nuclear industry has also argued that nuclear power can provide energy security, in the face of the OPEC oil cartel. However, oil is used for very little electricity generation. Nuclear power competes with natural gas, coal, renewable technologies and conservation – all of which are relatively well distributed internationally and regionally. The September 11, 2001 terrorist attacks on New York and Washington have heightened security concerns about nuclear plants, so it is absurd to suggest that nuclear plants can *enhance* security. Nuclear plants produce radioactive material that can be used in dirty bombs, or used to manufacture nuclear weapons. An airborne attack on a nuclear plant, similar to the one that destroyed the World Trade Center, could result in a catastrophic radiation release.

Nuclear propagandists have argued that the 'nuclear renaissance' is justified on environmental grounds – that nuclear power is cleaner than other energy alternatives. This is simply not true. It has long been recognized that renewable energy alternatives such as solar, wind, and small-scale hydraulic are environmentally preferable. High-efficiency natural gas generation, as provided by combined-cycle cogeneration plants, is preferable to nuclear power. Natural gas does not produce sulphur dioxide or nitrogen oxides, which are responsible for acid rain and smog. It does however, produce carbon dioxide, responsible for climate change. Because the nuclear industry has been historically argued that nuclear power is the solution to climate change, this issue has been addressed separately below.

On the basis of its polling, the nuclear industry has decided to focus on nuclear power as the solution to air pollution, rather than the solution to climate change.[46] This has resulted in a massive public relations campaign in Canada by the nuclear industry lobby group, the Canadian Nuclear Association (CNA). Beginning in August 2002, CNA ran advertisements in major Canadian newspapers with headlines reading "Clean air is important to all of us" and "A clean future requires clean electricity".[47]

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44. *National Energy Policy*, Report of the National Energy Policy Development Group, May 2001, Summary of Recommendations, Chapter 5.

45. Komanoff Energy Associates, *Fiscal Fission: The Economic Failure of Nuclear Power*, Greenpeace USA, December 1992.

46. David Herle, *Canadian Attitudes Regarding Nuclear Energy: A Summary of Research*, Earnscliffe Research and Communications, March 2001.

47. See for example: *Toronto Star*, October 6, 2002, p. A10; and: *Globe and Mail*, October 26, 2002, p. A13.

These advertisements constitute false advertising. Even if severe accidents with radiation releases such as Chernobyl are avoided, routine radioactive pollution from reactors can lead to environmental degradation and an increased risk of public health problems. Radioactive contamination is impossible to see, smell or taste. The health effects of exposure may take years to show up, but can have deadly consequences, including increased rates of cancer and birth defects in down-wind and down-stream populations of animals and humans. There are at least 29 radioactive pollutants produced in CANDU nuclear stations that are of environmental concern. These various radioisotopes emit different types of radiation at different energy levels, and cause varying degrees of biological harm.[48] Tritium (^{3}H or T) is produced by the activation (irradiation) of deuterium (^{2}H) in heavy water. Because of the use of heavy water for both moderator and coolant in the CANDU reactor, tritium is one of the main radioactive pollutants emitted by the CANDU system. If taken into the body, tritium oxide can cause cancer or birth defects.[49]

3.3 Nuclear Power: No Solution to Climate Change

The nuclear industry saw climate change for decades as a major public relations justification for nuclear power. The industry was also hoping to obtain carbon credits for nuclear exports under the Clean Development Mechanism (CDM) of the Kyoto Protocol.

At the Sixth Conference of the Parties to the United Nations Framework Conference on Climate Change (COP 6) in The Hague in November 2000, an overwhelming majority of the Parties agreed that the sale of nuclear power plants from industrialized countries to developing countries should not be allowed to generate carbon credits under the CDM. The credits were actually intended to support the international trade of green renewable energy technologies, by generating credits that could be used in an international trading system. A consensus eventually emerged at the conference opposing nuclear power in the CDM. This was a serious blow to the nuclear industry, since carbon credits for nuclear power would have provided a much-needed subsidy for reactor sales to developing countries. Even Canada, a notorious supporter of the nuclear industry, agreed to the exclusion of nuclear power from the CDM in the final days of the conference in The Hague. However, the collapse of the conference meant that the position on nuclear power could not be adopted until the resumption of the conference in Bonn, Germany in July 2001.

Prior to the Bonn Conference, in a desperate attempt to support AECL, Canada resumed its pro-nuclear position and took a leadership role among the small minority of countries that supported nuclear power. Having wasted billion of dollars on direct subsidies to AECL, the Canadian government was now trying to use the Kyoto Protocol as a new subsidy to prop up its failing nuclear industry. Environmental advocates argued that this would have undermined the need for domestic reductions of climate change gases in Canada.[50]

In the meantime, George W. Bush was declared President of the United States, and in March 2001 his administration rejected the Kyoto agreement. Despite the efforts of Canada and its few pro-nuclear allies, the Bonn COP 6 agreement eventually opposed emission credits for nuclear power,

48. Environment Canada, *Environmental Codes of Practice for Steam Electric Generation, Design Phase*, Report EPS 1/PG/1, March 1985, p. 23.

49. Amory Lovins, Robert Sardinsky et al., *The State of the Art: Lighting*, Competitek Service of Rocky Mountain Institute, March 1988, p. 239.

50. Sierra Club of Canada, “Canadian Environmentalists Say: Save the Climate, Not the Nuclear Industry”, *News Release*, July 9, 2001.

both for developing countries and the countries of Eastern Europe. This was a significant defeat for the international nuclear industry, which had argued for decades that nuclear power was a major solution to climate change. In contrast, the environmental community had pointed out that climate change was largely a problem caused by deforestation and pollution from transportation fuels – problems that could not be solved by nuclear power. Even in the electricity sector, environmentalists argued that there were cheaper, cleaner and safer alternatives to nuclear power, namely renewable energy and efficiency technologies. They also argued that it was ethically repugnant to trade nuclear power's problems (radioactive emissions, radioactive waste, the risk of catastrophic accident and nuclear weapons proliferation) for the environmental problems of climate change. The vast majority of countries at the Bonn COP 6 conference rejected carbon credits for nuclear power because they would have subverted the Kyoto Protocol's intent to promote the truly sustainable energy technologies as the real solutions to climate change.

4. New Nuclear Megaprojects

AECL has a number of new nuclear megaprojects on the drawing board and under way. The keystone of AECL's current corporate strategy is the "Next Generation CANDU" (NG CANDU), now known as the Advanced CANDU Reactor (ACR). Ironically, the reactor is neither a CANDU, nor is it "advanced". It is yet another risky reactor design from AECL that will likely never get off the drawing board. If a prototype is built, Canadian taxpayers will certainly live to regret it — the cost for just design and engineering work will be at least $200 million, and construction of a prototype reactor would be much more expensive.

AECL has also been attempting to build reactors to replace the aging NRU reactor for more than a decade. The story is another tale of staggering technical incompetence, legal wrangling, huge cost overruns, and ongoing government subsidies. Details about the MAPLE reactors are provided below.

Finally, yet another new nuclear boondoggle by AECL, the $500 million Canadian Neutron Facility, can be expected to resurface soon. The government apparently sees the construction of this reactor as the next stage in its new nuclear strategy.

4.1. Advanced CANDU Reactor: A New Failure in the Making

AECL began consideration of a re-designed CANDU reactor in 2000, when the reactor concept was known as the "Next Generation CANDU", or "NG-CANDU". In 2002, the name of the NG-CANDU was changed to Advanced CANDU Reactor (ACR). Former AECL President and CEO Allen Kilpatrick made this comment on the new reactor design in 2000,

> There are some very tough economic targets to be achieved if we are to remain competitive in the future in a deregulated environment. We must compete not only with other nuclear reactors, but also with other electricity-generating sources like combined cycle gas turbines.[51]

AECL faces the insuperable challenge that CANDU reactors are at least twice as expensive as natural gas and coal alternatives, which renders them unviable in a competitive electricity market. AECL engineers are therefore attempting to design a reactor that can be built for about half the current price. CANDU reactors are notorious for having a higher cost even than other reactors. The main reason for high CANDU cost is the large amount heavy water that is used for both cooling and moderation. Heavy water is worth about $300/kg [52] and there is roughly one tonne of heavy water per megawatt of capacity in a conventional CANDU.

In June 2001, it was reported that AECL was pressuring the government for $200 million to work on the NG-CANDU design.[53] With no public debate or discussion, the cabinet apparently committed hundreds of millions of dollars over five years to this major new initiative. Moreover, this program launches AECL on yet another round of futile international marketing, based on the unachievable

51. AECL, *President's 2000/01 Corporate Plan Update*, October 2000, p. 5.

52. Pearl Marshall, "AECL Official Says CANDU NG will be Ready to Build in 2005", *Nucleonics Week*, November 15, 2001, p. 9.

53. Peter Calamai, "Federal cabinet weighs funding for AECL: Fate of nuclear agency hangs in the balance as cabinet looks at 3 proposals", *Toronto Star*, June 4, 2001, p. A13.

hope that it can cut its reactor costs in half. AECL claims that the current capital cost of a conventional CANDU (presumably based on the two-reactor Qinshan station in China) is $1850/kW (US) ($2894/kW CDN), and that its target for cost reduction is $1000/kW (US) ($1564/kW CDN).[54] Based on past performance, this proposed 46% reduction in cost is not a credible goal.

Despite the fact that engineering work has not even been completed, AECL deceitfully claims in its news releases that the cost reduction has already been achieved: "The overnight capital cost for twin units is $1000/kW [US]...".[55] The term "overnight capital cost" means that interest during construction period is ignored. However, in a real evaluation of nuclear plant costs, interest *must* be taken into account, because the construction time is at least four to five years, and interest charges become a major cost component. In an extraordinary example of wishful thinking, British Energy Executive Chairman, Robin Jeffrey, went even further than the AECL news release and suggested that the ACR capital cost could be reduced to as little $700 or $800/kW (US).[56] Contradicting both Robin Jeffrey and AECL's own news release, AECL Vice-President Gary Kugler said more honestly that $1000/kW (US) is a "...target, and we're not there yet...".[57] AECL consultant Roger Gale of GF Energy has stated that the $1000/kW is only a "target... for the fourth unit and beyond..." (i.e. cost reductions are possible through economies of scale *only if* a client commits to build at least four reactors).[58]

Even if AECL can achieve the seemingly impossible task of cutting its costs in half, it is still uncertain that its reactors will be able to compete in an open market with gas-fired plants that cost $500/kW to build.[59] Much will depend upon the relative prices of gas and uranium. The Canadian government is subsidizing the ACR in the hope that natural gas prices will escalate dramatically; that the ACR will function at very high capacity factors (85% or more); and that there will be no technological problems associated with the reactor. This is a scenario doomed to failure.

The major design elements of the ACR are as follows:

- *Use of slightly enriched uranium (SEU).* This is a major departure from conventional CANDU design, which has used "natural" uranium at about 0.7% uranium-235. SEU for the ACR will be 1.6% U-235, as compared to the 3 or 4% used in American-style Light Water Reactors.

- *Light water cooled, heavy water moderated.* Another major departure from conventional CANDUs which use heavy water for both cooling and moderation.

- Reduced reactor core size.

54. *AECL Corporate Plan Summary 2001-02 to 2005-06*, November 28, 2001, p. 30. The conversion to Canadian dollars is at November 11, 2002 @ 1.564.

55. AECL, "AECL Technologies Inc. Launches the ACR-700 in the US", *News Release*, June 24, 2002.

56. Pearl Marshall, "Jeffrey optimistic AECL can meet tough BE Targets for CANDU design", *Nucleonics Week*, November 15, 2001, p. 10.

57. Pearl Marshall, "AECL Official Says CANDU NG will be Ready to Build in 2005", *Nucleonics Week*, November 15, 2001, p. 10.

58. Jenny Weil, "AECL says economics of ACR-700 are attracting utility interest", *Nucleonics Week*, June 27, 2002, p. 3.

59. Michael Chinworth, R. Lee Clanton, Chris Rusch & Audrey Taucher, "Deregulation in the USA", *Nuclear Engineering International*, December 2001, p. 22.

Reduced use of heavy water in the ACR is expected to reduce costs, since heavy water is expensive to produce (about $300/kg). There is a tradeoff however, since there will be an added cost to enrich the uranium fuel.

Despite its name, the ACR is clearly not an "advanced" reactor in the usual sense, i.e. with full passive fail-safe safety systems. Ten countries (including Canada) have formed an international body known as the "Generation IV International Forum" to cooperate on the promotion of advanced reactor designs. They have chosen six reactor technologies to focus on, and significantly, the ACR is not one of the six designs.[60]

The British government's *Energy Review*, released in February 2002, was established to make recommendations for Britain's long-term energy future. The Review received a submission from British Energy (BE), a private sector nuclear utility, which included a proposal for 10 GW of new nuclear capacity by 2020 – using either the CANDU-NG or the Westinghouse AP1000 reactor. Experts retained for the Review concluded however, that the deployment time proposed by BE (commissioning of the first twin station by 2011) was unrealistic, since it assumed an immediate commitment by the government and BE. Review experts said it would more likely be 2014 or 2015 before the first units were commissioned, meaning it would be 2025 before 10GW of nuclear capacity could be completed. Given this delay, the Review experts suggested that it would make sense to wait for the "Generation IV" advanced reactor designs, which would be available by 2015 or 2020.[61]

AECL's marketing strategy for the ACR is to hit a supposed market window of opportunity before the most of the truly advanced reactor designs are available in the 2015-2020 time frame. Thus they are already rushing the untested ACR design to market, hoping that costs can be reduced sufficiently and trying to pass the design off as "advanced" – thus the name change from "Next Generation CANDU" to "Advanced CANDU Reactor". AECL is pretending that the ACR will have the proven technology of the existing CANDU 6 reactors, while having the advantages of advanced designs. In reality, the ACR is neither fish nor fowl – not a truly advanced design, and with unproven new technology combining light water coolant, heavy water moderator and SEU fuel.

Because of its dismal history of technological failure, AECL is very sensitive about charges that it is not engaging in a responsible or acceptably conservative research and development program for the Advanced CANDU Reactor. Speaking about the ACR project, AECL Vice-President Gary Kugler has said, "We're not leapfrogging technology".[62] Unfortunately, that's exactly what they are doing. The Canadian nuclear industry has a long history of proceeding with the construction of new reactors before the prototypes or earlier versions have had sufficient operating time to be fully tested. This was what led to major technological and financial failures along with multi-million dollar dead-ends in research and development. For example, AECL and Ontario Hydro began to design the Douglas Point reactor in 1959 before its predecessor, the prototype NPD reactor was even built or operating. Douglas Point was ten times bigger, and it turned out to be a dismal failure, with a capacity factor of 50% over a lifetime of less than 18 years. Federal taxpayers forgave a $70 million debt. The reason AECL and Ontario Hydro proceeded with Douglas Point was because early commercial reactors

60. US Department of Energy, "Secretary of Energy Announces International Agreement on the Future of Nuclear Energy Technologies", *News Release*, September 20, 2002.

61. Performance and Innovation Unit, United Kingdom Cabinet Office, *The Economics of Nuclear Power*, PIU Energy Review Working Paper, February 2002, pp. 14-15.

62. Pearl Marshall, "AECL Official Says CANDU NG will be Ready to Build in 2005", *Nucleonics Week*, November 15, 2001, p. 9.

were already operating in the United States and Great Britain, and they were anxious not to get left behind. The same kind of commercial pressure is being used as an argument for throwing money at the ACR, in order to get it launched in 2005 or 2006, before truly advanced reactor designs are put on the market.

