The Local and Province-Wide Economic Effects of The Point Lepreau Power Plant: Lessons for Saskatchewan

INSTITUTE FOR SASKATCHEWAN Enterprise

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EXECUTIVE SUMMARY

This report examines New Brunswick's experience with the Point Lepreau nuclear power facility to determine whether it holds any lessons for Saskatchewan. The specific focus of this report is on describing the impacts of Point Lepreau on New Brunswick's economy. As well, the anticipated effects of installing a second reactor at Point Lepreau are considered. Finally, as directed by the terms of reference, this study does not undertake a detailed economic assessment of the Point Lepreau plant, nor are the relative merits of nuclear power *versus* other energy options addressed.

The Point Lepreau nuclear power plant is located on the Bay of Fundy about 40 kilometres west of Saint John, New Brunswick. The construction of the first of two planned 630-megawatt CANDU reactors began in 1974 and was brought into commercial operation 105 months later, three years behind schedule. As well, the cost of constructing this reactor was between two and three times higher than the original estimates. Whether the second reactor will be constructed remains to be seen.

The New Brunswick economy was affected by the Point Lepreau nuclear power plant in a number of ways. For example, the construction and operation of the plant created both direct and indirect employment and business opportunities. As well, its impacts were felt through (a) its income generation and associated increase in aggregate demand, (b) its effects on housing markets, and (c) its impacts on local and provincial treasuries.

It is estimated that 85 percent of the 11,000 person-years of pre-production employment associated with Point Lepreau went to residents of New Brunswick. The operational phase of the project required another 300 full-time, highly skilled employees. Should the second reactor be installed at the Point Lepreau facility, these employment impacts could increase by a factor of two.

New Brunswick businesses also benefitted by taking advantage of opportunities to supply goods and services required for the construction and operation of the plant. During the peak construction period, Point Lepreau accounted for 17 percent of provincial construction expenditures. Furthermore, during the construction period, New Brunswick's GDP was two to three percent higher than it would have been had this project not been built.

In addition, there is some evidence that specific New Brunswick businesses benefitted from the technology transfer associated with Point Lepreau. Even so, Lepreau's overall impact on technology development in New Brunswick was not major.

The Point Lepreau project increased revenues going to each level of government although it did not appear to put undue strain on the demands for provincial and local government services. During the construction period, housing prices in Saint John grew at a rate three times faster than what would have been expected without the project. As well, the output of Point Lepreau appears to have had a moderating influence on electricity rates in New Brunswick.

Although the construction and operation of the Point Lepreau nuclear power plant had significant impacts on the New Brunswick economy, the project was not without its problems. It was plagued by labour-management disputes, cost overruns and project delays. Each of these resulted from different factors. Recognizing and understanding these factors can provide valuable lessons for Saskatchewan.

The first lesson is that because a number of problems at Point Lepreau were due to incomplete engineering plans and designs when construction commenced, comprehensive and detailed plans and drawings must be completed and approved before construction begins. While this suggestion seems obvious, inadequacies in this area caused significant problems at the Point Lepreau site.

The second lesson for Saskatchewan pertains to how to minimize the labour problems that resulted from the labour-management style adopted at Lepreau. Such problems must be anticipated and plans for their mitigation be made before construction commences. A cooperative approach between management and labour would be useful in this regard. This would require that the detailed allocation of work among various trades be negotiated prior to the start of construction. As well, provincial union personnel ought to be given preference for jobs if they have the required skills and experience. This would avoid some of the strife caused at Lepreau by the hiring of senior union personnel from outside the province.

A third lesson relates to cost overruns and scheduling delays. Based on the Lepreau experience, the timetable of project milestones should be realistic, and contingency plans should exist. As well, 'cost plus' and 'cost reimbursable' contracts have been ascribed part of the blame for the Point Lepreau project's cost overruns. Hence, if possible, these kinds of contracts should be avoided.

A fourth lesson is that to increase the likelihood of maximizing the benefits of the project accruing to provincial businesses and labour, the proponent should provide the public with as much project detail as is feasible in a timely manner. This would involve a description of the skill and experience levels required to work on the project. As well, anticipated shortfalls in specific trades ought to be determined as soon as possible in advance of the project so that training can be undertaken to reduce these shortfalls and to increase local participation. This would have the additional impact of reducing the disruption caused in local labour markets as people with key skills would otherwise be bid away from other industries.

Also, in order to ensure that provincial firms capture a reasonable share of the business generated by the project, the proponent should provide, as early as possible, a detailed list of the types of goods and services required. This should include amounts of each good and service needed, the minimum quality standards that would have to be met, and the schedule of when these goods and services would be required. If possible, procurement and design ought to be undertaken within the province. Also, in-province suppliers may be unable to fill excessively large orders for inputs. Therefore, where feasible, job lots (packages) ought to be small enough to ensure that local businesses have a reasonable chance of bidding on them successfully.

Although Saskatchewan and New Brunswick are similar in terms of population and electrical generating capacity, production, and consumption, and would be even more similar should a nuclear power facility be constructed in Saskatchewan, these similarities in themselves do not hold any particular lessons other than Saskatchewan might reasonably expect post-construction impacts similar to those experienced in New Brunswick. The more important lessons for Saskatchewan arise from the pre-project and construction phases of the Point Lepreau facility. Errors were made that led to cost overruns, delays and less in-province involvement in the project than was possible. We have identified the factors which contributed to these negative aspects so that they may be avoided. The major lesson for Saskatchewan, therefore, is to learn from Point Lepreau's mistakes.

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1. Introduction

The share of electricity generated by nuclear power plants in Canada has grown steadily since 1971. Accounting for only 4 percent of total electricity generated in 1975, its share had risen to about 10 percent by 1981 and to 16 percent by 1991.[1] Three provinces - Ontario, Quebec and New Brunswick - account for all the nuclear-generated electricity in Canada. Ontario is Canada's major producer, while Quebec and New Brunswick each have one nuclear power plant. In 1991 nuclear-generated electricity accounted for 46 percent of Ontario's electricity output, 32 percent of New Brunswick's and 3 percent of Quebec's.[2] The entire Canadian nuclear industry consists of 19 plants:the oldest, commissioned in 1971, is Pickering A1 and the newest, commissioned in 1990, is Darlington 2.[3]

There is some possibility that in the near future Saskatchewan will examine the feasibility of partially satisfying its requirement for electricity *via* the nuclear alternative. This report examines New Brunswick's experience with the Point Lepreau nuclear power facility to determine whether it holds any lessons for Saskatchewan. The specific focus of this report is on describing its impacts on New Brunswick's economy. As well, an examination of the anticipated effects of building a second reactor at Point Lepreau is considered. Finally, as directed by the terms of reference, this study does not undertake a detailed economic assessment of the Point Lepreau plant, nor are the relative merits of nuclear power *versus* other energy options addressed.