AECL also has a long history of horribly expensive reactor designs that never made it off the drawing board, such as the CANDU 3, the Slowpoke Energy System (SES), the CANDU-Boiling Light Water reactor, the Organic Cooled Reactor, and the CANDU 9. The rationales for these projects bear a marked resemblance to rationale for the Advanced CANDU Reactor. They were all going to be the commercial salvation of AECL. However, all of them required multi-million dollar investments from the federal government, courtesy of Canadian taxpayers...

- **Organic Cooled Reactor (WR-1)** -- AECL built an experimental 40 MWt organic-cooled reactor (WR-1) at the Whiteshell Nuclear Laboratories in Manitoba in the 1960s. Using experience gained from the WR-1, AECL designed an organic-cooled power reactor in 1970s, but it was never built because of the previous investment in heavy water-cooled reactors.[63] We don't know how many million of taxpayer dollars AECL wasted on that project.

- **CANDU-BLW (Gentilly 1)** -- In 1965 AECL and Hydro Quebec cooperated on new variation of the CANDU reactor. Like the ACR, it was going to be an "evolutionary" design. The Gentilly I reactor was a 250 MW boiling light water reactor. Frighteningly like the ACR, it also used ordinary water as coolant and heavy water as moderator. Once again, the federal government assumed liability if things went wrong, as they did. The reactor was completed in 1970, but operated less than 200 days in total, and was finally shut down for good in 1979. Federal taxpayers paid $126 million for bad loans and interest.

- **Slowpoke Energy System** -- From 1985 to 1990, AECL spent about $45 million on the Slowpoke Energy System (SES) – a small reactor intended to provide district heating. However, nobody wanted a reactor for a furnace in their backyard. AECL was run out of town when it proposed to install an SES free-of-charge at the University of Sherbrooke Medical Center (CHUS) in Sherbrooke, Quebec in 1987-88 [64]. AECL subsequently tried to give the reactor away to Canadian General Electric for its plant in Peterborough, Ontario and to the University of Saskatchewan – the offer was rejected in both locations after public protest.

- **CANDU 3** -- In 1989-90, AECL spent about $75 million on design and engineering for the CANDU-3 -- a small 300 MW reactor. Like the ACR, it was going to be smaller and cheaper. It was going to fit into the niche markets where a larger reactor would not be appropriate. However, the CANDU 3 was a flop, because nobody in the world wanted to risk being the first to build an untested reactor. AECL had even tried to convince the provinces of New Brunswick and Alberta into building the reactor with federal support, but neither province was willing to take the risk.

- **CANDU 9** -- The CANDU-9 is 900 MW single-unit reactor designed by AECL in the early 1990s, roughly based on the Bruce and Darlington nuclear stations in Ontario. The CANDU-9 reactor is untested, since all of AECL's previously built reactors in Canada and around the world are 600 to 700 MW designs known as 'CANDU-6'. AECL claims that the four 881 MW reactors at Ontario Power Generation's Darlington Nuclear Station serve as reference plants. However, the Darlington reactors were designed and built by the former Ontario Hydro, with a unique four-

63. AECL, *Canada Enters the Nuclear Age*, 1997, pp. 325-332.

64. Tom Vandermeulen, *Beware of AECL Bearing Gifts: A Slowpoke Journal*, Coalition CHUS, 1989.

reactor configuration, sharing containment and other systems. The design went for a two-year "up-front" licensing review by the Atomic Energy Control Board (now known as the Canadian Nuclear Safety Commission) in 1995-96 [65], but there is no reference plant. AECL tried to sell two CANDU 9 reactors to South Korea, which was its best customer, having bought four CANDU reactors in the past. However in February 2001, after much prevarication, Korean government officials finally disclosed that Wolsong-5 and -6 would be built as 1000 MW Pressurized Water Reactors.[66] This decision closed the door on AECL's last best hope for more reactor sales in the foreseeable future.

AECL has not disclosed how much money was wasted on CANDU 9 design and engineering, since it was not tracked as a separate line item in parliamentary appropriations. However, we do know that AECL started conceptual phase studies on the CANDU 9 reactor in 1987, so it must represent a sizable investment over a decade -- likely hundreds of millions of dollars.[67] Former AECL President Allen Kilpatrick said that during the 1990s AECL thought that marketing the CANDU 9 was "the way to go". In 2001 the CANDU 9 was out the window, and AECL argued that smaller units were more saleable. [68] So AECL then lobbied for more subsidies for design work on the Advanced CANDU Reactor (ACR).

AECL hopes to have the ACR ready to market in five years – by 2005 or 2006. Never a company to let proper preparation get in the way of precipitous action, AECL is already proceeding with an aggressive marketing and pre-licensing review process for the ACR in Canada, the United States and the United Kingdom before design and engineering work has been completed.

As noted above, in September 2001, British Energy (BE, a private British electrical utility primarily devoted to nuclear power) made a submission to the United Kingdom's Energy Review. A key part of this submission was the proposal to replace the company's aging existing nuclear plants with ten gigawatts of nuclear generating capacity. [69] The proposal was not for a specific number of reactors, but proposed consideration of the Westinghouse AP 1000 (1000 MW) and the CANDU NG 600 (600 MW reactor).[70] On November 2, 2001, BE (as potential customer) and AECL (as vendor) signed a one-year agreement in Edinburgh to assess the feasibility of building CANDU NG reactors (ACRs) in the UK.[71] The signing ceremony was followed by a public seminar organized by the Canadian High Commission in Edinburgh.[72] However, the February 2002 report of the *Energy Review* was widely heralded as sounding the death knell of the nuclear industry. The report opposed further government subsidies or special policy support for nuclear power, measures deemed absolutely necessary by BE.[73]

65. Victor Snell, *CANDU 9 – Meeting Evolving Safety and Licensing Requirements*, AECL, March 1994, p. 2.

66. Mark Hibbs, "Wolsong-5 and -6 to be PWRs, Korea decided at end of 2000", *Nucleonics Week*, February 15, 2001, pp. 3-4. See also: Mark Hibbs, "CANDU out of running in Korea for new orders, AECL believes", *Nucleonics Week*, February 8, 2001, pp. 1, 11-13.

67. "CANDU 9 based on Darlington", *Nuclear Business Review*, Ontario Hydro Nuclear, Vol. 3, No. 2, February 1995, p. 5.

68. "CANDUs get smaller and leaner", *Nuclear Engineering International*, April 2001, p. 35.

69. This could for example equal ten 1000 MW reactors or twenty 500 MW reactors.

70. British Energy, *Replace Nuclear With Nuclear*, September 2001, p. 13.

71. "British Energy and AECL Sign Agreement on Potential New UK Nuclear Reactor Programme", *AECL News Release*, November 2, 2001. See also: Pearl Marshall, "Joint Canadian-British approach explored for Advanced CANDU design", *Nucleonics Week*, November 8, 2001, pp. 3-4.

72. Pearl Marshall, "BE, AECL, ready contract to study feasibility of CANDUs in UK", *Nucleonics Week*, November 1, 2001, p. 6.

73. Performance and Innovation Unit, UK Cabinet Office, *The Energy Review*, February 2002, p. 11.

In June 2002, AECL launched its campaign to market the ACR-700 (a 700 MW version of the reactor) in the United States, with a news conference in Washington.[74] The previous week, AECL had sent a request for "pre-certification review" of the ACR design to the Nuclear Regulatory Commission (the American nuclear regulatory agency). It is expected to take one to two years for the pre-application work, and another two years for the certification process.[75] At the same time, AECL has also initiated an "up-front" licensing process in Canada with the Canadian regulator — the Canadian Nuclear Safety Commission, and a pre-licensing review with the British regulator — the Nuclear Installations Inspectorate (NII).[76] The NII was planning to set up a 23-man team to review both the Westinghouse AP-1000 reactor and ACR-700, which were both proposed for licensing in June 2002. The NII estimated that it would be a three-year project costing about 6 million pounds, or $9.3 million (US). AECL and BE have proposed that the licensing process for the ACR be a partnership effort between the NII, the NRC, and CNSC. However, the NII put the review on hold because British Energy is bankrupt, and there is uncertainty whether the company can pay its share of costs for the review.[77]

4.2. The MAPLE Reactor Fiasco: AECL Incompetence

On November 1, 1991, the Canadian government sold a former AECL subsidiary called Nordion for $165 million to MDS Health Group (now known as MDS Inc.). $150.5 million from the sale was transferred to the federal government.[78] AECL also entered into a 23-year contract for the exclusive supply of medical radioisotopes to Nordion International (now known as MDS Nordion), and committed to construction of a new reactor at the Chalk River Nuclear Laboratories – the MAPLE-X10 reactor (Multipurpose Applied Physics Lattice Experimental - 10 MW) – to produce the radioisotopes. In the meantime, radioisotopes continued to be produced in the aging NRU reactor, also at Chalk River. The NRU reactor is experiencing serious technical problems due to aging but its shutdown has been delayed several times. The current shutdown deadline is 2005.

Some time after the sale of Nordion, it became obvious that AECL had drastically underestimated both the cost of operating the old NRU reactor, and the capital cost of the new MAPLE-X10 reactor. MDS Nordion, having already entered into a contract on the basis of lower costs, was unwilling to pay more for its isotopes in order to compensate for AECL's inaccurate cost assessment. MDS Nordion went to court, claiming that AECL was obligated to complete the MAPLE-X10 to back up production at the NRU. Failing that, MDS Nordion argued that the 1991 sales contract should be rescinded, and that AECL should return the $165 million purchase price of Nordion International, plus $300 million in damages.

As a result of the legal action, AECL halted construction of the MAPLE-X10 in November 1993,[79] and the case eventually went to arbitration. In an out-of-court settlement on July 9, 1996,

74. "AECL Technologies Inc. Launches the ACR-700 in the US", *AECL News Release*, June 24, 2002.

75. Jenny Weil, "AECL says economics of ACR-700 are attracting utility interest", *Nucleonics Week*, June 27, 2002, p. 3.

76. Pearl Marshall, "Prelicensing reviews of AP-1000, ACR-700 hit funding uncertainties", *Nucleonics Week*, October 24, 2002, p. 18.

77. Pearl Marshall, "Prelicensing reviews of AP-1000, ACR-700 hit funding uncertainties", *Nucleonics Week*, October 24, 2002, p. 18.

78. Atomic Energy of Canada Ltd., *AECL 1991-1992 Annual Report*, p. 12. CDIC had "expenses" of $4.5 million, and $10 million was held back until November 1993.

79. Ray Silver, "Battle Over Isotope Production Costs Threatens AECL's MAPLE-X10", *Nucleonics Week*, November 18, 1993, p. 8.

the federal government agreed that it would fund the construction of *two* MAPLE reactors.[80] Taxpayers paid the lion's share of costs, and a private corporation, MDS, reaped the profits. The reactors will be operated by AECL on a contract basis, but owned by MDS Nordion. As part of the settlement, the federal government paid $5 million of the cost of the reactors directly, and AECL provided another $12.5 million. In addition, the federal government provided a $100 million interest-free loan to finance the reactors and a new reprocessing facility.[81] Details of the total project cost, loan terms, long-term liability for waste management and decommissioning, have remained secret.

The original estimated total cost of the MAPLE-X10 reactor in 1989 was $23 million, but by 1993, AECL had spent $40 million on just the reactor design and construction of the reactor building. The total estimated cost had sky-rocketed to $100 million.[82] MDS Nordion had apparently contributed $20 million of the $40 million spent on the reactor up to that point. MDS Nordion owns the reactors, but AECL (owned by the federal government), is responsible for their construction, operation and decommissioning, as well as radioactive waste management. Similarly, AECL and the federal government will be responsible for liability in the event of a serious accident. MDS Nordion said that the estimated cost of construction of the reactors is $140 million.[83]

It was originally expected that the reprocessing facility for the two reactors would be complete in July 1999; with the first reactor to be complete in September 1999, and the second in May 2000. On April 3, 1997, the Atomic Energy Control Board (now known as the Canadian Nuclear Safety Commission) approved the Environmental Screening Report for the two MAPLE reactors and the processing facility under the Canadian Environmental Assessment Act. Environmental groups protested and said that the two reactors were of an un-tested design, that the need for the project had not been demonstrated. They complained about time pressure on the project for commercial reasons, and said that reactor design changes should have been reviewed because of safety concerns.[84]

Despite many crucial gaps in information about the project, the AECB gave its approval on December 12, 1997 for construction to proceed on what was by then being called the *MDS Nordion Medical Isotope Reactor Project* (MMIR).[85] Environmentalists objected to construction approval because only limited safety analyses had been conducted, rather than waiting for the final Safety Analysis Report, which was scheduled for completion on June 30, 1998.[86] They argued that AECL was pressuring the AECB into premature approval for commercial reasons with inadequate safety and quality assurance. Despite a number of still unresolved questions relating to safety, on November 5, 1998, the AECB allowed AECL to assemble and install the reactor cores for both MAPLE reactors.[87]

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80. "Settlement will preserve high-tech jobs and save taxpayer dollars", *Natural Resources Canada News Release*, 96-78, July 9, 1996.

81. *Ibid..*

82. R. Silver, "New Research, Test Facilities are Dropped from AECL Plans", *Nucleonics Week*, March 10, 1994, p. 5.

83. *MDS 1997 Annual Report*, note 13, p. 43

84. See: *Submission from Nuclear Awareness Project*, CEEA Environmental Screening for the Medical Isotope Project, March 5, 1997 (Available as AECB BMD 97-51.1) See also: *Presentation to the Atomic Energy Control Board, April 3, 1997, on the Screening Report for the Medical Isotope Project* (presented by David H. Martin).

85. "AECB announces recent decisions", *Atomic Energy Control Board News Release*, December 12, 1997.

86. Concerned Citizens of Renfrew County and Area, Letter from Ole Hendrickson (CCRCA Researcher) to Dr. Agnes Bishop (AECB President & CEO), December 7, 1998 (filed as AECB BMD 97-205.2).

87. Atomic Energy Control Board, *MAPLE Reactors, Approval to Assemble the Reactor Cores pursuant to condition 14 of Construction Approval, NRCA 62/97*, BMD 98-159, October 20, 1998.

The first MAPLE reactor went critical in February 2000, but the warnings of environmental groups proved to be exactly correct when problems developed with control and shut off rods – crucial systems that ensure safety of the reactors. Shut Off Rods were failing to drop fully into the reactor core when tested, due to jamming by foreign particles.[88] The reactor was put in a guaranteed shutdown state in July 2000, and a Canadian Nuclear Safety Commission (CNSC) Incident Inspection Team was formed to investigate the technical problems. The CNSC renewed the operating licence for the two MAPLE reactors following hearings on March 8 and May 29, 2001. However, permission to recommence the low-power commissioning program for MAPLE-1 and the loading of fuel into MAPLE was delayed until a one-day hearing held on December 13, 2001 when the CNSC heard submissions from AECL, Nordion, CNSC staff and the public on AECL's application .

Pointing out their earlier prophetic warnings and the inadequacy of the limited environmental assessment screening, environmental intervenors urged the CNSC to conduct another public hearing to resolve the many outstanding safety issues.[89] On January 15, 2002, the CNSC issued a decision that it would not authorize the immediate resumption of commissioning, but generally ignored the recommendations of the environmental groups and stated that another hearing would not be required, delegating restart approval to staff.[90]

To the continuing embarrassment of the CNSC and AECL, a report on the MAPLE project to the March 1, 2002 CNSC meeting revealed serious ongoing problems. In February, there had been repeated instances of the shut off rods jamming during withdrawal from the core. The problems had still not been resolved, leading to serious questions about the technical competence of the AECL as well as the regulator. At the August CNSC meeting new dates were determined for the commissioning schedule of the MAPLE reactors (see Table 4). The restart of low power commissioning for MAPLE 1 was scheduled to take place on October 24, 2002.

Table 4. Commissioning Schedule: MAPLE Reactors
(August 2002)

	MAPLE 1	MAPLE 2
Restart Low Power Commissioning	Oct 24, 2002	n/a
Load Fuel	n/a	Nov 21, 2002
Testing above 2 kW	n/a	Mar 27, 2003
Testing above 500 kW	Jan 14, 2003	May 16, 2003
Testing above 8 MW	May 1, 2003	Aug 11, 2003

Source: *UNECAN News*, Vol. 12 No. 9, September 30, 2002, p. 6.

88. Canadian Nuclear Safety Commission, *Renewal of the Operating Licence for the MAPLE Reactors at the Chalk River Laboratories*, CMD 01-H9, February 6, 2001, p. 8.

89. Submission by Irene Kock, Sierra Club of Canada, *Re: Application by AECL to resume low power commissioning of MAPLE 1, load fuel in MAPLE 2 and begin commissioning of the New Processing Facility*, November 29, 2001, CMD 01-H35.4 & CMD 01-H36.4. See also: Submission by Ole Hendrickson for Concerned Citizens of Renfrew County, CMD 01-H35.3, November 29, 2001,

90. Canadian Nuclear Safety Commission, "CNSC Announces Decisions on Medical Isotopes Facilities Operated by AECL", *News Release*, January 15, 2002.

4.3. Canadian Neutron Facility: Another Nuclear Boondoggle

In addition to the construction of two MAPLE reactors at Chalk River for production of radio-isotopes, AECL has also proposed to build a much larger and more expensive ($500 million) reactor known as the Canadian Neutron Facility (CNF). Together, the MAPLEs and the CNF would replace the functions of the NRU reactor at Chalk River. In 1998, AECL joined with the National Research Council (NRC)[91] to promote the CNF, prematurely announcing that construction would begin in 1999, with start-up in 2005. The NRU was scheduled for shutdown in year 2000, but following a drawn-out lawsuit and delay in construction of the MAPLE reactors, the Atomic Energy Control Board (now the Canadian Nuclear Safety Commission, CNSC) allowed AECL to continue operating the NRU until December 31, 2005.[92]

AECL and the government have delayed the CNF, while increased government subsidies are allocated to the design and engineering of the Advanced CANDU Reactor.[93] However, the government apparently intends to reintroduce the CNF and provide funding in the near future, in time to be built before the NRU reactor is finally shut down.

The CNF is a pool-type reactor based on the MAPLE X-10 design with a nominal power of 40MW (thermal). The reactor assembly (including the reactor vessel) is located in a light-water pool about 15 metres deep. The fuel is aluminum clad and enriched to about 20% uranium-235, and the coolant is light water. It is proposed that the reactor have a dual purpose. One purpose to test fuel and components for existing as well as new CANDU reactor designs. The other purpose is for “materials research”. Neutron radiation produced in the reactor would be used to study the nature of various materials through neutron scattering.[94] Such research has commercial applications.

The estimated cost of the reactor is $460 to $500 million. The reactor and reactor building are expected to cost about $250 million; materials research equipment and facilities over $100 million; equipment and facilities for CANDU reactors, over $100 million.[95] The final cost will be much more than $500 million, when operating costs and the costs of reactor decommissioning and waste management are added on. The proposed users of the facility should pay for the capital and operating costs, as a market-based hurdle for the decision to build this facility.

The CNF was originally described as a “partnership” between the National Research Council, AECL, the universities and industry[96], although it is clear that none of these partners were willing to put up any of the capital cost of the facility. Several private sector corporations, including Alcan International Ltd., Marubeni Canada Ltd., and Xerox Canada have spoken in favour of the project, but to date, they have not expressed a willingness to invest in it.

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91. The NRC is a research and development organization owned and operated by the Canadian government.

92. “Renewal of the Operating Licence at the Chalk River Laboratories of Atomic Energy of Canada Limited, Appearance by AECL”, *AECB BMD 98-86.1*, June 9, 1998, Table C.

93. Peter Calamai, “Stalling will dull Canada’s cutting edge: Scientists” *Toronto Star*, May 1, 2001, p. A6.

94. General background on the CNF can be found in two studies: A.G. Lee *et al.*, *A Description of the Canadian Irradiation Research Facility Proposed to Replace the NRU Reactor*, AECL-11231, July 1995. See also: A.G. Lee *et al.*, *Progress in Developing the Concept for the Irradiation Research Facility*, AECL Whiteshell Laboratories, Canadian Nuclear Society 17th Conference Proceedings, June 9-12, 1996, Fredericton, New Brunswick, Vol. 2.

95. “NRU Replacement not mentioned in the government’s budget”, *UNECAN News*, March 10, 2000, p. 1.

96. NRC and AECL, *ibid.*, Summary.

Perhaps more importantly, there has been no mention as yet of funding from Ontario Power Generation, Hydro Québec, or New Brunswick Power, for use of the CNF for their reactor support programs. As the largest owner and operator of CANDU reactors, Ontario Power Generation should pay a large share of the capital and operating costs, since half of the reactor's facilities will be devoted to research and the testing of reactor fuel and components. The value of the reactor for research in AECL's ongoing reactor export program should also be questioned. This would only have value if AECL's export program is successful. Based on past experience, this is extremely unlikely.

There should be absolutely no public funding for the CNF, and a clear up-front agreement from all potential users (academic, private-sector and utilities) that the reactor would function on user-pay basis to cover all operating costs. The private sector and utilities, notably OPG, should be required to provide operating *as well as* capital costs of the reactor. Failure to build a new reactor to replace the NRU is not a disaster. Materials research using neutron sources can be conducted at other international facilities.

5. CANDU Rehabilitation: Financial & Safety Risk

As CANDU reactors in Canada have aged, they have experienced increasing technical problems and dramatically poorer performance. Although it was assumed that reactors would last for forty years, they are typically experiencing serious operational problems much earlier. Thus, Ontario Hydro (the generating wing of which is now Ontario Power Generation) announced in August 1997 that it would temporarily shut down its oldest seven reactors because of poor performance and safety concerns.[97] This included four 515 MW reactors at the Pickering "A" nuclear station, just east of Toronto, and three 848 MW reactors at the Bruce "A" nuclear station on the shore of Lake Huron near the town of Kincardine. Ontario Hydro had already shut down reactor #2 at the Bruce "A" station in 1995.

The four Bruce "A" reactors lasted less than half of their expected 40-year lifetimes, before being shut down for long-term repair work. The Pickering "A" reactors lasted only 25 years, despite having been re-tubed at a cost of $1 billion (Cdn) following a disastrous pressure tube break at Pickering reactor #2 in 1983.[98] The shutdowns left Ontario Power Generation with 12 reactors in operation — four at the Pickering "B" station; four at the Bruce "B" station; and four at the Darlington station. The closure of eight reactors was the largest single long-term nuclear shutdown by any nuclear utility in the world.

Outside of Ontario, there are only two nuclear power reactors in Canada -- one operated by Hydro Québec (Gentilly 2) and one operated by New Brunswick Power (Point Lepreau). Both nuclear stations are single unit CANDU-6 (i.e. 600 MW) reactors designed by AECL. They both began commercial operation in 1983, and at twenty years of age both reactors need full-scale refurbishment if they are to continue operating. Based on the experience of the Pickering A refurbishment it is unlikely that refurbishment will be cost-effective or result in good performance. That has been the conclusion of a 2002 New Brunswick regulatory review of the proposed Point Lepreau refurbishment. With the collapse of its reactor export program, and the approaching completion of the Qinshan AECL has increased its work on the refurbishment and maintenance of existing CANDU reactors.

The refurbishment and restart of aging CANDU reactors represents a particular challenge to the regulatory regime of the Canadian Nuclear Safety Commission. The CNSC has admitted that it has no regulations, simply an *ad hoc* approach on the refurbishment and restart of nuclear power plants.[99] While CNSC has conducted environmental assessments on the refurbishment and restart of Pickering A and Bruce A reactors 3 and 4, no commitment has been made to conduct assessments on either Point Lepreau or Gentilly 2. In its 2001 report *Canada's Nuclear Reactors: How Much Safety is Enough?*, the Standing Senate Committee on Energy, the Environment and Natural Resources stated,

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97. Ontario Hydro News Release, *Ontario Hydro moving ahead on major overhaul of its production facilities*, August 13, 1997. The four Pickering reactors were shut down December 31, 1997. The three Bruce A reactors were shut down March 31, 1998. The eight shut down reactors began commercial operation on the following dates: Bruce 1, September 1977; Bruce 2, September 1977; Bruce 3, February 1978; Bruce 4, January 1979; Pickering 1, July 1971; Pickering 2, December 1971; Pickering 3, June 1972; Pickering 4, June 1973.

98. CANDU reactors, unlike Light Water Reactors, have their fuel contained in hundreds of pressure tubes that run horizontally through the reactor vessel. These tubes are subject to high levels of stress, and may require replacement after twenty years. The replacement of the tubes in the four Pickering A reactors cost more than the original capital cost of the plant.

99. Letter from J.D. Harvie, CNSC, to R. Pageau, Chef avant-projet réfection, Gentilly 2, Hydro Québec, July 25, 2001, Objet: Réfection de la centrale nucléaire de Gentilly-2.

> The Committee recommends that the Comprehensive Study List Regulations of the CEAA [Canadian Environmental Assessment Act] be amended to include the restart of a nuclear power reactor following a prolonged shut down of the reactor or significant modification to the reactor and/or the station.[100]

The Government of Canada has not acted on the Committee's recommendation.

5.1. Pickering A Disaster

In August 1964, AECL and Ontario Hydro reached an agreement to build two 500 MW CANDU reactors at Pickering, Ontario, just east of Metropolitan Toronto on Lake Ontario.[101] The federal and provincial governments not only provided most of the financing for Pickering reactors 1 and 2, but they also provided Ontario Hydro with what amounted to a performance guarantee. The total cost of the two Pickering reactors (to both the federal government and Ontario Hydro) was reported at $393 to $420 million (dollars of the year).[102] Ontario Hydro has reported that the release estimate for all four reactors in 1965 was $508 million (dollars of the year)[103], and that the total cost for all four Pickering A units was $716 million (dollars of the year).[104]

In August 1983 a disastrous pressure tube rupture occurred in Pickering Reactor 2, and all four reactors at the Pickering A station were shut down. The pressure tubes of each reactor were replaced in succession over a ten year period. The retubing of the four reactors cost about $1 billion (dollars of the year)[105] -- more than their original capital cost. As noted above, despite this enormous investment, the reactors were shut down just a few years later at the end of 1997 because of technical and performance problems. The reactors remained shut down as of January 2003.

Refurbishment of the four Pickering reactors has been taking place since they were shut down at the end of 1997. The refurbishment happened simultaneously with a screening level environmental assessment conducted by the Canadian Nuclear Safety Commission from 1999-2000 that was condemned by environmental and community groups as a whitewash for failing to deal with vital issues such as the possibility of severe accidents, the need for restart, and financial cost. AECL has played an important role in the Pickering A restart...

> AECL was contracted as OPG's design agency for the [Pickering 'A' Return to Service (PARS) refurbishment] project and is undertaking engineering work in the nuclear steam plant and balance of plant areas. Primary focus has been on Unit 4 (the first unit that will be returned to service) where, in addition to producing installation, procurement and licensing packages, AECL has provided on-going support to equipment vendors and field engineering. [106]

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100. Standing Senate Committee on Energy, the Environment and Natural Resources, *Canada's Nuclear Reactors: How Much Safety is Enough?*, Interim Report, June 2001, Executive Summary & Recommendations, p. b.

101. Wilfrid Eggleston, *Canada's Nuclear Story*, Clarke Irwin, Toronto, 1965, p. 340.

102. Robin Ann Cantor, *An Analysis of Public Costs and Risks in the Canadian Nuclear Industry*, PhD Dissertation, Department of Economics, Duke University, 1985, p. 69.

103. Ontario Hydro, *Demand Supply Plan Hearing Interrogatory No. 9.7.62.*, February 1991, p. 1.

104. Ontario Hydro, *A Journalist's Guide to Nuclear Power*, 1988, p.2.

105. Ontario Hydro, *A Journalist's Guide to Nuclear Power*, 1988, p.2.

106. *AECL Annual Report 2001-2002*, p. 22.

AECL had about 100 staff seconded to OPG in 2001-2002, largely for the Pickering refurbishment.[107] Other reports place AECL staff at about 400. AECL has been part of a tri-partite management team consisting of themselves, OPG and CANEC (the general contractor). AECL staff have been condemned for having "no or limited, current experience in CANDU technology".[108] Thus AECL must bear responsibility for the lengthy delays and massive cost overruns which have plagued the Pickering A refurbishment project, and its engineering role on the project has ended. OPG President Ron Osborne has said that in retrospect "I would have outsourced less."[109]

When the four old Pickering A reactors were first shut down on December 31, 1997, the first reactor (Unit 4) was supposed to restart in June 2000, with the remaining three to be restarted at six month intervals (to be completely operational by June 2002). OPG now expects to have Pickering Reactor #4 in commercial service sometime in the second quarter of 2003, and is no longer making any public commitment for the restart of reactors 1, 2, and 3.[110] If they are restarted at all, it has been suggested that reactors 1, 2, and 3 would be restarted at one-year intervals.[111]

The cost of the Pickering A restart has escalated from $800 million in 1999 [112] to $1.025 billion at the end of September 2002. It is estimated that the start-up of Reactor 4 will cost another $230 million, and the additional three reactors will cost $300 to $400 million each.[113] Thus the cost for restarting reactor 4 alone will be $1.255 billion, with a likely additional $1.2 billion for the other three reactors, totaling $2.455 billion. The Ontario government is is apparently considering a review of cost overruns at Pickering A.[114]

AECL has been part of a scandalous cover-up in the Pickering A refurbishment along with OPG and the Canadian Nuclear Safety Commission. The cover-up has aimed at avoiding re-certification of replacement components. Original suppliers of components for Pickering A often no longer exist, so new suppliers have had to be found. Test Reports on many components are over 20 years old, but are still being quoted as applicable in order to avoid lengthy and costly re-testing. When more rigorous nuclear qualification standards for components began to be introduced in the early 1980s, Pickering A was grand-fathered and allowed to continue using commercial-standard components. Commercially produced components are typically only tested on a sample basis, meaning that they are not nuclear-qualified. Nuclear qualified products are subject to intense scrutiny, including material traceability, verification of manufacturing processes used and testing/inspection.

Ontario Hydro and OPG have ignored the post-Chernobyl international regulatory push to have reactors upgraded to current nuclear qualification and traceability standards. It is reprehensible that the federal regulator, the Canadian Nuclear Safety Commission, has allowed substandard commercial qualification to be perpetuated at Pickering A, during the current refurbishment project.

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107. *AECL Annual Report 2001-2002*, p. 22.