The remainder of this report is organized in the following way. The next section provides a brief comparison of Saskatchewan's and New Brunswick's energy scenes. This section examines population, the level and types of installed capacity, production, consumption and international and interprovincial electricity flows. It is demonstrated that New Brunswick and Saskatchewan are similar in many ways and that New Brunswick's experience with nuclear power could provide meaningful lessons for Saskatchewan. Following this is a brief discussion of the characteristics of a nuclear power plant that distinguish it from other types of thermal plants. Project-specific information is described in the following section. Then, we highlight actual and predicted employment impacts. It is in this section that we examine the actual employment generated by Lepreau I, the skills and training levels required to build and operate the plant, and the anticipated employment impact of Lepreau II. The four subsequent sections deal with the project's non-labour effects: business opportunities arising from the project, its income effects, its localized impacts and the project's tax implications. In the following section we report on the project's other impacts that are not easily included in the above categories. The specific topics discussed in this section are: technology transfer, electricity exports and electricity prices. Problems encountered during the construction of the Point Lepreau facility are discussed in the penultimate section. The final section contains our conclusions.

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[1] Canada: Energy, Mines and Resources [1992:40].

[2] Canada: Energy, Mines and Resources [1992:41].

[3] Canada: Energy, Mines and Resources [1992:52, Table 7.6].

2. Comparing Saskatchewan's and New Brunswick's Energy Scenes

If New Brunswick's experience with nuclear power is to provide lessons for Saskatchewan, there must be a sense of how these provinces compare in terms of their electrical energy production and consumption. An important determinant of a province's demand for energy is its population. In 1986, Saskatchewan's population was 1,009,613 while New Brunswick's was 709,442.[4] By 1991, Saskatchewan's population had fallen to 988,928 while the population of New Brunswick's had risen to 723,900. Obviously, the population bases and trends of these provinces differ but, even so, they are similar in size and, certainly, they are much different from either Ontario or Quebec, the other two provinces that have nuclear plants.[5]

Also, it would appear that gaps in the levels of provincial GDP and per capita personal income in New Brunswick and Saskatchewan are narrowing. Statistics Canada [1991] reports New Brunswick's GDP (at market prices) in 1986 and 1991 to be $10,078 million and $13,689 million, respectively, whereas, in the same years, GDP in Saskatchewan was $17,145 million and $19,985 million, respectively. According to the same source, nominal personal income per capita in New Brunswick grew from $13,163 to $17,961 between 1986 and 1991, while the same datum grew from $15,221 to $18,343 in Saskatchewan during the same period.

To gain a more complete picture of the energy scene in each province, we also examine: (a) the capacity of each province to produce electricity; (b) the breakdown of this productive capacity between hydroelectric plants and thermal plants; and, (c) the consumption, production and interprovincial and international transfers of electricity associated with each province.

To address this first issue, we include Table A-1 in Appendix A. This data shows that from (at least) 1978, New Brunswick has enjoyed more installed capacity than Saskatchewan. In 1978, New Brunswick possessed about 20 percent more installed hydroelectric capacity and approximately 13 percent more capacity to generate electricity thermally. By 1991, New Brunswick's hydroelectric capacity was only 8 percent higher than Saskatchewan's but its thermal capacity was 56 percent higher, thus yielding New Brunswick 42 percent more total installed capacity than Saskatchewan. The Point Lepreau nuclear power plant accounted for this huge increase in New Brunswick's installed capacity.

The second issue pertains to the amount of power produced in each province. From Table A-2 in Appendix A, one observes that prior to 1983, when Lepreau went into commercial operation, Saskatchewan produced as much or more electricity than New Brunswick. This was in spite of the fact that Saskatchewan's productive capacity was less than New Brunswick's. In 1991, Saskatchewan produced 40 percent more hydroelectricity than New Brunswick but New Brunswick's thermally produced electricity, enhanced by the output of Point Lepreau, was 36 percent higher than Saskatchewan's thermal output.

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[4] Statistics Canada [1992].

[5] Ontario's population was 9,101,694 in 1986 and 10,084,885 in 1991. The corresponding figures for Quebec were 6,532,461 and 6,895,963

As Tables A-3 and A-4 show, the time profile of consumption in both provinces is very similar in terms of its magnitude and its pattern of growth. The same cannot be said for interprovincial and international transfers of electricity.

Although New Brunswick imports very little electricity from the United States compared to what it exports (3,091,699 megawatt-hours in 1991), it is a net importer of electrical energy from the rest of Canada. For example, interprovincial trade accounted for 6.6 percent (903,884 megawatt-hours) of New Brunswick's consumption of electricity in 1991. Currently, New Brunswick Power simultaneously imports electricity from Quebec to service northern communities and exports surplus electricity produced in southern New Brunswick to the United States. This strategy lessens transmission wastage and, as such, makes economic sense.

Saskatchewan's history of electricity dealings with the United States essentially began in 1982. From that time to 1991, it has been a net exporter of electrical power in some years and a net importer of it in others. Over this decade, it has been a small net importer — only of 5,966 megawatt-hours per year on average. Over the last two years shown, Saskatchewan has been a net exporter of electricity to the United States of an average of 17,107 megawatt-hours annually. Like New Brunswick, Saskatchewan is a net importer of electricity from within Canada, although this source accounted for only 1.9 percent (268,277 megawatt-hours) of its total consumption in 1991.

This simple comparison of production and consumption over the period 1970-1991 reveals that New Brunswick, on average, produces more electrical energy than it consumes. Over the same period, Saskatchewan's electrical energy consumption exceeds its production by a small margin. Based on these comparisons, it would appear that Saskatchewan and New Brunswick are similar in many ways. Certainly, of the provinces operating nuclear power plants, the New Brunswick case is the most reasonable comparison for Saskatchewan. The major differences lie in thermal production capacity and that New Brunswick produces more electricity than it consumes whereas Saskatchewan is practically self-sufficient in terms of its electricity requirements. Obviously, these differences would narrow should Saskatchewan construct a nuclear power plant.

3. Distinguishing Features of a Nuclear Power Plant

To appreciate fully how a nuclear plant may impact upon a particular province, it is important to understand its distinguishing features. The essential difference between nuclear and standard thermal plants is the heat source. Both use steam to turn a generator. The CANDU reactor, in use at Point Lepreau, is a heavy-water reactor. It uses heavy water as both a moderator and a heat transport system. Heavy water surrounding fissioning uranium slows down (moderates) free neutrons. This increases the probability that some neutrons will collide with Uranium-235 atoms in the fuel, causing them to split, release energy and free even more neutrons. This released energy heats the heavy water which, in turn, heats ordinary water into steam. This steam turns a generator to produce electricity, just as in ordinary thermal generation.[6] From this point on, the generating processes of an ordinary thermal plant and a nuclear plant coincide.