108. John Spears and Richard Brennan, "Pickering shows how not to run a complex job", *Toronto Star*, December 21, 2002.

109. John Spears & Richard Brennan, "Power 'fix' cost $1B extra", *Toronto Star*, October 29, 2002, pp. A1 & A7.

110. Ontario Power Generation, *Pickering A Update: Presentation to the Durham Nuclear Health Committee*, November 22, 2002.

111. Richard Brennan, "Shake-up at hand over nuclear plant", *Toronto Star*, November 27, 2002, p. A8.

112. Marianne Takacs, "A case for starting idled Pickering reactors", *Ajax-Pickering News Advertiser*, April 20, 1999, pp. 1` & 5.

113. Ontario Power Generation, *Third Quarter 2002 Results*, October 28, 2002.

114. Ontario Power Generation, *Pickering A Update: Presentation to the Durham Nuclear Health Committee*, November 22, 2002.

The CNSC is also allowing the first reactor at Pickering A to be restarted without all of the previously required fire protection measures in place. It is clear that these measures are being delayed in order to speed up the restart of the reactors.[115]

5.2. Bruce A: Risky Restart

In May 2001, Ontario Power Generation closed a deal with Bruce Power (a subsidiary of British Energy, a nuclear power plant operator in the United Kingdom) for an eighteen-year lease to operate the Bruce nuclear complex on the shore of Lake Huron in Ontario.[116] The details of the agreement were kept secret, but it was clearly a sweetheart deal for Bruce Power.[117] Among other things, Bruce Power had no long-term responsibility for radioactive waste management and decommissioning, responsibility for which remained with Ontario Power Generation (OPG), and ultimately with OPG's sole shareholder, the Government of Ontario. The agreement was a cash cow for British Energy, earning $120 million profit in its first year of operation.[118] The Bruce complex includes four 769 MW (net) reactors at the Bruce A station and four 860 MW (net) reactors at the Bruce B station. While the four Bruce B reactors continued to operate, reactor #2 at the Bruce A nuclear station was shut down in October 1995, and reactors 1, 3 and 4 were shut down in March 1998 because of technical problems and poor performance.

In November 2000, Bruce Power had announced that AECL had been selected as the general contractor to lead an internal "inspection and condition assessment" of 70 fuel channels[119] as well as steam generators for Bruce A reactors 3 and 4. The assessment cost $30 million and was intended to determine if the re-commissioning of the reactors was economically justified.[120] With the guaranteed profit of its lease agreement with OPG, there was little doubt that the restart project would proceed. On April 6, 2001, Bruce Power announced that it intended to restart reactors 3 and 4 at the Bruce A station. At that time, Bruce Power expected that the reactors would be restarted in the summer of 2003 at a total cost of about $340 million (CDN).[121] The estimated refurbishment cost has escalated to $400 million, and the restart schedule has been speeded up to have reactor 4 restarting in April 2003, and reactor 3 shortly afterwards.[122]

After the four Pickering A reactors, the Bruce A nuclear station has the oldest commercial reactors in Canada. The 480 fuel channels in each Bruce reactor core are prone to age-related problems due to the weight of the fuel bundles, as well as high temperatures, pressures and radiation fields in the reactor cores. Fuel channels in CANDU reactors consist of an outer calandria tube, and an inner pressure tube. The inner pressure tube holds uranium fuel bundles, and heavy water coolant is

115. Peter Calamai, "Reactor to be rebooted without full fire upgrade", *Toronto Star*, December 19, 2002.

116. Ontario Power Generation, Bruce Power, "Ontario Power Generation and Bruce Power Complete Lease Agreement for Bruce Nuclear Stations", *News Release*, May 12, 2001.

117. Sierra Club of Canada, "Bruce Deal a Disaster for Ontario", *News Release*, April 17, 2001.

118. Peter Calamai, "Nuclear panel gives Bruce Power reprieve", *Toronto Star*, September 13, 2002, pp. E1 & E11.

119. There are 480 fuel channels in each Bruce A reactor, so AECL is making a safety judgement based on an examination of only 7% of the 960 channels in reactors 3 and 4.

120. Bruce Power, "Bruce A Re-start Evaluation in the Works", *Open Line*, Issue 9, November 24, 2000. Http://www.brucepower.com/whatsnew/pdfs/Issue_9.pdf

121. Bruce Power, "Bruce Power Forges Ahead on Bruce A Restart", *News Release*, April 6, 2001.

122. Pearl Marshall, "Bruce Power said to be planning return of final Bruce A units", *Nucleonics Week*, October 24, 2003, pp. 1, 14-15.

pumped through at high pressure to draw off the heat released by the fission process. Pressure tube problems include 'creep' and 'sag', where the metal thins out over time and the tubes become wider and longer, bending under the strain. Various design changes were made in later stations to try to accommodate this problem, but eventual tube replacement ('retubing') is anticipated on a schedule dictated by the extent of the problem in each reactor core.

When the pressure tubes sag they can come into contact with the outer 'calandria tube'. This increases the chance of pressure tube rupture caused by 'embrittlement', where the metal becomes brittle due to absorption of hydrogen. This 'metal hydriding' process happens faster where the sagging pressure tubes make contact with the cooler calandria tubes. The space or annulus between the calandria and pressure tubes is maintained by spacers or 'garter springs'. However, at Bruce reactors 3 and 4 (as well as at Pickering reactors 5 and 6), the garter springs are not locked into place and have to be periodically checked and moved back into position to keep the two tubes from touching.

AECL has argued that pressure tubes will always leak before rupturing, allowing time to shut the reactor down before a loss of coolant accident occurs -- an assumption they call 'leak before break'. However, there have been at least two cases of catastrophic pressure tube ruptures in Ontario reactors: August 1983 at Pickering 2 and March 1986 at Bruce 2. All fuel channels at the Pickering A station reactors were subsequently replaced. Bruce reactors 1 and 2 will require complete retubing if they are ever to be restarted. Some individual tubes at Bruce reactors have been replaced in the past, but Bruce Power is taking a calculated risk, trading off safety against profit by arguing that complete replacement of fuel channels is not necessary at Bruce reactors 3 and 4. Bruce Power has taken this controversial position despite having inspected only 7% of tubes. Complete retubing of the reactors would more than double the estimated $400 million restart cost as well as extending the outage time.[123]

Serious problems are ongoing at Bruce. On June 11, 2002, an electrical arc burned a hole through a pressure tube and calandria tube during maintenance at Reactor 6 of the Bruce B station. This resulted in the reactor being shut down until early September. Bruce Power lied about the incident, saying only that a pressure tube had been "slightly damaged" and "the operational impact is not expected to be significant".[124] The incident was kept secret on the basis that public knowledge of the shutdown of the reactor would have commercial implications for British Energy. Because of concerns about nuclear safety and the public's right-to-know, secrecy about nuclear shutdowns has prompted public protest.[125]

Bruce 3 and 4 steam generators (boilers) have also reportedly undergone inspections. Past problems with steam generators have included clogging due to mineral deposits, 'fretting' or breakage of the internal pipes due to excessive vibration, and stress corrosion cracking of the metal. Steam generators incorporate thin-walled pipes where coolant from the reactor core circulates to transfer heat to the turbine side of the station. The steam generators at Bruce reactor 2 were damaged beyond repair after a lead shielding blanket was left inside the system following maintenance years earlier, altering the water chemistry. Bruce 2 was subsequently closed in 1995.

123. Martin Mittelstaedt, "Reactor restart plan sparks safety fears", *Globe and Mail*, July 31, 2002.

124. John Spears, "Shutdown hits Bruce reactor while Ontario had heat wave", *Toronto Star*, September 26, 2002, pp. A1 & A21.

125. See: "Secrecy at Bruce", *Toronto Star Editorial*, September 27, 2002, p. A26.

The economic failure of nuclear power has been highlighted by the effective bankruptcy of British Energy, the majority shareholder of Bruce Power. In 1996, British Energy was created from the public entity, Nuclear Electric in a privatization deal that saw the best nuclear plants in Britain acquired at a tiny fraction of their original capital cost. Despite this unprecedented financial advantage, in May 2002 British Energy posted a massive loss of 527 million pounds (about $1.2 billion CDN) for the financial year ending March 2002.[126] British Energy subsequently asked the British government for a bailout, but by September 4 the company announced that unsuccessful talks with the government could lead to insolvency. Trading of British Energy shares was suspended and by September 6, rating agencies had downgraded British Energy bonds to junk status.[127]

Following the British Energy announcement of possible collapse on September 4, 2002, the Canadian Nuclear Safety Commission expressed concern about a $264 million (CDN) financial guarantee required as a licence condition for six months of operating costs in the event of an emergency shutdown. British Energy has a commitment for $222 million of that total.[128] On September 9, 2002, the British government provided 410 million pounds ($998 million CDN) for British Energy's immediate financial needs.[129] Despite the admission of Bruce Power CEO Duncan Hawthorne that the company could not deliver on the financial guarantee if required (a clear violation of an operating licence condition), the Canadian Nuclear Safety Commission has failed to enforce the operating licence.[130] In a December 13, 2002 statement, CNSC President Linda Kneen stated that "The Commission is satisfied that the current situation regarding the financial guarantee does not pose a safety risk warranting enforcement action by the CNSC at this time."[131]

On December 24, 2002, it was announced that the a new Canadian group will purchase Bruce Power. The group consists of Cameco Corporation, TransCanada Pipelines Ltd., and BPC Generation Income Trust, part of the OMERS pension fund. The three major partners will each hold 31.6%, while the Power Workers Union will have 4% and the Society of Energy Professionals will have 1.2%. The deal is expected to close on February 14, 2003. Duncan Hawthorne, CEO of Bruce Power, has claimed that the British government will back the guarantee until the closing date of the sale, after which the new owners will provide the required guarantees.[132]

The Canadian Nuclear Safety Commission (CNSC) has conducted a screening level environmental assessment on the restart of the Bruce A reactors 3 and 4. This was a low-level environmental assessment, and the CNSC maintained control over the process by ignoring public requests to ask the federal Environment Minister to appoint an independent assessment panel. As the "Responsible Authority" for federal nuclear matters, CNSC is in charge of all lower level environmental assessments (Screenings and Comprehensive Studies) unless it refers an assessment to the Minister of Environment for a hearing by an independent panel. A panel is more independent, since its members would be specially appointed by the Minister, and it would provide funding for intervenors.

126. Mathieu Robbins, "British Energy Slumps to All-time Low After Shutdown", *Bloomberg News*, August 13, 2002.

127. Andrew Porter, Robert Bailhache &Tim Webb, "Whitehall Farce that lit the fuse for BE Meltdown", *The Scotsman*, September 9, 2002.

128. Paul Waldie, "Regulator warns Bruce Power", *Globe and Mail*, September 6, 2002, pp. B1 & B4.

129. Paul Waldie, "UK bails out British Energy" *Globe and Mail*, September 10, 2002, pp. B1 & B2.

130. Peter Calamai, "Nuclear panel gives Bruce Power reprieve", *Toronto Star*, September 13, 2002, pp. E1 & E11.

131. Canadian Nuclear Safety Commission, "Commission statement on status of Bruce Power Inc. financial guarantees", *News Release*, December 13, 2002.

132. John Spears, "Canadian group buys Bruce Power", *Toronto Star*, December 24, 2002.

On April 12, 2002, the CNSC approved the *Environmental Assessment Guidelines* for the screening assessment. Bruce Power issued its Environmental Study Assessment Report in August 2002, and CNSC released its screening report in October 2002.[133] On December 12, 2002, the CNSC held a hearing on the environmental assessment screening report for the return to service of Units 3 & 4 of the Bruce Nuclear Generating Station (NGS) 'A'. The Board ignored the concerns of environmental groups, and decided that the Screening Report had met all of the requirements of the Canadian Environmental Assessment Act.[134] Citizens for Renewable Energy (CFRE) and other groups had expressed concern about: the limited scope of the hearing; the CNSC's failure to request a bump up of the assessment to a full panel review; poor management of the assessment process; the need to expand the study area boundaries; delegation of technical environmental assessment studies to the proponent; and the failure of the CNSC to select a realistic range of severe accidents and malfunctions for consideration. The Chippewas of Nawash First Nation raised many concerns about the impacts of the reactor restart project on their fishing business near the nuclear plant.

Continuing its long history of accommodating the wishes of the nuclear industry, in a side issue at its January 6, 2003 hearing, the CNSC allowed Bruce Power to load fuel into reactors three and four in advance of the actual reactor start-up, delegating actual approval to CNSC staff without any need for a public hearing review.[135]

5.3. Point Lepreau Refurbishment: Good Money After Bad

The Point Lepreau Nuclear Generating Station is a single CANDU 6 reactor (635 MWe) that began commercial operation in February 1983. The plant is owned and operated by New Brunswick Power, and was designed by AECL.

Like other reactors of the period, the Point Lepreau plant was intended to run for 40 years, however, after less than twenty years, the reactor experienced serious performance and safety problems. In 1998, an NB Power consultant decided that the plant would require total replacement of all 380 fuel channels in the 2006-2008 period.[136] This has been characterized as 'heart transplant' for a CANDU reactor – essentially the reactor is re-built, requiring an extended outage for the plant, at an extremely high cost. The fuel channel system is unique to the CANDU reactor, known generically as a Pressurized Heavy Water Reactor (PHWR). CANDU reactors have fuel bundles in hundreds of separate horizontal tubes. This fuel channel design allows fresh fuel to be loaded and spent fuel to be removed while the reactor is operating. In theory, this reduces outage time, compared to Light Water Reactors (including both Boiling Water Reactors and Pressurized Water Reactors), which are dominant in the world. LWRs have a single reactor vessel (calandria) containing the fuel, requiring the reactors to be shut down while all fuel is replaced at the same time. While so-called "on power" re-fueling of CANDU reactors is in theory an advantage over LWRs, in reality, the hundreds of fuel channels in CANDU reactors have created many more problems than any advantage gained through on-power refueling.

133. Canadian Nuclear Safety Commission, *Screening Report on Environmental Assessment of the Proposed Restart of Units 3 and 4 Bruce A Nuclear Generating Station, Kincardine, Ontario*, October 2002.

134. CNSC, *Record of Proceedings, Including Reasons for Decision, In the Matter of Applicant: Bruce Power Inc,., Subject: "Environmental Assessment Screening Report for the Return to Service of Units 3 & 4 of the Bruce Nuclear Generating Station (NGS) 'A'", January 6, 2003*.

135. CNSC, *Record of Proceedings, Including Reasons for Decision, In the Matter of Applicant: Bruce Power Inc,., Subject: "Referral to a CNSC Designated Officer - Application to load fuel at Bruce 'A' NGS unit 3 and 4 reactors", January 6, 2003*.

136. New Brunswick Power, *Road to Refurbishment at Point Lepreau Generating Station*, April 2001.

Irradiation, high temperature, pressure, and embrittlement all create high stress levels for fuel channel tubes. This results in a risk of tube rupture, and the eventual need for replacement – typically after less than twenty years. There have been two catastrophic failures of CANDU pressure tubes resulting in serious Loss of Coolant Accidents (LOCAs). LOCAs can lead to a meltdown if safety systems do not operate as intended. Point Lepreau has experienced other technical problems as well.

As the first phase of a plan to retube and refurbish Point Lepreau, NB Power retained AECL in January 2001 to conduct a two-year assessment of the project at a cost of $40 million. At the time NB Power stated,

> If the decision is made to refurbish Point Lepreau, NB Power intends to appoint AECL as project manager and implement a risk and benefits sharing arrangement with AECL based on the station's future operating performance. [137]

According to the retube and refurbishment schedule devised by AECL, Phase Two of the project (Work Commencement) would begin in February 2003. The plant would be shut down for an estimated 18 months beginning in April 2006, with project completion in September 2007.[138] The total estimated cost of the project is $845 million.[139]

As part of its Phase I work on Point Lepreau, AECL has already negotiated several draft contracts with NB Power, including a Refurbishment Agreement, a Retubing Agreement, a post-refurbishment Performance Agreement, and an Operation Support Service Agreement.[140]

The proposed Refurbishment Agreement includes:

- project management;
- shutdown system computer replacement;
- turbine control system replacement;
- a deterministic and probabilistic safety analysis; and
- rewinding the main generator and stator.

The proposed Retubing Agreement includes:

- replacement of pressure tubes, calandria tubes, and end fittings (fuel channel assemblies);
- partial feeder tube replacement; and
- extension of the on-site radioactive waste management facility.[141]

NB Power has boasted that it has reduced its risk through the negotiation of a largely "fixed price" contract with AECL. Including the Phase I Costs, the fixed price components of the proposed deal

137. "NB Power & AECL Reach Agreement on Point Lepreau Refurbishment Assessment, *NB Power News Release*, January 16, 2001.

138. NB Power, *Project Execution Plan*, Appendix A-4, February 2002, Table 4-1, p. 17.

139. NB Power, *Project Execution Plan*, Appendix A-4, February 2002, Table 1-1. p. 1. This includes an 'overnight' cost of $633 million with escalation and interest during construction of $211million.

140. Province of New Brunswick Board of Commissioners of Public Utilities, *Direct Evidence of Mr. Rod Eagles, Point Lepreau Refurbishment Project Director*, 2002, p. 2.

141. Province of New Brunswick Board of Commissioners of Public Utilities, *Direct Evidence of Mr. Rod Eagles, Point Lepreau Refurbishment Project Director*, 2002, p. 4.

account for 82% of the $598 million direct cost.[142] AECL has also agreed to performance guarantees for the scope and schedule of the project work .AECL agreed to post a performance bond for 50% of the value of the retube agreement and 30% for the refurbishment agreement.[143] On the $309 million retubing agreement, this would make AECL liable for up to $154.5 million in the event that the retubing effort experiences delays or technical problems. Similarly, on the $141 million refurbishment agreement, AECL would be liable for $42.3 million, for a total of $196.8 million between the two agreements.

The Plant Performance Agreement also commits AECL to performance incentives and penalties over the expected 25-year operating life of the plant that have not been publicly disclosed.[144] The Operation Support Service Agreement provides for ongoing technical support.

AECL has provided warranties for two years on materials and workmanship and up to ten years on design.[145] AECL has agreed to pay 'liquidated damages' under the retubing and refurbishment contracts. These are the damages that would have to be paid if AECL did not complete the work according to the schedule and other contractual agreements for the project. The Retubing Contract stipulates the conditions under which AECL would be responsible for $250,000 per day, with a maximum payable of $10 million over the life of the facility. The refurbishment Contract stipulates the conditions under which AECL would be responsible in the amount of $75,000 per day with a maximum payable of $5 million. The warranty covers a period of two years for materials, labour and design after the final completion of the project. There is also a special eight-year warranty on the welded feeder connections and fixed pressure tube spacers (two particularly problematic reactor components). [146]

In addition, AECL has effectively provided a performance guarantee whereby it takes on a large part of NB Power's risk for the project. AECL has projected performance of 89% capacity factor – a measurement of actual performance as a percentage of perfect performance (also known as load factor). By way of comparison, Point Lepreau's capacity factor in 2001 was 80.5%, and the average for the 19-year period 1983-2002 was 83%.[147] Performance at CANDU reactors has had a statistical tendency to decline after about ten years of operation.

Rod White NB Power Vice President, Nuclear, stated under cross-examination at the Public Utility Board hearings that three companies, AECL, Siemens and NUCO were asked to take an equity position in Point Lepreau as part of the refurbishment and retubing work. All three companies declined to do so. Siemens did not wish to invest any money up front, and NUCO proposed a lease arrangement. AECL did not want to invest money, but subsequently offered to undertake a

142. NB Power, *Project Execution Plan*, Appendix A-4, February 2002, p. 20.

143. New Brunswick Board of Commissioners of Public Utilities, NB Power Application for Refurbishment of Point Lepreau, Transcript of Proceedings, June 3, 2002, p. 698.

144. NB Power, *Project Execution Plan*, Appendix A-4, February 2002, p. 20.

145. New Brunswick Board of Commissioners of Public Utilities, NB Power Application for Refurbishment of Point Lepreau, Transcript of Proceedings, June 3, 2002, p. 694.

146. *Decision of the New Brunswick Board of Commissioners of Public Utilities on the Proposed Refurbishment of the Point Lepreau nuclear Generating Facility*, September 24, 2002, p. 7.

147. *Decision of the New Brunswick Board of Commissioners of Public Utilities on the Proposed Refurbishment of the Point Lepreau nuclear Generating Facility*, September 24, 2002, p. 5. See also: "Nuclear Electricity Generation for December 2001", *Nucleonics Week*, February 14, 2002, p. 18.

performance agreement.[148] Rod White gave the following explanation of how AECL came to offer a significant performance guarantee...

> ...As I said originally the Hagler Bailly studies had indicated that this refurbishment would be in the order of $500 million. And we looked at the AECL offerings and were interested in seeing if we could get capital cost involvement in the order of about half of that number. Because of AECL's structure and the federal Acts that they operate under they apparently cannot borrow money. And so they had to advance the money out of profits or monies that they would have from other work. And their limit was in the order of about $100 million.
>
> So in order to get up to the about 50 percent level, $250 million, we looked at different ways to do that and that's where the plant performance agreement actually came into vogue. So instead of putting the money on the front end they put up $225 million against the performance of the station over the 25 years, with a $24.9 million limit on a yearly basis. So that's how that evolved.[149]

It has also been stated that, "the proposed agreement between NB Power and AECL uses a capacity factor of 80% as the benchmark for determining payments by either party for the first 15 years and 75% for the last 10 years."[150]

NB Power has confirmed that the Government of Canada will be responsible for any debts that AECL will incur should it fail in its contractual obligations for the Point Lepreau refurbishment and retubing contract. The General Counsel of the Federal Department of Justice stated on May 28, 2002, the following:

> It is my considered opinion that the contractual commitments made by AECL with respect to Point Lepreau retubing and refurbishment services are valid and enforceable against AECL, and would be valid and enforceable against its principal Her Majesty the Queen in the Right of Canada in the event of default by AECL in the fulfilment of those commitments.[151]

5.3.1. PUB Opposes Refurbishment

On January 8, 2002, New Brunswick Power filed an application to the New Brunswick Board of Commissioners of Public Utilities (often referred to as the Public Utilities Board or PUB) to hold a public hearing on the refurbishment of the Point Lepreau nuclear generating station. Pre-filed evidence was submitted on February 25, 2002, the hearing began on May 27, 2002, and final argument was heard on June 18 and 19, 2002. The PUB released its decision on September 24, 2002. The PUB noted that its review was made from an economic perspective, but with a public interest viewpoint. The decision was a stunning rejection of AECL's refurbishment proposal as put forward by NB Power...

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148. New Brunswick Board of Commissioners of Public Utilities, NB Power Application for Refurbishment of Point Lepreau, Transcript of Proceedings, June 3, 2002, pp. 715-718.

149. New Brunswick Board of Commissioners of Public Utilities, NB Power Application for Refurbishment of Point Lepreau, Transcript of Proceedings, June 3, 2002, p. 776.

150. *Decision of the New Brunswick Board of Commissioners of Public Utilities on the Proposed Refurbishment of the Point Lepreau nuclear Generating Facility*, September 24, 2002, p. 5.

151. New Brunswick Board of Commissioners of Public Utilities, NB Power Application for Refurbishment of Point Lepreau, Transcript of Proceedings, June 3, 2002, p. 668. Quoting a letter from Mr. Gene Trotman to AECL.

> The Board, as a result of its review of the evidence in relation to the capacity factor and the cost of capital, finds that there is no significant economic advantage to the proposed refurbishment project. In addition, the Board considers that there are other significant aspects of the refurbishment option for which the economic impact is uncertain. These aspects create additional economic risk which leads the Board to conclude that the refurbishment of Point Lepreau, as outlined in the evidence, is not in the public interest. The Board, therefore, will recommend to the Board of Directors of NB Power that it not proceed with the refurbishment of Point Lepreau.[152]

The PUB rejected many of the basic assumptions underlying the agreements proposed by AECL and NB Power. The following are some of the conclusions reached by the PUB...

- an 80% capacity factor should be assumed for the refurbished plant instead of 89% as proposed by AECL and NB Power; [153]

- a discount rate of 9.33% should be used instead of 7.15% for the cost of capital for the project; [154]

(N.B. These two adjustments alone make the cost of Point Lepreau refurbishment approximately equal to the cost of a new natural gas-fired generating plant [155])

- the stipulated liquidated damages payable by AECL may not be sufficient; [156]

- there is a significant risk from delay of the project (a four-month delay would increase the cost by $63 million plus $5 million per month in interest charges.); [157] and

- there is a “regulatory risk” that the federal regulator, the Canadian Nuclear Safety Commission, may require significant changes to the refurbishment plan as proposed.[158]

As noted above, the PUB decision of September 24, 2002, was only a recommendation to the Board of Directors of NB Power. The timeline originally envisaged by NB Power and AECL saw a decision by PUB in July 2002 followed by a the commencement of Phase 2 work in February 2003, leading to the 18-month refurbishment outage in April 2006. That schedule was superceded when NB Power retained a consulting firm in November 2002 to seek a purchaser or equity partners for Point Lepreau. A decision may take place as early as February 2003. If a new deal is arranged, then the

152. *Decision of the New Brunswick Board of Commissioners of Public Utilities on the Proposed Refurbishment of the Point Lepreau nuclear Generating Facility*, September 24, 2002, p. 16.

153. *Decision of the New Brunswick Board of Commissioners of Public Utilities on the Proposed Refurbishment of the Point Lepreau nuclear Generating Facility*, September 24, 2002, p. 5.

154. *Decision of the New Brunswick Board of Commissioners of Public Utilities on the Proposed Refurbishment of the Point Lepreau nuclear Generating Facility*, September 24, 2002, p. 6.

155. *Decision of the New Brunswick Board of Commissioners of Public Utilities on the Proposed Refurbishment of the Point Lepreau nuclear Generating Facility*, September 24, 2002, p. 6.

156. *Decision of the New Brunswick Board of Commissioners of Public Utilities on the Proposed Refurbishment of the Point Lepreau nuclear Generating Facility*, September 24, 2002, p. 8.

157. *Decision of the New Brunswick Board of Commissioners of Public Utilities on the Proposed Refurbishment of the Point Lepreau nuclear Generating Facility*, September 24, 2002, p. 10.

158. *Decision of the New Brunswick Board of Commissioners of Public Utilities on the Proposed Refurbishment of the Point Lepreau nuclear Generating Facility*, September 24, 2002, p. 13.

refurbishment outage would not likely take place until 2007. [159]

In the wake of the PUB decision, there will be increased pressure on AECL and the federal government from New Brunswick to provide further financial support and guarantees in order to allow the ill-advised Point Lepreau refurbishment to proceed. AECL not only desperately needs the cash flow that would be generated by the Point Lepreau refurbishment, it also wishes to avoid the public relations disaster of having a CANDU 6 reactor shut down after only 20 years of operation. AECL President Robert Van Adel has already made it clear that AECL is willing to go even further in terms of financial commitment to the Lepreau refurbishment...

> We did talk about an equity position by AECL, but the province didn't feel it was necessary or appropriate at the time. At some point [it] may be re-approached. We would consider it at that time.[160]

AECL has also stated publicly that it will consider buying Point Lepreau... "Our president and CEO is saying that if that is something they want to talk about [purchase of Point Lepreau] we are willing to listen ... If NB Power were to come to us and say 'would you be willing to take a position in this', obviously we are not going to say no" said Mac Kealey, general manager of communications for AECL.[161]

New Brunswick Energy Minister Jeannot Volpe said, "I talked to these people [AECL] last week, and they are really interested in trying to develop the technology where they can refurbish a nuclear power plant, a CANDU, and try to share that technology around the world.".[162] "It's time for them to come back to the table with a better offer.".[163] Volpe wants AECL and the federal government to take a larger share of the risk at Point Lepreau....

> ...it looks like they [AECL] are ready to maybe extend a little more the first offer that they made.... they said, 'Well, we could share the risk [with private sector partners] we could probably even invest some money in it, because we would like to develop the technology that could be extended to some other nuclear plants.'[164]

Although AECL has designed nuclear plants, it has never owned or operated any commercial power plants. An ownership or managerial role for AECL at Point Lepreau would be an unprecedented, risky undertaking for the federal government. Federal taxpayers would be forced to pick up the cost of AECL's inevitable mistakes.

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159. Communication with David Coon, Conservation Council of New Brunswick, November 14, 2002.

160. "AECL President makes pitch for Point Lepreau", CBC web site, September 27, 2002.

161. Campbell Morrison, "Atomic Energy may buy Point Lepreau -- Crown corp says refit of NB nuclear plant necessary to prove fixing CANDU reactors around the world also worth the investment", *Moncton Times & Transcript*, October 2, 2002, p. A1.

162. "NB government explores sale of Point Lepreau to feds – Atomic Energy of Canada Ltd wants to refurbish nuclear plant", *Moncton Times & Transcript*, October 3, 2002.

163. Lisa Hrabluk, "Minister wants AECL to take bigger share of risk of project", *New Brunswick Beat*, October 11, 2002, p. A2.

164. Mac Trueman, "Atomic Energy considers sweetening Lepreau offer – NB Power: Province hires consultants to search globe for possible investors", *Telegraph-Journal*, October 5, 2002.

5.4. Gentilly 2: Time to Say No

Hydro Québec undertook an agreement in 1973 with the federal government to build Gentilly 2 -- a standard AECL-designed 645 MW(e) CANDU-6 built at Bécancour, near Trois Rivières. The federal government agreed to finance 50% of the estimated $302 million capital cost of Gentilly-2 at a special low interest rate.[165] However, Hydro Québec was solely responsible for the billion dollar cost overrun which saw the capital cost of the plant soar to $1.36 billion by the time it achieved first criticality in September 1982 -- quadrupling the original estimate. Not surprisingly, the Québec government declared a moratorium on nuclear power plant construction in 1978.

In the 2001-2002 fiscal year, AECL signed contracts with Hydro Québec for the Gentilly 2 refurbishment pre-engineering work, and a General Services Agreement.[166] In February 2002, Hydro Québec gave a 'notice of project' for the refurbishment of Gentilly 2 to the Quebec Ministry of the Environment.[167] A decision is expected by the Hydro Québec Board of Directors in 2003, followed by the filing of an environmental impact study in the fall of 2003, which will allow engineering and tendering to take place by 2005. Enlargement of the radioactive waste facility would take place in 2006 and 2007, and the plant would be shut down for an 18 month period for the main refurbishment work from April 2008 to September 2009.[168]

Given the position against the refurbishment of the Point Lepreau nuclear station taken by the New Brunswick Board of Commissioners of Public Utilities, it is logical that Province of Québec should reconsider its commitment to refurbish Gentilly 2. The Point Lepreau and Gentilly 2 plants are virtual duplicates, built at the same time with the same technology.