There are many components of a nuclear power plant which are common to either a coal-fired or oil-fired plant. Warner [1984:89] suggests that well over 50 percent of the equipment used in a nuclear power station would be conventional. He notes that the two things that distinguish a nuclear plant are: "the standard of reliability dictated by difficulties of access for maintenance or repair, and the demands for safety." Therefore, one should expect that a province with a well-developed industrial structure could play a major role in the construction of a nuclear power plant. Even so, for most provinces in Canada, many components would have to be imported from Ontario and Quebec. This would lessen the provincial content of the business activity that results from constructing a nuclear power plant and, as such, would reduce the benefits accruing to residents of that province.

6 Ontario Hydro [1988:9a].

4. Project Information

New Brunswick Power owns and operates the Point Lepreau nuclear power facility. It is located on the Bay of Fundy about 40 kilometres west of Saint John. In the early 1970s, New Brunswick was highly dependent on imported oil to produce electricity and this dependence was growing. Because of this, the province decided to construct a nuclear power plant at Point Lepreau with two 630-megawatt CANDU reactors.

Construction began in 1974 and it took 105 months to bring the first CANDU reactor into commercial service. This represented a delay of three years beyond the schedule estimated originally. As well, the project cost $1.45 billion to construct. This was between two and three times higher than the original cost estimate.[7] We elaborate on several reasons for these delays and cost overruns in Section 11.

In the end, only one reactor, known as Lepreau I, was constructed at Point Lepreau. Since then there has been consideration of whether a second reactor, Lepreau II, ought to be installed. Maritime Nuclear has subjected its proposal to construct a second nuclear power plant at Point Lepreau to an environmental assessment review.[8] This project is an updated version of the Lepreau I design. Maritime Nuclear estimated that Lepreau II would cost (in the dollars of the day) between $1.9 and $2.4 billion.[9] The projected schedule for the project is between 78 and 84 months from the date of commitment to it. The plant would be built, according to the New Brunswick Electric Power Commission [1983:13], to export power to the United States until that power was needed in New Brunswick.

Currently, Lepreau I provides about 30 percent of New Brunswick's electricity requirements, and almost one-half of the production from its installed capacity is exported.[10] Also, this power plant has the distinction of being the first project in Canada to be subjected to the Federal Environmental Assessment Review process.[11] Because this project occurred early in the environmental review era, the documentation on its impacts is not as detailed as one would like. However, as Lepreau II is simply a more modern version of Lepreau I, we use the estimates for Lepreau II wherever detailed information concerning Lepreau I is unavailable.

More recently, Atomic Energy of Canada Limited undertook a preliminary assessment of the industrial impacts of installing a CANDU 3 reactor at Point Lepreau. The CANDU 3 design would be instead of the CANDU 630 reactor considered by Maritime Nuclear in its original proposal. The CANDU 3's modular design distinguishes it from other CANDU reactors because it allows for components of the power plant to be constructed off-site.[12] Where it is appropriate, information on this alternative will also be discussed.

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7 There is a range of estimates provided in the literature as to the original cost estimate. The New Brunswick Electric Power Commission [1983:2] suggested $684 million whereas Gardner [1985:61] and Rose [1981:164] reported the original estimate to be $466 million.

8 Maritime Nuclear is a consortium of Atomic Energy of Canada Limited and New Brunswick Power.

9 Environment Assessment Panel estimated the cos to be $1.05 billion (in 1983 dollars). See New Brunswick and Canada [1985:22].

10 New Brunswick Electric Power Commission [1983:i].

11 Washburn and Gillis [1984:7-56, 7-57].

12 According to the Atomic Energy of Canada Limited [1989:11], "A primary objective of the CANDU 3 design program is to reduce the long construction schedules that have been associated with nuclear power projects in the past."

5. Employment Impacts: Actual and Predicted

5.1 Actual Employment: Lepreau I

Construction of Lepreau I began in 1974 and the plant entered commercial service in January 1983. The project required 11,000 person-years for on-site management, supervision, engineering and construction labour; 2,300 person-years for engineering and design; and 1,000 person-years for commissioning.[13] Actual labour requirements greatly exceeded initial estimates. Projected on-site labour requirements were approximately 5,000 person-years — slightly less than half of the actual demand. Peak employment, according to Table 1, occurred in June 1979 when 2,275 workers were on the construction site. This was almost two and one-half times larger than the projected peak of 925 workers. This peak also occurred eighteen months later than originally forecast. As well, the biggest error in forecasting labour requirements occurred for pipefitting/welding trades. Demand for these trades was underestimated by a factor of five.

Obviously, Lepreau I was a large project. During the peak construction period (1977-78), the project accounted for almost 17 percent of all construction activity in New Brunswick.[14] In addition, approximately 300 people were employed full-time during the operational phase of Lepreau I.

TABLE 1

Peak Labour Requirements
A Comparison of Predicted and Actual
(through September 1979)

Classification	Actual Number	Actual Peak Date	Predicted Number	Predicted Peak Date	Difference (in number)	Difference (in months)
All trades	2,275	June 1979	925	January 1978	1350	18
Labourers	385	June 1979	155	1977	230	18
Electricians	365	November 1979	175	1978 - July 1979	190	2
Operators	140	June 1979	40	1977	100	12
Sheetmetal Workers	35	October 1979	22	January 1978	13	18
Boilermakers	85	June 1979	50	1978-79	35	12
Millwrights	95	September 1979	70	June 1978	25	15
Ironworkers	135	September 1979	90	January 1978	45	21
Carpenters	230	September 1979	125	1977	105	21
Pipefitters	960	September 1979	200	1977	760	21
Insulators	Not yet	on site	45	January 1977-78	-	12

Source: Rose [1981: Table I-III]

[13] Washburn and Gillis [1984:7-360].

[14] Washburn and Gillis [1984:7-36].

Table 2 shows the number of people working in on-site construction trades per week in March of 1979.[15] During that period, 81 percent of the project's workforce consisted of pipefitters, labourers, welders, electricians and carpenters, with pipefitters representing the largest number of tradespeople required. This table also shows that approximately 85 percent of the project's construction labour force came from within New Brunswick and that most of those hired from out-of-province were in highly skilled trades. For example, 69 welders (24 percent of welders) were from outside the province. The corresponding figures for pipefitters and electricians were 152 people (26 percent) and 84 people (31 percent), respectively. Although an 85-percent provincial share of the total construction labour requirement is substantial, the Environmental Assessment Panel for Lepreau II expressed concern that this figure could have been higher.[16]

TABLE 2

On-site Tradespeople by Type and Residence
Average Weekly Data for March 1979

Classification	Total	In-Province	Out-Of Province
Carpenters	184	184	0
Labourers	290	283	7
Ironworkers	64	56	8
Electricians	274	190	84
Pipefitters	589	437	152
Operators	99	99	0
Machinists	17	17	0
Millwrights	47	47	0
Sheetmetal Workers	27	26	1
Welders	283	164	69
Boilermakers	57	45	12
Painters	4	4	0
Cutters	5	5	0
Roofers	1	1	0
Heat & Vent Workers	6	6	0
Total	1,997	1,564	333

Source: Rose [1981, Table I-II].