165. T.W. Wallace (Canadian Department of Finance), "An Overview of Federal Government Financial Involvement in the Canadian Nuclear Program", *Nuclear Policy Review Background Papers*, Energy Mines and Resources Canada, Report No. ER81-2E, 1981, p. 310.

166. *AECL Annual Report 2001-2002*, p. 18.

167. Letter from Thierry Vandal, Président, Hydro Québec Production, to M. André Boisclair, Ministre de l'environnement du Québec, February 25 2002.

168. Letter from Thierry Vandal, Président, Hydro Québec Production, to M. André Boisclair, Ministre de l'environnement du Québec, February 25 2002.

6. CANDU Exports: Fated to Fail

6.1. Cernavoda-2: Unneeded, Risky & Expensive

Romania's Cernavoda nuclear power plant is located on the Danube River near the Black Sea. Construction on Cernavoda-2 started in 1980 along with the first reactor which began operation in 1996. Work on the second reactor floundered throughout the 1980s and ground to a halt following the revolt against communist dictator Nicolae Ceausescu in 1989. Cernavoda-2 was only 20 to 40% complete at the time.

Much of the equipment was supplied earlier for Cernavoda-2, but many of the components were borrowed for use on Cernavoda-1, and the plant was only partially completed. Work on Cernavoda-2 had stopped "with 80% of the civil work and 5% of the mechanical work completed".[169] AECL remains in a consortium with the Italian state-owned nuclear company Ansaldo to complete Cernavoda-2.

On April 27, 1998, AECL announced interim Canadian financial support for Cernavoda-2. It was a $142 million (US) (about $200 million Canadian), nine month program, with the Export Development Corporation providing an unconfirmed percentage. The AECL news release stated that the "Canadian scope of the project [is] worth $80 million...".[170] During his May 1998 visit to Canada, former Romanian President Constantinescu asked Prime Minister Chrétien for a $1 billion loan.[171] The cost of completing the second reactor was at that time $750 million (US) or over $1 billion Canadian.[172] Constantinescu said that the Romania did not want to provide a 100% guarantee for any Canadian loan. In addition, Romania wanted a longer payback period and a four-year holiday before loan payments start.[173]

There has been strong opposition in Canada to further Canadian financing for Cernavoda-2. In March 1999, 164 members of parliament -- a majority of MPs including one third of the governing Liberal Party -- came out publicly against federal government financial support for Cernavoda-2.[174] A petition from the Romanian environmental group *Mama Terra* (For Mother Earth) opposed the second reactor at Cernavoda, and was endorsed by more than 50 Canadian environmental groups, and over 80 organizations in 40 countries.[175]

169. Western European Nuclear regulators Association (WENRA), *Report on nuclear safety in EU applicant countries*, March 1999, p. 62.

170. Atomic Energy of Canada Limited (AECL), "Romania awards $200 million contract for work on Cernavoda Unit 2", *News Release*, April 27, 1998.

171. Ray Silver, "Romanians seek funds to finish Cernavoda; eye exporting power", *Nucleonics Week*, May 28, 1998, p. 3.

172. Mark Hibbs, "RENEL aims to finish Cernavoda-2 by 2000, but later date likely", *Nucleonics Week*, July 4, 1996, pp. 11-12.

173. Randall Palmer, "Italy offers to take Romanian nuclear power", *Reuters*, May 25, 1998. See also: Geoffrey York, "Romania seeks reactor loan", *Globe and Mail*, August 6, 1998, p. A12.

174. "Majority of MPs Oppose Romanian Reactor Deal", *Campaign for Nuclear Phaseout News Release*, March 16, 1999.

175. "Majority of MPs Oppose Romanian Reactor", *Nuclear Awareness News*, Winter 1999/2000, p. 2.

Cernavoda-2 is unneeded, since Romania has a huge three-fold surplus of generating capacity. In 1999, total installed capacity was 19,676 MW,[176] and peak demand in 1998 was only 6,000 MW.[177] Construction of the nuclear plant will cause dislocation of the existing system, and ultimately depends on electricity exports which are still unconfirmed and are dubious at best. The target completion date for the reactor is December 2006.[178]

Large loans to Romania carry a high risk. Because of its weak financial position and slow movement on market reforms, the International Monetary Fund (IMF) put a constraint on Romania in 1998 against taking large foreign loans, such as would be required to complete Cernavoda-2.[179] Financing for Cernavoda-2 was held up beginning in August 2002, when the IMF advised the Romanian government to limit its sovereign loan guarantees, which count as liabilities on the government accounts. Under the terms of its debt agreement with the IMF, Romania is only providing a sovereign guarantee for $115 million (US) of the Cernavoda-2 loans in 2002. A guarantee on $318 million (US) would be released in the first quarter of 2003, and before the end of June 2003, a second guarantee would be released on the Euro 223 million loan from Euratom.[180] This leaves about $160 million (US) of export credit agency loans that do not seem to be covered by a sovereign guarantee.

The cost of completing Cernavoda-2 has been estimated at $650 million (US), or about $1 billion CDN. AECL lobbied intensively to arrange Canadian and international financing for Romania's state nuclear company, Societatea Nationala Nuclearelectrica (SNN). On January 3, 2003, Canadian International Trade Minister Pierre Pettigrew announced the lynch-pin financing for the project from the Canadian government's export loan agency, now known as Export Development Canada (EDC), a guarantee of up to $328 million (CDN) for the Canadian component of the project.[181] The loan is being provided through the French bank, Société Générale. The $328 million guarantee will be supported by the "Canada Account" of the EDC, dependent directly on the government's main operating account, the Consolidated Revenue Fund, because it is too risky for private sector financial institutions or normal EDC 'Corporate Account' transactions.

The second largest amount of financing -- $223.8 million (US) (Euro223 million) -- is expected from the loan facility of Euratom, European Commission's nuclear energy agency. A further $118.4 million (Euro118 million) is expected from SACE, Italy's export credit agency; $24 million (US) from COFACE, the export credit agency of France; and $25 million(US) from the US Export Import Bank. Romania has provided only about $200 million (US) from its own resources.

176. National Commission for Nuclear Activities Control (CNCAN), *Romania Country Report*, Tenth Plenary Meeting f the G-24 NUSAC Group, Bruxelles, March 25-26, 1999, p. 1.

177. Dan Floru, "Reorganization of RENEL", *International Market Insight*, Central and Eastern Europe Business Information Center, October 7, 1998, p. 2.

178. *Government of Romania Ordinance No. 126/2000 regarding the completion of the Cernavoda NPP - Unit #2 Project (Summary)*, August 31, 2000. See also: Ann MacLachlan, "Cernavoda-2 completion bolstered by Romanian government support", *Nucleonics Week*, September 14, 2000, pp. 1, 10-11.

179. Ann MacLachlan, "AECL offers Romania financing to begin Cernavoda-2 completion", *Nucleonics Week*, March 5, 1998, p. 3.

180. SACE memo, November 11, 2002.

181. Government of Canada, "Government of Canada Financial Support Finalized for Romanian Project", *News Release*, January 3, 2003.

6.2. No Prospects for Reactor Sales

AECL's business planning has traditionally focused on the premise that it could achieve commercial success through the overseas sales of CANDU reactors. However, overly optimistic sales plans have never materialized. In a notice to AECL employees after the 1996 budget announcement, former AECL President and CEO Reid Morden made the following infamous statement...

> The CANDU business is, in fact, what AECL is all about. We will continue to seek opportunities in the global marketplace, and our goal is to secure ten CANDU sales over the next ten years.[182]

Since that goal was set in 1995, only three reactors have been sold -- two to China in 1996, and one to Romania in 2003. The Cernavoda-2 deal should not really be considered a new reactor sale, since it was initiated in 1980, and in the latest agreement, Canadian content was limited to $328 million (CDN). AECL's ambitious export goal was likely intended to convince gullible politicians in Ottawa to continue providing subsidies.

Beyond the completion of the Cernavoda-2 reactor, there remain virtually no possibilities for reactor sales. The general international trend is for the long-term decline of nuclear power capacity as older plants are shut down. High cost, adverse environmental impacts, safety concerns, and public opposition ensure that few new nuclear plants will be built.

In recent times AECL has suffered a number of high profile failures in its attempts to sell reactors. On July 25, 2000 former Turkish Prime Minister Bulent Ecevit announced that he was canceling the controversial nuclear power plant that had been proposed for Akkuyu Bay on Turkey's Mediterranean coast north of Cyprus. Ecevit said "The world is abandoning nuclear power... It is unnecessary for us, for the time being, to invest in nuclear energy." AECL wasted a huge amount of taxpayers' money on the Akkuyu bid -- more than $40 million according to a Turkish media report. But that would only have been a small part of the cost if AECL had won the bid. A leaked Cabinet document in 1997 revealed that the Chrétien government had agreed to provide $1.5 billion in financing for Akkuyu.[183] The loan would have matched the $1.5 billion provided for the sale of two reactors to China in 1996.

Even if the Turkish government had not decided to cancel the Akkuyu nuclear plant, it was unlikely that AECL would have won the bid. AECL was competing against Nuclear Power International (NPI -- a consortium of the German company Siemens and the French company Framatome), and a third bidder, a partnership of Westinghouse (USA/UK) and Mitsubishi (Japan). It was common knowledge that NPI had submitted a bid lower ($2.4 billion US) than AECL, which came in at $2.6 billion US, or almost $4 billion CDN.[184]

AECL lost another reactor bid in June 2000. The Australian Nuclear Science and Technology Organization (ANSTO), had initiated a bidding process in 1998 to replace its aging HIFAR reactor at Lucas Heights, near Sydney. The replacement reactor was specified to be a 14-20 MW (thermal)

182. AECL, *Information Notice for Employees from Reid Morden*, March 7, 1996.

183. For more detail on the Akkuyu deal, please see: David H. Martin, *Nuclear Threat in the Eastern Mediterranean: The Case Against Turkey's Akkuyu Nuclear Plant*, Nuclear Awareness Project, June 2000. http://www.cnp.ca/issues/nuclear-threat.html

184. "Akkuyu gets 3 bids", *Nuclear Engineering International*, November 1997, p. 2.

pool-type reactor. At the end of 1998, ANSTO narrowed down the bidders to four companies, including AECL, Siemens (Germany), Technicatome (France), and Invap (Argentina). In June 2000, ANSTO announced that it had chosen Invap for the contract, because it was within budget (not to exceed $278.5 million in AUS 1999 dollars), and had the highest Australian content (53%).[185] Details of the AECL bid have been kept secret.

The sale of four reactors to South Korea (the Republic of Korea) was AECL's biggest success. One of AECL's most bitter failures was Korea's decision in 2001 to stop building CANDU reactors. AECL achieved the four reactor sales by means of a series of bribes to government officials and officers of the Korea Electric Power Corporation [186] (KEPCO is a state-owned electrical utility that owns and operates all of the reactors in the country). The CANDU reactors at Wolsong began operation in 1983, 1997, 1998 and 1999.

South Korea's so-called 'two reactor policy' included a small CANDU program, but Pressurized Water Reactors (PWRs) were dominant.[187] South Korea has 16 PWRs operating or under construction, as compared to four CANDUs. KEPCO has its own 1,000 MW PWR known as the Korean Standard Nuclear Plant (KSNP), based on the System-80 design of the American company Combustion Engineering. The fate of CANDU and the two-reactor-policy was focused on which reactor design will be chosen for a two-reactor plant at Shin Wolsong (formerly known as Bonggil) close to the Wolsong site. The original plan for Shin Wolsong was to build up to four reactors, and a bidding process was scheduled for decision in late 1996. The decision was first postponed until June 1997[188], and delayed again as bribery scandals and financial crises rocked South Korea. In 2000 KEPCO decided to proceed with just two reactors and AECL was asked to submit a bid for two 900 MW CANDU-9 reactors. However in February 2001, after much prevarication, Korean government officials finally disclosed that Wolsong-5 and -6 would be built as 1000 MW Pressurized Water Reactors.[189] The decision shattered AECL's last best hope for reactors sales.

185. Ann MacLachlan, "Invap chosen as preferred bidder for ANSTO's replacement reactor", *Nucleonics Week*, June 8, 2000, pp. 8&9.

186. David H. Martin, *Financial Meltdown: Federal Nuclear Subsidies to AECL*, Campaign for Nuclear Phaseout, November 2000, p. 13.

187. Pressurized Water Reactors use ordinary ('light') water as the moderator, and pressurized light water as the coolant, with enriched uranium as the fuel. The PWR operates at sufficiently high coolant pressures that the water is kept in a liquid state and passes to a steam generator, creating steam in a secondary system to drive a turbine. Together, PWRs and Boiling Water Reactors (BWRs) dominate the world market. They are called Light Water Reactors (LWRs), because they use ordinary water (as opposed to heavy water in CANDU reactors) for both coolant and moderator.

188. Mark Hibbs, "Influence-buying concern delays Bonggil vendor choice until June", *Nucleonics Week*, April 17, 1998, pp. 14-15.

189. Mark Hibbs, "Wolsong-5 and -6 to be PWRs, Korea decided at end of 2000", *Nucleonics Week*, February 15, 2001, pp. 3-4. See also: Mark Hibbs, "CANDU out of running in Korea for new orders, AECL believes", *Nucleonics Week*, February 8, 2001, pp. 1, 11-13.

6.3. China: Qinshan Phase III

On November 26, 1996, the final contract was announced for the sale of two CANDU-6 reactors to China. The nuclear station is known as Qinshan Phase III, and is on the coast at Hangzhou Bay in Zhejiang Province, 126 km south-west of Shanghai. We now know that the deal was worth $3 billion (CDN), although the Canadian scope was only $1.5 billion (CDN)[190], which was provided by the Export Development Corporation for goods and services within Canada.[191]

The Chinese government had driven a hard bargain. On February 17, 1996, in a last minute attempt to save the deal, AECL Vice President/Commercial Relations Garry Kugler (AECL's top representative in China) had demanded that Canadian CANDU subcontractors to cut their bids by a further 15%.[192] Nuclear industry insiders speculated that AECL was willing to sell the CANDUs at cost in order to secure the contract.[193]

Because Canadian financing was limited to $1.5 billion (Cdn), AECL had to seek foreign partners with their own financing for the remainder of the $3 billion (Cdn) project. AECL reportedly retained Korea Heavy Industries and Construction Company (Hanjung) for big-ticket heavy components such as steam generators, pressurizers, heat exchangers, and feed header assemblies -- worth more than $120 million.[194] As Korea's first major nuclear export order, inclusion of the Korean company was likely an enticement for Korea to build more CANDU reactors. Hanjung is a subsidiary of the state-owned Korea Electric Power Company (KEPCO).

In January 1997, the Export-Import Bank of the United States loaned $323 million (US) for Qinshan's balance of plant equipment and services by Bechtel Power Corporation.[195] At the same time, the Export-Import Bank of Japan (JEXIM) announced that a $280 million (US) loan was being provided for Qinshan III. The loan was co-financed with Industrial Bank of Japan and Bank of Tokyo, with JEXIM providing 60% or $168 million (US) of the total.[196] The loan was for the purchase of turbines, generators and other equipment from ITOCHU and Hitachi. The US EX-IM Bank provided funding for Bechtel Corporation to supply the transformer facility for the station. All of the loan agreements were signed with the State Development Bank of China, 100% owned by the Chinese government.