5.2 Skill and Training Levels

Whereas the number of tradespeople employed during the construction phase of Lepreau I is publicly available, the data for other vocations and phases were not available to the authors.[17] Yet, obviously, to design, construct and operate a nuclear power facility requires many highly educated and trained individuals. To overcome this deficiency, we provide Tables B-1 through B-19 in Appendix B which contain estimates by the International Atomic Energy Agency of the number and skill levels of the professionals required to take a generic nuclear power plant from the pre-project stage through commissioning to the operational phase.[18] A quick perusal of these tables suggests that most of the jobs associated with planning, managing, designing, constructing, commissioning and operating a nuclear plant require very high skills. The majority of employees required are engineers who have graduated at the bachelors or masters level and who have supplemented their degrees with substantial experience and other professional training.

[15] The reader should be aware that this table corresponds to the period that was some months prior to peak labour demand. It is utilized in this context because it is the only source of information that the authors could locate that showed the breakdown of in-province *versus* out-of-province workers.

[16] For example, the Environmental Assessment Panel for Lepreau II noted that New Brunswick did not benefit fully from the job creation associated with Lepreau I partly because of
a lack of job training both prior to and during construction. See New Brunswick and Canada [1985:22].

[17] New Brunswick Power did not accede to the authors' requests for interviews with their personnel. And, without access to their library, the authors had to rely on publications already in the public domain.

[18] The skilled labour requirements and qualifications shown in this appendix have been developed for nuclear plants whose productive capacities fall in the 600 to 1300 megawatts range. Both the Lepreau I plant and the originally planned second reactor for Point Lepreau fall in this range.

5.3 Predicted Employment Impacts: Lepreau II CANDU 630

An estimate of the total labour requirement of Lepreau II is 9,944 person-years.[19] This would encompass the labour requirements for site management, construction, pre-commissioning and commissioning. The largest labour demand, 7,800 person-years, occurs during the construction phase. As well, it is expected that more than 90 percent of these jobs would be filled by residents of New Brunswick. This represents a significant improvement over the 85 percent New Brunswick labour content for the construction of Lepreau I. This construction labour requirement would begin in year 2 of the project and peak at 3,500 person-years during year 5.[20]

5.3.1 Construction Trades: Lepreau II

The construction phase of the project would generate approximately 7,800 person-years of on-site work. This consists of approximately 4,900 person-years for construction trades, 900 person-years for contractors' administrative overhead, 1,450 person-years for site management and supervision, and 550 person-years for commissioning.[21] Table 3 shows the principal trades to be hired during the construction phase.[22] Peak demand for most trades occurs during the fourth and fifth years after construction commences. Fifty-nine percent of this construction employment takes place during this peak period. Pipefitters/welders are the trades that are in the largest demand. They represent 1,356 person-years of employment or 30 percent of the construction total. Next in order of size is the demand for 1,164 person-years of labourers who make up another 24 percent of the construction workforce. Electricians and carpenters make up 651 and 584 person-years, respectively.

TABLE 3

Construction Labour Requirements for Lepreau II
Person-years of Employment
(excluding supervisory personnel and staff)

Labour Type	1985	1986	1987	1988	1989	1990	Total
Ironworkers	42	70	70	65	62	28	337
Carpenters	105	117	111	120	93	38	584
Labourers	193	195	202	250	200	124	1,164
Millwrights	-	1	19	62	66	25	173
Boilermakers	-	6	39	42	31	10	128
Insulators	-	2	-	2	20	16	40
Sheetmetal workers	-	6	15	23	22	18	84
Operators	70	67	62	71	52	15	337
Electricians	13	20	65	260	210	83	651
Pipefitters	11	20	40	741	468	76	1,356
Totals	434	504	623	1,636	1,224	433	4,854

Source: Washburn and Gillis Associates [1984. Table 7-1]

Note: Totals from the original table were adjusted because of addition errors.

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[19] Washburn and Gillis [1984:7-32].
[20] New Brunswick Electric Power Commission [1983:ii, 26].
[21] Washburn and Gillis [1984:7-4, 7-5].
[22] Table 3 was constructed under the assumption that planning, design, procurement and regulatory activities would occur in 1984 and that construction would take place between 1985 and 1990.

5.3.2 The Project Office: Lepreau II

As was not the case during the construction phase of Lepreau I, Maritime Nuclear is planning to construct a project office in Fredericton. It would be responsible for the engineering design and procurement activities for both Lepreau II and for any offshore sales of the CANDU 630. This office will result in more of the benefits from the construction project accruing to New Brunswickers. The labour requirements for the project office would average about 400 professionals per year. This level would be maintained for the first four years, then taper off for the rest of the project.

The detailed plans for the Fredericton office are not as precise as those for the rest of Lepreau II. Washburn and Gillis [1984: 7-5] suggest that this office would require 2,100 person-years over a seven-year period. This employment would consist of the following categories:

Professional	35% (engineering)
Technical	35% (drafting)
Managerial	15%
Administrative	15% (secretarial/clerical)

5.3.3 Operational Stage: Lepreau II

According to the information provided to the environmental review panel, the start-up period for Lepreau II was to be the early 1990s. Approximately 220 person-years would be required to operate the plant with an annual wage bill of $9 million (1983). Induced effects increase this to $22.5 million (1983) with the creation of an additional 390 jobs.[23] This represents an increase of 0.34 percent in GDP.

Except for administrative and service maintenance staff, plant personnel would be required to have highly technical backgrounds or to undergo comprehensive training programs.[24] Table 4 displays the breakdown, by job classification, of the 220 person-years of employment required for the operational stage. For each of these job classifications, Tables B-10 to B-15 in Appendix B provide more details of the types of skills required for these positions.

TABLE 4
Operational Labour Requirements - Lepreau II

Labour Type	Number
Engineering	25
Administrative	8
Technical	54
Operators	58
Mechanical Maintenance	32
Service Maintenance	33
Supervisors	8
Health Physics	2
Total	220

Source: Washburn and Gillis Associates [1984: Table 7-2].

[23] To produce spin-off effects of this magnitude, one would need an expenditure multiplier of 2.5. For an economy with a substantial amount of import leakages, this may be an overly optimistic estimate of this multiplier.

[24] Washburn and Gillis [1984:7-7]. For a more detailed listing of the kinds of skills required, the reader is referred to Tables B-10 through B-15 in Appendix B. As well, Ontario Hydro[1988] provides a brief description of the kinds of training programs that are required for a CANDU reactor.

Lepreau II would be operated by New Brunswick Power under contract to Maritime Nuclear who would maintain a corporate office in Fredericton. This corporate office would employ an additional 50 people: 40 percent of which would be administrative, 30 percent technical and 30 percent managerial. Thus, the total labour requirement related to the operation of Lepreau II would be approximately 270 person-years. Based on the Lepreau I experience, approximately 85 percent of these positions would be filled from within New Brunswick.[25]

5.3.4 Summary of Direct and Indirect Employment Impacts: Lepreau II

Table 5 provides a summary of direct labour requirements by function for both the construction and operational phases of a Lepreau II CANDU 630 reactor. For the construction of the plant and project office, there would be approximately 9,950 person-years of employment. As well, there would 270 full-time positions created during the operational phase.

TABLE 5
Lepreau II Direct Employment Impacts

Phase	Person-Years
Construction	
- Trades Labour	4,954
- Contractor's Overhead	879
- Site Management/Supervision	1,445
- Commissioning	555
- Total Construction	7,833
Project Office	2,111
Operations	
- Lepreau II Plant	220
- Administration Office	50
- Total Operations	270

Source: Washburn and Gillis [1984: Table 7-11].

Besides its direct employment impact, the proposed project would create indirect (spin-off) employment. Table 6 considers both the direct job creation and the project's indirect employment effects. During the construction phase, an additional 7,591 person-years of employment will be created within New Brunswick for a total construction phase employment of 17,535 person-years. The corresponding figure during the operational phase is 555 person-years per year: 270 person-years of direct employment and 285 person-years of indirect and induced employment. Some caution should be exercised concerning the level of indirect employment that this project would generate.[26]

TABLE 6

Lepreau II Employment Impacts Summary
Construction and Operational Phases

Employment Type	Construction Phase	Operational Phase
Direct Employment	9,944	270
Indirect Employment	7,591	285
Total Employment	17,535	555

Source. Washburn and Gillis [1984: Table 7-12]

5.4 Predicted Employment Impacts: Lepreau II CANDU 3

An alternative to the CANDU 630 reactor proposed for Lepreau II is the CANDU 3 reactor. Because of its more advanced, modular design, it would have less of an impact on employment than a CANDU 630. Table 7 presents a breakdown of labour requirements for the CANDU 3 design.

[25] Washburn and Gillis [1984:7-8].
[26] The Environmental Assessment Review Panel, New Brunswick and Canada [1985: 22], expressed concern that these predicted indirect impacts might be overly optimistic.

The employment effects of a CANDU 3 project can be further disaggregated. Directly and indirectly, this project would create 5,200 person-years of employment. Most of this will occur during its construction phase. During this phase, approximately 2,500 person-years of employment would be created for tradespeople. Table 8 shows how these person-years would be distributed across job classifications. Comparing this breakdown to that for the CANDU 630 design presented in Table 3, one observes that the distribution of skills is almost identical. The essential difference is that in each category, the total labour requirement is approximately half of that required for the CANDU 630 design.

TABLE 7

Employment Impact of Lepreau II - CANDU 3

Activity	Person-years
Direct Project-Related Activities	
- Engineering	260
- Local Manufacturing	140
- Modular Manufacturing and Construction	2,500
- Management Offices	270
- Commissioning and Training	650
Indirect Project-Related Activities	
- Manufacturers Offsets	1,250
- Simulator	125
Subtotal	5,195
Ongoing Annual Benefits	
- Operations	300
- Engineering	100-200
- Simulator and Training Centre	20-50
- Construction Industry (Modularization)	125-625
- Manufacturing	100-200
- Research and Development	20-50
Subtotal	665-1,425

Source: Atomic Energy of Canada Limited [1989:4].

TABLE 8

Estimated Labour Requirements

Distribution by Trade of 2,500 Person-years of Employment

Trade	Percent
Pipefitters/Welders	30
Labourers	22
Electricians	13
Carpenters	12
Ironworkers	[illegible]
Operators	6
Millwrights	4
Boilermakers	3
Sheetmetal Workers	2
Insulation Workers	1

Source: Atomic Energy of Canada Limited [1989: Table 2.[illegible]].

Construction of a CANDU 3 also would generate employment for very high-skilled personnel such as engineers and other professionals. Table 9 provides a breakdown of the scope of engineering and other consulting services the project would require.

TABLE 9

Breakdown of Engineering Scope and Consulting Services for Lepreau II - CANDU 3

Plant Area	Person-years of Employment
Nuclear Steam Plant (NSP): Engineering	
- Process, C&I and Electrical	35
- Civil	14
- Safety Analysis	20
- Equipment Engineering	17
Subtotal	86
Nuclear Steam Plant (NSP): Procurement	40
Nuclear Steam Plant (NSP): Total	126
Balance of Plant (BOP)	
- Engineering	104
- Procurement	10
Balance of Plant (BOP): Total	114
Total Engineering and Procurement	240
Inaugural Assessment	5
Environmental Assessment	15
Total Engineering, Procurement and Consulting Services	260

Source: Atomic Energy of Canada Limited [1989: Table [illegible]]

6. Business Opportunities

Another way in which a project affects a provincial economy is through its demand for goods and services from businesses within that province. As little information exists on the types and/or amounts of goods and services demanded by Lepreau I, the following discussion draws heavily on information available concerning the projected demands of Lepreau II.

Expenditures within New Brunswick accounted for almost 50 percent of the material and labour costs of Lepreau I.[27] Part of this expenditure went to local manufacturing and fabrication activities while some went to purchase locally produced cement.[28] As explained above, Lepreau I accounted for almost 17 percent of construction activity in New Brunswick during its peak. For Lepreau II, it is estimated that the total New Brunswick content would increase from the 29 percent level reached for Lepreau I to 75 percent. This is an increase of $30.4 million (1983). Moreover, the New Brunswick content in manufacturing would increase from 10 percent to 21 percent, an increase over Lepreau I of $8.2 million (1983).[30]

Table 10 illustrates the kinds of goods and services that would be purchased within New Brunswick. There are approximately $210 million of non-labour expenditures planned for New Brunswick over a five-year period. Office supplies and engineering services are the biggest categories. The kinds of goods that would be required for Lepreau II are: aggregate, concrete, structural steel, prefabricated building materials, metal pipes and fittings. As well, New Brunswick Power highlighted some possibilities for increasing provincial content. For example, provincial content could be enhanced further by fabricating ends for pressure tubes, bending boiler tubes, providing heat treatments of boiler tubes and assembling heating tanks in-province. They noted that the establishment of a pipe fabrication shop would generate 83 person-years of employment for four years and would generate a payroll of $2.8 million (1983) per year.

TABLE 10

Lepreau II Estimated Project Expenditures - New Brunswick
($ 000)

Type	1985	1986	1987	1988	1989
Prefabricated structures	70	570	360	360	0
Structural & fabricated steel	5,880	10,750	5,880	0	0
Pipes, siding and sheet metal	0	660	660	0	0
Concrete	2,070	2,760	2,760	0	0
Other engineering services	15,060	15,060	15,060	15,060	15,060
Office supplies	17,978	17,978	17,978	23,018	23,018
Subtotal	41,058	47,778	42,698	38,576	38,078
Wages & salaries	84,580	84,580	84,580	104,800	104,800
Supplementary labour income	11,540	11,540	11,540	11,540	11,540
Operating surplus	3,120	3,120	3,120	3,120	3,120
Total	140,298	147,018	141,938	157,598	157,538

Source: Washburn and Gillis [1984: Table 7-14].