The $1.5 billion (CDN) government guarantee and loan for the Qinshan reactors was the largest loan in Canadian history, and as an EDC Canada Account transaction, it will be a liability on the government's account. The loan was far too large and risky for either private sector banks or the EDC to handle on their own. However, few details about the deal have been revealed. The contract allegedly meets the terms of the OECD Consensus Agreement, including an interest rate reportedly

190. "AECL sells two CANDU-6 units worth $4 billion to China", *AECL News Release*, November 26, 1996.

191. "Prime Minister announces final sale of CANDU-6 to China", *Prime Minister's Office News Release*, November 26, 1996.

192. Ray Silver, "Demand for price cuts may kill AECL bid to sell CANDUs to China", *Nucleonics Week*, March 14, 1996, p. 4.

193. *Ibid.*.

194. "Canadian Breakthrough at Qinshan", *Nuclear Engineering International*, September 1996, p. 3.

195. Export-Import Bank of the United States, *Meeting of the Board of Directors, Summary of Minutes*, January 14, 1997.

196. "Export loan to Qinshan III nuclear power plant project in China", *Export-Import Bank of Japan News Release NR96-38*, January 27, 1997. http://www.jbic.go.jp/english/release/exim/1996-e/nr96-38.html

of 7.49%[197] -- a lower rate than any normal commercial deal. Although AECL originally claimed that the deal was worth $4 billion (CDN), it has since stated that it was $3 billion (CDN).[198] Other concessions were attached to the deal.[199] For example, the OECD consensus agreement was flouted when the Canadian Minister of International Trade Art Eggleton announced on the same day as the CANDU agreement that the EDC would grant a concessional line of credit to China for up to $75 million, noting at the same time that the EDC was providing commercial lines of credit for business in China of up to $430 million.

AECL is hoping for further reactor sales in China, but the situation is extremely competitive, with China also buying reactors from France and Russia, as well as having its own indigenous nuclear program. As with the Qinshan III deal, any sales would likely be dependent on generous financial terms that trend into the murky ground of concessional practices that are supposedly banned under the terms of the OECD Consensus Agreement. These practices bring Canada's international trade reputation into disrepute and effectively provide yet another subsidy for AECL and its nuclear industry allies.

197. Ray Silver, "AECL, CNNC ink contracts for two CANDU-6s at Qinshan", *Nucleonics Week*, November 28, 1996, pp. 9-10.

198. Affidavit of Bill Hancox, Vice-President of AECL, In the Supreme Court of Canada (On Appeal from the Federal Court of Appeal), Between AECL and Sierra Club of Canada, March 2, 2001.

199. *Financing Disaster: How the G8 Fund the Global Proliferation of Nuclear Technology*, Editor: A. Froggatt, June 2002, p. 38.

7. AECL's Legacy: Radioactive Waste

7.1. Chalk River: Canada's Nuclear Sacrifice Area

The Chalk River Laboratories (CRL) are operated by Atomic Energy of Canada Limited (AECL). The 3,700 hectare property on the Ottawa River in Ontario 30 kilometres north of Pembroke, was created in 1944 as part of the of the allied war effort to develop the atomic bomb. There are seven reactors at Chalk River at various stages of construction, operation or decommissioning. Other equipment and facilities such as accelerators, and shielded 'hot cells' are used for research and commercial applications. Nuclear fuel production and reprocessing facilities are also housed at Chalk River. A variety of work is conducted, including research and development on nuclear reactors and nuclear waste management. The site also includes several radioactive waste storage and disposal areas occupying about 20 hectares. Wastes were handled carelessly in the first several decades of operation at Chalk River, and as a result there is widespread radioactive contamination of the site. AECL continues to accept new radioactive wastes from the nuclear power industry, radioisotope manufacturers and other industrial sources, universities, hospitals and government agencies. Wastes from outside of Canada are not accepted directly, but may be accepted through Canadian companies that deal in radioisotopes.

AECL has assiduously avoided dealing with its own radioactive waste problem. In the eight years from 1992 to 1999, the Auditor General of Canada strongly criticized AECL in its own annual reports for failing to account properly for the cost of decommissioning and radioactive waste management. Decommissioning activities include dismantling radioactive facilities such as old reactors and laboratories; cleaning up radiation-contaminated sites; managing the associated nuclear wastes; and eventually returning sites to green field condition.

AECL's historic practice for financing decommissioning costs was simply to send the bill to the taxpayers each year for expenses as they were incurred. As in previous annual reports the Auditor General pointed out in AECL's 1998-99 annual report that this was not a proper financial planning or accounting process:

> There are significant costs associated with decommissioning the Corporation's [AECL'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.[200]

AECL defied the Auditor General for eight years running, on the question of adherence to Generally Accepted Accounting Principles (GAAP) for these future liabilities. Pressure from the Auditor General resulted in AECL making some preliminary estimates of its decommissioning costs. In its 1995-96 annual report, AECL said that its decommissioning would take place over "the next four to five decades" (indicating the discount period for costs) and made a "preliminary estimate" of costs at

200. AECL Annual Report 1998-1999, p. 34.

$300 million, most of which would be spent over the next ten years.[201] By the following year, this story had changed. In its 1996-97 annual report, AECL stated that decommissioning activities would take place over the next 100 years (actively managed for a minimum of 75 years). The preliminary estimate had escalated to $400 million, with $200 million expected to be spent in the next ten years.[202] This position was reiterated by AECL for the following two years.[203]

In its 1999-2000 annual report, AECL took a new position. For the first time ever, AECL reported a liability of $377.5 million for decommissioning in its financial statements. The liability had been changed from the 1977 estimate of $400 million, and was made retroactive to the 1998-99 fiscal year (in the amount of $374.7 million).[204] That figure rose to $386.5 million in 2001-2002.[205] The $386.5 million represents only a partial estimate of total decommissioning costs. This is reflected in the fact that AECL anticipates activities over a *minimum* of 100 years -- activities for the full program will take much longer.

In December 2002, the Auditor General noted that AECL's waste management and decommissioning plans are still in a state of disarray...

> There is no consensus between the Corporation [AECL] and the government on how best to manage these [radioactive waste management and decommissioning] activities, or on which federal department or agency will be financially responsible for them beyond the five-year period [of the current corporate plan]. While Atomic Energy of Canada Limited's commercial activities will assist in funding these activities, it is by no means certain that its contribution will provide all the funding required.[206]

In November 1998, for the first time as part of the bi-annual re-licensing of AECL's Chalk River and Whiteshell Laboratories, AECL presented preliminary decommissioning plans.[207] AECL has five sites with a wide variety of nuclear and conventional facilities, some of them shut down permanently, some shut down but not operating, and some still operating.[208] The five sites are Chalk River Laboratories, Whiteshell Laboratories, the shutdown NPD Reactor at Rolphton, the shutdown Gentilly-1 reactor at Hydro Québec's Gentilly nuclear site, and the shutdown Douglas Point reactor at Ontario Hydro's Bruce Nuclear Power Development.

In 1998, it was also revealed for the first time that AECL's decommissioning plan involves continued operation of the Chalk River Laboratories until 2100, and "institutional control" of the site until at least 2200. The maintenance of the Chalk River site as a nuclear sacrifice zone for the next two hundred years is a controversial issue. The period of time during which people must be excluded from the Chalk River site is a cost-benefit decision. The decommissioning process could be carried out more quickly, but it would cost more. Those trade-offs should be a matter of public debate. AECL has done everything in its power to avoid the possibility of any informed decision-making

201. *AECL Annual Report 1995-1996*, Note 10, p. 33.

202. *AECL Annual Report 1996-1997*, Note 11, p. 34.

203. *AECL Annual Report 1997-1998*, p. 40. See also: *AECL Annual Report 1998-1999*, p. 45.

204. *AECL Annual Report 1999-2000*, p. 45.

205. *AECL Annual Report 2001-2002*, p. 48.

206. Auditor General of Canada, *Report of the Auditor General of Canada — December 2002*, Chapter 11, p. 37.

207. For the first time, the AECB issued separate licences for the Whiteshell and Chalk River Laboratories. Previously they received one combined licence.

208. D.R. Champ, *AECL's Decommissioning Plan and Program*, AECL, March 1998.

about the extent of the environmental problem at Chalk River, including the withholding of key environmental documents.[209]

It should also be remembered that the $386.5 million decommissioning liability recorded in 2001-2002 is simply an accounting provision. This liability has not been funded by either AECL or the government. The procedure for funding of the liability remains the same as it has been since 1996-97, when the government turned over the federal heavy water inventory to AECL, and allowed the sales and leasing of heavy water to be used for decommissioning costs.[210] AECL has referred to this arrangement as the "Ten Year Treasury Board Agreement".[211]

Instead of reimbursing taxpayers for the government's massive $816.9 billion bailout of AECL heavy water debts in 1981, funds from the heavy water inventory are simply being turned over to AECL. This is a very significant disguised subsidy, in the amount of the value of the heavy water inventory (valued at $583.4 million in 1995-96).[212] The Ten Year Treasury Board Agreement will be in place until 2005-06, when it may be continued or revert to the past practice of simply having the federal government pay the costs directly through annual parliamentary appropriations. Either way, these are *ad hoc* funding arrangements and an inadequate way to deal properly with these long-term liabilities.

AECL's actual decommissioning costs will be much higher than $400 million. The May 1995 *Report of the Auditor General* estimated federal radioactive waste and decommissioning costs at $850 million.[213] AECL is not responsible for the entire $850 million, but the Auditor General did not disclose AECL's portion, allegedly for reasons of commercial confidentiality and because some of the elements of the costing were subject to negotiation. The $850 million included $185 million for the cost for cleaning up radioactive waste in Port Hope, Ontario, so it is probable that most of the remaining $665 million is the Auditor General's estimate of AECL's responsibility. Even the figure of $665 million may be low, and it has been suggested that the clean-up of AECL's Chalk River Laboratories alone would cost over $1 billion.[214]

AECL's failure to account fully for its decommissioning and radioactive waste management costs conceals its financial insolvency. The need for this strategy was obvious to former AECL Chairman Bob Nixon, who said, "If AECL were to do this [deal properly with decommissioning], with present levels of funding, there would be little left for its prime task, the development of nuclear power."[215] Nixon was acknowledging that the high cost of AECL's commercial activities precluded responsible environmental behaviour.

AECL's detailed full decommissioning plan (including estimated costs) for AECL's Whiteshell and

209. Martin Mittelstaedt, "AECL documents stay under wraps", *Globe and Mail*, May 7, 1998, p. A14.

210. *AECL Annual Report 1995-1996*, p. 31.

211. D.R. Champ, *AECL's Decommissioning Plan and Program*, AECL, March 1998, Appendix D, p. 23.

212. It should be noted that in 1992, the government granted AECL the right to treat $97 million of the heavy water appropriations as "non-repayable appropriations". This was carried as an asset on the balance sheet of the corporation in 1992, but was written off against contributed capital retroactively in the 1993 financial statements. This is another disguised subsidy that did not appear as a line item under parliamentary appropriations.

213. *Report of the Auditor General of Canada to the House of Commons*, Chapter 3, "Federal Radioactive Waste Management", May 1995, ¶ 3.136, p. 3-32.

214. Art Milnes, "AECL fights with groups on cleanup", *Pembroke Observer*, August 27, 1994. The article cites Irene Kock of Nuclear Awareness Project.

215. John Hulbert, "AECL board chair voices optimism", *North Renfrew Times*, October 1, 1997, p. 2.

Chalk River sites was scheduled to be submitted to the Canadian Nuclear Safety Commission by January 31, 2002.[216] The Sierra Club of Canada made an Access to Information request to the Canadian Nuclear Safety Commission (CNSC) in February 2002 requesting documents related to the decommissioning of AECL's Chalk River Nuclear Laboratories. The documents received were highly expurgated because AECL objected as a "third party" to their release. In particular, the CNSC released almost nothing of RC-2593, the first draft of the *Chalk River Laboratories: Detailed Decommissioning Plan*, (July 2001). This matter is currently the subject of an appeal to the Information Commission of Canada. The Sierra Club of Canada has argued that "...given the potential threat to human health and the existing history of environmental contamination as a result of activities at Chalk River, the public interest served by disclosing the decommissioning plans outweighs any prejudice to AECL's competitive position". [217]

Local citizens have formally requested the federal Minister of the Environment to undertake a full panel environmental assessment under the Canadian Environmental Assessment Act for a decommissioning plan for the Chalk River Laboratories.[218] In response, the Minister of the Environment stated that "...the preparation of a decommissioning plan does not constitute a project under the Act, and therefore does not require that an environmental assessment be undertaken". Anderson then went on to say that separate environmental assessments would be conducted by the CNSC on individual facilities at the Chalk River Laboratories "once it has received a letter from Atomic Energy of Canada Limited expressing the intent to decommission any part of the Chalk River Laboratories.".[219]

The refusal to conduct an environmental assessment on the overall decommissioning plan for Chalk River will result in piecemeal separate assessments for individual facilities on the site. This fractured approach will have several undesirable impacts: redundant and wasteful analysis; a failure to take into account synergic environmental and public health effects; potentially wasteful and ineffective remediation efforts; a failure to determine the most desirable prioritization for decommissioning efforts; and discouragement of public participation. This is in violation of Section 4 of the Canadian Environmental Assessment Act, which list among its purposes:

- ensure that responsible authorities carry out their responsibilities in a coordinated manner with a view to eliminating unnecessary duplication in the environmental assessment process; and

- ensure that there be an opportunity for public participation in the environmental assessment process.

Section 15(2) of the Act also addresses the assessment of related projects. It states, "For the purposes of conducting an environmental assessment in respect of two or more projects... the Minister ... may determine that the projects are so closely related that they can be considered to form a single

216. Canadian Nuclear Safety Commission, CNSC Staff Plan of Action on Financial Guarantees for Decommissioning, CMD 00-M62, October 24, 2000, p. 6.

217. Letter from Kristen Ostling, Sierra Club of Canada, to Mr. John Reid, Information Commissioner of Canada, October 18, 2002.

218. Letter from Lynn Jones, President, Concerned Citizens of Renfrew County, to The Hon. David Anderson, Minister of the Environment, June 24, 2002.

219. Letter from The Hon. David Anderson, Minister of the Environment, to Lynn Jones, President, Concerned Citizens of Renfrew County, August 16, 2002.

project".[220]

The failure to conduct a full panel environmental assessment review of the overall decommissioning plan for Chalk River Laboratories will likely have significant adverse impacts on the environmental quality of the Ottawa River, which is used for recreation and drinking water by millions of Canadians in Ontario and Québec.

The CNSC has already begun its piecemeal environmental assessment of decommissioning at Chalk River with low-level screenings under the Act for:

- Phase I decommissioning of the Building 204A and 204B Fuel Rod Storage and Handling Bays (FEIA Reference No. 16692); and

- Decommissioning of Heavy Water Upgrading Plant in buildings 210 and 212 (FEIA Reference No. 31931).