[27] Of course, expenditure within a province does not equate to income benefits to residents of that province. This results from the facts that some of the goods and services purchased will have substantial import components and some domestically sourced inputs would have been diverted from alternative uses.

[28] New Brunswick Electric Power Commission [1983: ii].

[29] Based on the experience gained from the construction of Lepreau I, New Brunswick Power estimated that the portion of commodities such as piping and tubing, structural steel, electric panels, electric motor control centres, embedded parts, anchor bolts and base plates fabricated in New Brunswick, and activities such as machining of shielding steel, tanks, vessels and heat exchangers performed in New Brunswick, could be doubled for construction of Lepreau II. See New Brunswick Power Commission [1983:23]

[30] New Brunswick Electric Power Commission [1983:ii].

During the operational phase, $64 million (1983) worth of materials and services would be purchased annually. In addition, the operation of the Lepreau II facility would require an initial fuel loading of 4,560 bundles and then 16 bundles per operating day. Therefore, there would be a demand for approximately 11,000 fuel bundles that would cost $20.9 million (1983).[31] This would create additional business opportunities for Combustion Engineering Superheater Limited of Moncton. To meet this additional demand, this firm would need to expand the size of their workforce from 125 to approximately 200 people. There would also be an increase in this firm's consumption of local goods and services of approximately $0.5 million (1983).[32]

[31] New Brunswick Electric Power Commission [1983:36].
[32] New Brunswick Electric Power Commission [1983:33].

7. Income Effects

The total direct wages, salaries and supplementary income estimated to accrue to New Brunswick residents from Lepreau II would be approximately $521 million. An additional $12 million would go to domestic residents during each year of the operational phase. Table 10 illustrates the time profile of construction income. The New Brunswick Electric Power Commission [1983:28] provides a slightly different estimate. They suggest that the total wage bill associated with the New Brunswick work force would be $62.5 million over the six-year period. This level of remuneration corresponds to approximately 2 percent of the wages earned in New Brunswick in 1982. The Fredericton office would employ an average of 400 professionals per year with an annual wage bill of $20 million.[33]

The construction phase effects on GDP are shown in Table 11. Over the period 1985 to 1989, New Brunswick's GDP at factor cost would increase by $810 million. This would have the effect of causing GDP to be between 2 and 3 percent higher than it would have been without the project.[34] During the operational phase the GDP impact would be $171 million.[35]

TABLE 11

Direct and Multiplier GDP at Factor Cost Construction Phase: (Millions of 1983 dollars)

Year	Direct	Multiplier	Total
1985	99	53	152
1986	99	58	157
1987	99	54	153
1988	119	54	174
1989	119	54	174
Total	535	273	810

Source: Washburn and Gillis [1984: Table 7-8]

Construction of Lepreau I placed a strain on local labour markets. Gardner [1985:64] noted that hourly rates at the construction site were between 25 and 30 percent higher than at the Saint John Shipbuilding yard.[36] Table 12 illustrates some wage differentials for the Lepreau project over and above those that prevailed in Saint John.

TABLE 12

Examples of Wage Premiums at Lepreau I

Classification	Year	Hourly Wage Premium
Painters	1976	$0.03
Painters	1978	$0.05
Sheetmetal Foremen	1978	$0.15
Sheetmetal Lead-Hands	1978	$0.20
Bricklayer Foremen	1976	$0.25
Electrician Foremen	1976	$0.50

Source: Rose [1981:212].

[33] New Brunswick Electric Power Commission [1983:ii].
[34] The New Brunswick Electric Power Commission [1983:29] indicates that construction activity would increase GDP by 0.29 percent in the first year to 4.39 percent in the final year.
[35] Washburn and Gillis [1984:7-27].
[36] This point was also made by Rose [1981:216]

8. Local Impacts

Any large project has the potential to affect, positively and negatively, communities adjacent to its construction site. For example, the influx of workers and work-seekers into the area can increase dramatically demands on local communities to provide police protection, schooling, health services, recreational facilities and other local services. Of course, the new economic opportunities that arise also have potentially positive effects on the affected communities.

A survey of local governments affected by the Point Lepreau project indicated that the strain put on government services by the construction of Lepreau I was not significant.[37] Also, it appears that this project had the effect of increasing the utilization rate of some area schools and may have prevented their closing.

This small negative impact on local government services may be due to the fact that less than 1 percent of the total workforce chose to live in the immediate area. Most workers lived in Saint John and commuted daily to the job site.[38] According to Rose [1981:172], the majority chose to do this because of the generous room, board and travel allowances paid by the project.

On the plus side, the construction of the Point Lepreau power plant stimulated the establishment of new commercial ventures in the surrounding area: service stations, restaurants and convenience stores opened.[39] As well, some long-time residents of the impact area gained economically by billeting the part of the workforce that chose to stay in the immediate area. Finally, as a result of the increased spending power of the construction workers, commercial operations throughout New Brunswick benefitted, with those in Saint John benefitting the most.

Near the construction site, housing prices did not increase dramatically. Yet, during the construction period, the growth in housing prices in Saint John was about three times higher than one would have expected to observe. Also, as the construction activity at the Lepreau I site declined, so did the growth rate of housing prices. That is, there was a close correlation between the level of construction activity at Lepreau I and the price of housing in Saint John.[40] Besides its impact on housing prices, the Point Lepreau project was directly or indirectly responsible for the construction of some 2,000 dwellings.[41] Washburn and Gillis [1984:7-54] suggested that should Lepreau II proceed as planned, there would be an inflationary impact on housing prices. The exact magnitude of this anticipated effect was not forecast. In addition, some 1,000 new housing units would be required in the Saint John area and 400 more in Fredericton should this project proceed.[42]

[37] Washburn and Gillis [1984:7-38, 7-48] determined this through discussions with local government authorities in the impact area. They concluded that "government services such as police and fire protection, hospitals, medical clinics and social services were not unduly strained."

[38] Washburn and Gillis [1984:7-40].

[39] Washburn and Gillis [1984:7-38].

[40] Washburn and Gillis [1984:7-54] report this correlation. They attributed the increase in housing prices to Lepreau I, but suggested that part of the decline in housing prices after its construction was due to a downturn in general economic activity and high interest rates.

[41] Washburn and Gillis [1984:7-39].

[42] New Brunswick Electric Power Commission [1983:ii].

9. Taxes

The construction of Lepreau II would generate $8.25 million in income taxes annually. Because of the additional spending it would cause, the province would collect an extra $3.6 million per year in retail sales taxes. Property taxes in Saint John and Fredericton were projected to increase by $0.8 million.[43] During the operational phase, income tax revenue would rise by $1.1 million, retail sales tax revenue by $0.56 million and New Brunswick Power's property taxes by almost $2 million. While these effects are not large, they are nonetheless significant.

[43] New Brunswick Electric Power Commission [1983:29-30].

10. Other Effects

10.1 Technology Transfer

The construction of a large project utilizing state-of-the-art techniques and technology provides opportunities for the transfer of skills to the local workforce and to local businesses. These new skills can then be used to create other non-project business opportunities. This is the so-called benefit of 'technology transfer'.

The Point Lepreau nuclear power plant is credited with the transfer of technology to New Brunswick businesses. For example, due to its work on Lepreau I, the Research and Productivity Council increased its staff by thirty and was able to market worldwide the skills, experience and expertise its employees acquired from working on that project.[44] It successfully competed for work in the pulp and paper industry, in offshore oil and gas exploration and in the construction of a CANDU reactor in Korea. Washburn and Gillis [1984:7-45] argue that the construction of Lepreau I made the development of these capabilities possible.

In addition, the development of Lepreau I was a direct stimulus to the establishment of Combustion Engineering Superheater Limited in Moncton. This company employs approximately 130 employees and supplies fuel bundles to Point Lepreau, Ontario Hydro and to CANDU reactors overseas.[45]

While these two examples of technology transfer are obviously beneficial, the Environmental Assessment Panel [1985:4] suggested that the stimulative effect of Lepreau I on the general development of high technology in New Brunswick was minor. Thus, technology transfer is possible from this type of project, but its potential benefits should not be overstated.

10.2 Exports

Table A-3 in Appendix A shows how exports of electricity from New Brunswick changed over the period 1970 to 1991. One can see thatafter 1983, when production began at Lepreau I, electricity exports increased dramatically. An immediate increase in excess of 2 million megawatt-hours occurred - more than a 70 percent increase - that continued to grow to a peak in 1986 of more than 7 million megawatt-hours. Table 13 shows some companies to which New Brunswick exported electricity in 1991. These sales accounted for over $115 million in export revenues and almost 2,500 gigawatt-hours of power.

[44] See New Brunswick Electric Power Commission [1983:8]. The Research and Productivity Council was involved in the rebuilding of the steam generator. It was through this activity that the Council developed capabilities in zirconium metallurgy, non-destructive testing techniques and plant commissioning work.

[45] New Brunswick Electric Power Commission [1983:8].

It has been estimated that the export of $1 million (1980 dollars) worth of electricity results in $750,000 direct, indirect and induced income in New Brunswick and 13 person-years of employment.[46] Hence, the level of exports afforded by Lepreau I has obviously been beneficial to the provincial economy.

TABLE 13

Examples of New Brunswick Power Exports to the United States

Importer	Revenue ($-Millions)	Quantity (Gwh)
Maine Public Service Co	3.3	128
Eastern Maine Electric Cooperative Inc.	4.5	63
Maine Electric Power Co.	12.5	372
Central Maine Power Co.	2.6	140
Bangor Hydro-Electric Co (Maine)	3.4	129
Massachusetts Municipal Wholesale Electric Company	39.6	772
Boston Edison Co (Massachusetts)	39.9	704
Commonwealth Electric Co. (Massachusetts)	10.0	176

Source: Canada: Energy, Mines and Resources [1992: Table A6].

10.3 Electricity Rates

Although our terms of reference preclude an examination of the specific economics of the Point Lepreau nuclear power plant, it is informative to examine how electricity rates in New Brunswick have evolved relative to rates in other Canadian jurisdictions. Tables C-1, C-2 and C-3 in Appendix C present data on Canada-wide residential, commercial and industrial electricity rates, respectively. Figure C-1 in the same appendix compares residential electricity rates in New Brunswick to Canada-wide average rates. Before Lepreau I came on stream, the New Brunswick residential rate was higher than the Canada-wide average rate and was growing at almost the same pace. Within two years of Lepreau I coming on line, residential electricity rates stabilized in New Brunswick while the Canada-wide average rate continued to increase. By 1990, Canada-wide average and New Brunswick residential rates were approximately equal.

Figure C-2 in Appendix C compares residential electricity rates for New Brunswick, Nova Scotia and Saskatchewan. Prior to Lepreau I, the rates in all three provinces had similar growth patterns. After production began at Lepreau I, New Brunswick's rates levelled off while rates in Saskatchewan and Nova Scotia did not.

New Brunswick's commercial electricity rates and the Canada-wide average rate are compared in Figure C-3 of Appendix C. A pattern similar to the residential rates exists. Until Lepreau I came on stream, commercial electricity prices exhibit similar growth rates. After that period, New Brunswick's commercial rate stabilized but the Canada-wide average rate continued to increase. After 1990, the New Brunswick rate and the Canada-wide average rate grew at approximately the same pace.

[46] New Brunswick Electric Power Commission [1983:9].

Turning to Figure C-4, one observes that a similar pattern emerges when New Brunswick's experience with commercial rates is compared with those of Nova Scotia and Saskatchewan. The pre-Lepreau I rates grew at about the same pace. After Lepreau I, the New Brunswick rate levelled off while the others did not. By 1990, the rate of growth of these three commercial rates converged.

The pattern observed for residential and commercial rates was, as shown in Figures C-5 and C-6, repeated for industrial rates. The only difference is that after 1988, Saskatchewan's industrial rate tends to flatten out.

Based on this casual empiricism, it would appear that the Lepreau plant has had a moderating effect on the price of electricity in New Brunswick. Even if one were to accept this conclusion at face value, this does not imply that the Lepreau option was necessarily the most economic. The answer to that question is beyond the scope of this study.

11. Problems

Construction of Lepreau I was subject to cost overruns and scheduling delays. The New Brunswick Electric Power Commission [1983:2] suggested that these were due to construction delays and to unpredictably high interest and inflation rates. The construction delays resulted from a manufacturing defect in the steam generators that required modifications to be undertaken on-site. They also noted that manufacturing delays combined with labour management problems and overly optimistic time schedules all contributed to the failure of the project to be completed on time and on budget.

There was also labour strife. Tables 14 and 15, respectively, show the number of days lost due to illegal and legal work stoppages. These work stoppages, according to Rose [1981:229], resulted in a loss of 8 percent of working time. The Lepreau II Environmental Assessment Panel noted the frustration of local tradespeople concerning the hiring of senior union members from outside New Brunswick to work on Lepreau I. A concern of the panel was that problems similar to those experienced at Lepreau I might resurface with Lepreau II.