The Building 204 Fuel Rod Storage and Handling Bays were used to store and process spent fuel rods and experimental fuel rods from the NRX reactor for nuclear weapons plutonium production and other purposes. Since 1959, this bay has leaked several thousand litres per day of highly radioactive water, creating a contaminant plume of fission products and tritium that drains into the Ottawa River along several hundred metres of the shoreline. This has been the cause of significant public concern.[221] AECL's plan for the NRX fuel bays involves moving radioactive sludge to one of about a dozen radioactive waste management areas, many of which are already contaminating biota, sediments in the Ottawa River, surface water and ground water. Failure to conduct this decommissioning plan in the overall context of the site will almost certainly result in the exacerbation of an already bad situation.

Decommissioning the Heavy Water Upgrading Plant (buildings 210 and 212) involves the dismantling and removal of storage tanks, process equipment and piping from a facility that was shut down in 1998. The facility is contaminated with radioactive pollutants from used heavy water. Contaminated components from the facility will also be put into potentially deficient waste facilities on the site.

Instead of putting pressure on Atomic Energy of Canada Limited, the Canadian Nuclear Safety Commission has given Canada's national nuclear polluter even further latitude. The two-year licence for the Chalk River Laboratories was due to expire in October 2002. With no public consultation in the summer of 2002, that licence was quietly extended seven months.

The overall environmental assessment on Chalk River should include a review of the financial and accounting procedures for the decommissioning process, including cost estimates, and the proposed terms for management of funds. AECL and the federal government should establish an actual fund to cover the future costs of radioactive waste management and decommissioning of AECL's various facilities after the end of their service lives. The total cost (allowing for accrual of interest over time) should be paid into this fund during the active operating life of the facilities. This fund should be separate from the operations of AECL, and should be managed and accounted for by an independent body.

220. See: Letter from Lynn Jones, President, Concerned Citizens of Renfrew County, to The Hon. David Anderson, Minister of the Environment, October 15, 2002.

221. Tom Spears, "Chalk River's dirty secret", *Ottawa Citizen*, May 28, 1997.

7.2. Whiteshell: The Cleanup Begins

Whiteshell Laboratories (originally known as the Whiteshell Nuclear Research Establishment) is a 4,000 hectare facility owned and operated by AECL on the east bank of the Winnipeg River at Pinawa, about 100 km northeast of Winnipeg. Whiteshell went into operation in 1963, initially to develop a prototype 40 MWt organic-cooled reactor known as WR-1 (Whiteshell Reactor-1). AECL's Underground Research Laboratory is located at Lac du Bonnet, about 15 kilometres to the northeast of the Whiteshell site. It is a test mine site intended to demonstrate the viability of deep-rock burial of high-level radioactive waste. Employment at Whiteshell peaked at about 1,000 employees in 1985.[222]

In its 1995 Program Review, the federal government reduced AECL's large and redundant research infrastructure, which included three major research facilities in Canada -- the Chalk River Laboratories in Ontario's Ottawa Valley; the Whiteshell Laboratories in Manitoba, and the Sheridan Park complex in Mississauga, Ontario. Whiteshell was a logical candidate for shutdown, since most of its major facilities had already been shut down or were undergoing decommissioning by that time.

While a simple shutdown of Whiteshell would have been cheaper and easier, political pressure was exerted to maintain the facility. AECL had apparently proposed shutting down Whiteshell, laying off most of the 700 employees that remained in 1996-97, and transferring the remainder to either Chalk River or Sheridan Park[223]. However, the government decided it would try to privatize the facility.[224], There was no mention of pay-back to the public purse for the massive taxpayer investment in Whiteshell over the previous 40 years.

Following the June 1996 report of the Whiteshell Task Force [225], the government announced its plans for Whiteshell In December 1996: [226]

- establishment of an Economic Development Authority with $3 million funding over five years ($1.5 million each from the Government of Manitoba and the federal department of Western Economic Diversification);

- creation of a $20 million fund of "repayable assistance" over five years for companies locating at the site ($10 million each from Manitoba and Western Economic Diversification; proposed terms for loans have not been revealed); and

- $100,000 for a feasibility study for establishment of an educational facility by the Red River Community College ($50,000 each from Manitoba and Western Economic Diversification).

On February 6, 1997 the formation of the Economic Development Authority for Whiteshell (EDAW)

222. AECL, *Canada Enters the Nuclear Age*, p. 36.

223. Dan Lett, "British Giant Wants Lab", *Winnipeg Free Press*, April 3, 1997, pp. A1 & A2.

224. The privatization strategy was reportedly brokered by Foreign Affairs Minister Lloyd Axworthy (senior Manitoba MP), Anne McLellan (another western MP and then Minister of Natural Resources), former AECL President Reid Morden, and Peter Siemens (then Chair of the Whiteshell Task Force). See: Dan Lett, "Pinawa Spared AECL Axe", *Winnipeg Free Press*, May 26, 1998.

225. *Report of the Whiteshell Task Force*, Appendix A: Terms of Reference, p. 23.

226. "Federal Government Moves to Commercialize Whiteshell", *Canada/Manitoba News Release*, December 19, 1996.

was announced by the federal and Manitoba governments.[227]

As part of the December 1996 announcement, the investment firm of Nesbitt Burns was engaged to manage a process that selected two parties, who submitted detailed "Definitive Proposals" on March 21, 1997.[228] On April 18, 1997, former Natural Resources Minister Anne McLellan announced negotiations with a consortium known as Canadian Nuclear Projects Ltd. (CNPL).[229] CNPL was headed by BNFL Inc. (the US subsidiary of the state-owned British Nuclear Fuels Ltd. plc), and also included Wardrop Engineering of Winnipeg, Acres International Ltd. (a Canadian engineering company), and SENES Consultants.[230] However, by February 1998, CNPL spokesperson David Campbell stated that "By itself, Whiteshell is probably not commercially viable."[231] In April 1998, CNPL withdrew from negotiations with the federal government for the comprehensive privatization of Whiteshell. CNPL said that the possibility of privatizing Whiteshell had "disappeared or seemed improbable".[232]

On December 16, 1998, the federal government announced that AECL would end its activities at Whiteshell by December 2001.[233] This did not happen. Employment stood at about 240 people in 2001. These people are employed in the Nuclear Reactor Safety and Waste Management research programs, as well as preparation for decommissioning work.[234]

Despite loans and grants of over $40 million since 1996, there has been little success in the attempt to privatize AECL's activities at Whiteshell. A handful of small companies have been formed, of which Acsion is the largest. Acsion Inc. "bought" an electron particle accelerator from AECL (the purchase price remained secret), and was given a $200,000 loan by Whiteshell Economic Development Authority.

In December 1999, as the "Responsible Authority" for nuclear issues under the Canadian Environmental Assessment Act, the Canadian Nuclear Safety Commission decided that a Comprehensive Study Report[235] would be conducted on Whiteshell decommissioning, delegated the conduct of the study to AECL, and issued the scope for the study. As usual, the proponent of the undertaking writes the environmental assessment report itself (subject to review by the Responsible Authority, the AECB/CNSC). The scope document said that decommissioning activities would include, "...dismantling and/or decontamination and refurbishment of all structures, infrastructure and services, and the remediation of all lands in the project area, *except for an eight hectare area where continued management of radioactive waste under AECB licence is proposed to continue in*

227. "Paul M. Soubry & Peter Siemens to Lead Whiteshell Economic Development Authority", *Canada/Manitoba News Release*, February 6, 1997.

228. "Negotiations to Commercialize Whiteshell Set to Begin", *Natural Resources Canada News Release*, April 18, 1997, *Backgrounder*, "Commercializing Whiteshell Laboratories".

229. "Negotiations to Commercialize Whiteshell Set to Begin", *Natural Resources Canada News Release*, April 18, 1997.

230. "Negotiations to Commercialize Whiteshell Set to Begin", *Natural Resources Canada News Release*, April 18, 1997, *Backgrounder*, "Canadian Nuclear Projects Limited".

231. Vance Gutman, "Whiteshell privatization clock is winding down", *North Renfrew Times*, February 18, 1998, p. 1.

232. Tim Ruhnke, "CNPL withdraws from Whiteshell talks", *North Renfrew Times*, April 15, 1998, p. 1.

233. Natural Resources Canada, "AECL announces decision on future plans for Whiteshell", *News Release 98-102*, December 16, 1998

234. *AECL Annual Report 2001-2002*, p. 39.

235. A lower level of environmental assessment that does not involve the appointment of an independent panel for review, or provide funding for public interventions.

the future." [emphasis added][236]

Despite public requests, the actual remaining waste management areas, as well as the Underground Research Laboratory were excluded from the study.[237] The Manitoba government has stated publicly that it wants radioactive waste to be removed from the Whiteshell site. Manitoba Highways Minister Darren Praznik stated, "The message we gave [AECL] is that if you leave Manitoba, we expect you to take your nuclear waste with you. We don't want to be your dumping ground. [...] Essentially their plan is to lock up the buildings, install a monitoring system and hire security guards to watch the place."[238]

In March 2001 the Whiteshell Laboratories Comprehensive Study Report (Volume 1: Main Report and Volume 2: Appendices) was released in draft form. Following a comment period that ended April 30 2001, select comments and responses from AECL were incorporated into Volume 3. On April 2, 2002 a decision was announced by the Minister of the Environment which ignored many substantive concerns raised by the public.[239] Manitoba provincial officials have complained that the cleanup and decommissioning of the Whiteshell site should be accelerated, and they have opposed AECL's plan for a 60-year cleanup period followed by 200 years of monitoring.[240]

As at Chalk River, the CNSC has also been accommodating to AECL with its operating licence for Whiteshell Laboratories. The former two-year Whiteshell licence (simultaneous and integrated with the Chalk River Laboratories licence) was to have expired in October 2002, but was extended two months. On December 19, 2002, the CNSC issued a "decommissioning licence" for Whiteshell, valid for an unprecedented six years, until December 31, 2008. Previously, AECL underwent a licence hearing at two year intervals, but these hearings will now be downgraded into biannual "interim reports" to the CNSC. Reinforcing its role as apologist for the nuclear industry, CNSC stated that "AECL is qualified to carry out the activities under the licence and, in doing so, will make adequate provision for the protection of the environment, the health and safety of person, and the maintenance of national security...".[241]

236. AECB, *Decommissioning of the Whiteshell Laboratories: Scope of Project and Assessment for an Environmental Assessment Pursuant to the Canadian Environmental Assessment Act*, December 22, 1999.

237. See for example: Letter from I. Kock, Nuclear Awareness Project, to Barclay Howden, AECB, November 25, 1999.

238. Canadian Press, "Feds and province feuding over waste disposal", *CP Newswire*, February 20, 1999.

239. See for example: *Comments by the Concerned Citizens of Manitoba Regarding the Draft Report of the Whiteshell Labs Decommissioning Project*, April 16, 2001.

240. Peter Calamai, "Watchdog urged to get tough on national nuclear agency", *Toronto Star*, November 15, 2002, p. A27

241. Canadian Nuclear Safety Commission, "CNSC announces decision on Atomic Energy of Canada's application to decommission the Whiteshell Laboratories", *News Release*, December 19, 2002.

7.3. Nuclear Fuel Waste Act

High level radioactive waste is the spent uranium fuel from reactors. Fuel bundles from commercial reactors weigh about 25 kilograms. In Canada, there are over one million spent fuel bundles, weighing about 30,000 tonnes at various sites, mostly in water-filled pools at nuclear power stations. Because of its intense radioactivity, spent nuclear fuel is lethal and remains dangerous for hundreds of thousands of years. This makes long-term management of radioactive waste extremely difficult.

In 1978, by federal/provincial agreement, AECL was given responsibility for devising a burial plan for the Canadian nuclear industry's high level radioactive waste, including its own waste as well as that of the former Ontario Hydro (now Ontario Power Generation), Hydro Québec and New Brunswick Power. As part of that work, from 1978 to 1981, AECL investigated sites near Massey, Atikokan, Kirkland Lake and Bancroft in Ontario, and drilling tests were conducted at Atikokan and Massey. Strong public opposition forced AECL to cease its site studies, and by 1981, AECL had switched to a 'generic' or 'concept' approach for deep geological disposal, based on the field work done at its Underground Research Laboratory established at Pinawa Manitoba. AECL finally proposed that nuclear waste be buried 500 to 1000 metres below the surface of the Canadian Shield ('deep geological disposal'). In 1989 a federal environmental assessment panel was appointed to review AECL's proposal and provide advice to the federal government. The 'concept' assessment did not require AECL to identify or study an actual future burial site -- it used only generic computer models of the Canadian Shield. The proposal relied on 'barriers' to protect the surface environment from the toxic waste: the fuel bundles, the waste canisters, backfill and the Shield rock.

After ten years of deliberation, the environmental assessment panel (known as the Seaborn Panel, after its Chairperson Blair Seaborn) released its long-awaited report in March 1998.[242] Seaborn found that AECL's proposal was not acceptable, and identified 95 technical deficiencies. The panel recommended that an independent agency, excluding AECL and the nuclear utilities, should be formed to compare waste management options and manage long-term programs. Other Seaborn panel recommendations included: initiating an Aboriginal participation process, conducting an effective public consultation and review of waste regulations, and developing a comprehensive public participation program as well as an ethical and social assessment framework. The government's formal response to the Seaborn Panel came in December 1998, setting the tone and direction for legislation that would reject fuyndamental aspects of the panel's recomendations.[243]

On April 25, 2001, the Chrétien government introduced Bill C-27 "An Act respecting the long-term management of nuclear fuel waste" into the House of Commons.[244] The government ignored the major recommendations of the Seaborn panel, and the dozens of specific amendments to the legislation that were recommended by environmentalists.[245] The Nuclear Fuel Waste Act came into force on November 15, 2002.

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242. Canadian Environmental Assessment Agency, Federal Environmental Assessment and Review Process, *Nuclear Fuel Waste Management and Disposal Concept: Report of the Nuclear Fuel Waste Management and Disposal Concept Environmental Assessment Panel*, February 1998.

243. Natural Resources Canada, *Government of Canada Response to Recommendations of the Nuclear Fuel Waste Management and Disposal Concept Environmental Assessment Panel*, December 1998.

244. Natural Resources Canada, "Nuclear Fuel Waste Legislation Announced", *News Release*, April 25, 2001.

245. Irene Kock, *Recommended Amendments to Bill C-27*, Sierra Club of Canada, November 2001. See also: Brennain Lloyd, *Brief to the Senate Standing Committee on Energy, the Environment and Natural Resources with Respecxt to Bill C-27*, Northwatch, April 21, 2002.

Under the new legislation, the Nuclear Waste Management Organization (itself created by the legislation), is required within three years of the legislation coming into force to make a recommendation to the Minister of Natural Resources on its choice between three options for the long-term management of radioactive waste. The three options are (a) “deep geological disposal”, (b) “storage at reactor sites”, or (c) “centralized storage, either above or below ground”.[246]

The fundamental problem identified with the legislation was the lack of independence for the proposed Waste Management Organization (WMO). The government proposed that the WMO would be comprised only of representatives of the nuclear industry. The nuclear industry’s predilection for deep geological disposal is well known, so the lack of independence guarantees that this option will be selected. The legislation also allows the Waste Management Organization to selected its own Advisory Committee, so this body also generally reflects the industry viewpoint.[247]

246. See section 12 of the Act.

247. Waste Management Organization, “Elizabeth Dowdeswell to Lead Study of Approaches to Manage Used Nuclear Fuel”. *News Release*, October 24, 2002. See also: WMO, “David Crombie to chair Nuclear Waste Management Organization Advisory Council”, *News Release*, November 7, 2002.