TABLE 14

Illegal Work Stoppages: Lepreau I

Year	Number of Disputes	Workers Involved	Person-Days Lost
1975	16	1,977	1,562
1976	21	4,426	18,000
1977	20	2,397	2,875
1978	22	3,515	3,438
1979	10	1,288	1,166
1980	14	7,234	6,226
Total	103	20,837	33,267

Source: Rose [1981 Table V-III]

TABLE 15

Legal Work Stoppages, Lepreau I

Year	Number of Disputes	Workers Involved	Person-Days Lost
1978	2	2,642	54,938
1976	1	1,330	3,864
Total	3	3,972	58,802

Source: Rose [1981, Table V-III]

Gardner [1985:27], in his discussion of the problems that led to cost overruns and scheduling delays, was highly critical of several aspects of the project. He suggested that poor planning and scheduling were fundamental problems of this project. Gardner indicated that detailed drawings were "often nonexistent, inaccurate or incomplete," and felt that the government's impatience to proceed with the project may explain this part of the problem.[47] He went on to point out that construction contracts were of a 'cost plus' and a 'cost reimbursable' type. This, in his opinion, contributed to the cost overruns. Finally, Gardner was critical of the project management from the perspective of labour relations. Although special agreements were in place with the various construction trade unions, it would appear that there was little effort devoted to planning the allocation of work among unions before construction began. For such projects, Gardner recommended that the proponent complete detailed engineering work before construction starts. As well, he emphasized the need to ensure good management of labour relations.[48]

The Lepreau II Environmental Assessment Panel also heard complaints regarding the limited role of local firms in the construction of Lepreau I. The concern was that New Brunswick Power's approach to contracting out for services did not provide sufficient stimulus or opportunity for private firms in New Brunswick to upgrade their capabilities so that they might more successfully compete to supply such services to Lepreau II should it proceed.[49]

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[47] Gardner [1985:61]
[48] Gardner [1985:27].
[49] Environmental Assessment Panel, New Brunswick and Canada [1985:23].

12. Conclusion

This report has examined the impacts that Lepreau I had on the New Brunswick economy. The employment effects, during both the development and production phases of the project, were impressive. It has been estimated that 85 percent of the 11,000 person-years of pre-production jobs associated with Lepreau I were filled from within New Brunswick. And, to operate the plant, another 300 full-time, highly skilled employees were needed. As substantial as these employment effects have been, they would be almost doubled should a second (CANDU 630) reactor at Lepreau be installed.

In addition to employment impacts, it is clear that, through the provision of goods and services for the construction and operation of the plant, New Brunswick businesses benefitted. A clear indication of the size of this benefit is that, during its peak, the activities associated with Lepreau I accounted for 17 percent of provincial construction expenditures. This point is reinforced by the fact that over the construction period, New Brunswick's GDP was two to three percent higher than it would have been had the project not been built. Again, should the second phase proceed, the business sector, because of its experience on Lepreau I, stands to provide an even greater share of the goods and services required by the project. Finally, the business opportunities of some firms were expanded because of the transfer of technology that resulted from Lepreau I.

Lepreau I's influences were also felt in indirect ways. For example, all three levels of government received increased tax revenues. As well, the project did not appear to place undue strain on provincial and local government services. In addition, electricity prices after Lepreau appeared to be more stable than those same prices before Lepreau. The effects of the project were also felt in the housing market through elevated prices and higher housing starts.

Can New Brunswick's experience with Lepreau I yield meaningful lessons for Saskatchewan should that province consider construction of a nuclear power facility? Keeping in mind that the construction of Lepreau I was plagued by labour-management problems, cost overruns and significant project delays, we now turn to this issue.

The first lesson is that because a number of the problems related to Lepreau were due to incomplete engineering plans and designs, detailed plans and drawings must be complete before proceeding with the project. While this seems like an obvious suggestion, inadequacies in these areas did create problems for the Lepreau project.

The second lesson for Saskatchewan pertains to how to minimize the labour problems that resulted from the labour-management style adopted at Lepreau. These problems must be anticipated and how to mitigate them planned before the project begins. A cooperative approach between labour and management would be useful in this regard. This would require that the detailed allocation of work among the various trades be negotiated prior to the start of the project. As well, provincial union personnel ought to be given preference for jobs if they have the required skills and experience. This would avoid some of the problems caused at Lepreau by the hiring of senior union people from outside the province.

A third lesson relates to cost overruns and scheduling delays. Based on the experience at Lepreau, the schedule of project milestones should be realistic and contingency plans should be made. As well, 'cost plus' and 'cost reimbursable' contracts have been ascribed part of the blame for Lepreau I's cost overruns. Hence, if possible, these kinds of contracts should be avoided.

A fourth lesson is that to increase the likelihood of maximizing the benefits accruing to provincial businesses and labour, the project's proponent ought to provide to the public as much project detail as is feasible in a timely manner. This would involve a description of the skills and experience levels needed to work on the project. As well, anticipated shortfalls in specific trades ought to be determined as soon as possible in advance of the project so that training can be undertaken to mitigate these shortfalls and to increase local participation. This would have the additional impact of reducing the disruption caused in local labour markets as people with key skills would otherwise be bid away from other industries.

Also, in order to ensure that provincial firms capture a reasonable share of the business generated by the project, the proponent should provide, as early as is feasible, a detailed list of the types of goods and services required. This should include the amounts of each good and service needed, the minimum quality standards that would have to be met and the schedule for when these goods and services would be required. If possible, procurement and design ought to be undertaken within the province. Also, in-province suppliers may be unable to fill excessively large orders for inputs. Therefore, where feasible, job lots (packages) ought to be small enough so that local businesses have a reasonable chance of bidding on them successfully.

Although Saskatchewan and New Brunswick are similar in terms of generating capacity, production, consumption and population, and would be even more similar should Saskatchewan construct a nuclear power facility, these similarities in themselves do not hold any particular lesson other than Saskatchewan might reasonably expect to experience post-construction impacts similar to those experienced by New Brunswick especially in the areas of electricity rates and exports. The more important lessons for Saskatchewan arise from the pre-project and construction phases of Lepreau I. Mistakes were made that led to cost overruns, delays and less in-province involvement in the project than was possible. We have identified the factors which contributed to these negative aspects so that they might be avoided. The major lesson for Saskatchewan is, therefore, to learn from Lepreau I's mistakes.

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APPENDIX A

ELECTRICAL POWER GENERATION CAPACITY, PRODUCTION AND CONSUMPTION

New Brunswick — Saskatchewan

Appendix A consists of Tables A-1 through A-4. The source of all data shown in this appendix is "Electric power statistics," Statistics Canada, Annual Statistics: Catalogue 57-202 for the years shown.

Table A-1 shows a comparison of New Brunswick and Saskatchewan on the basis of installed generating capacity for producing electrical energy from both hydro-electric and thermal sources for the years 1978-1991.

Table A-2 shows actual production of electricity from these same sources for the same time period.

Tables A-3 and A-4, respectively, show for New Brunswick and Saskatchewan how electrical energy production and consumption balance for the years 1970 to 1991 when inter-provincial and international electricity flows are taken into account.

TABLE A-1

Installed Generating Capacity (Kilowatts)

New Brunswick - Saskatchewan
1978 - 1991

End of Year	Hydro Capacity NB	Hydro Capacity SASK	Thermal Capacity NB	Thermal Capacity SASK	Total Installed Capacity NB	Total Installed Capacity SASK
1978	679,875	566,880	1,707,563	1,513,882	2,387,438	2,080,762
1979	793,250	577,140	1,891,840	1,455,482	2,685,090	2,032,622
1980	900,930	578,740	1,893,840	1,761,412	2,794,770	2,340,152
1981	900,930	575,500	1,890,840	1,780,987	2,791,770	2,356,487
1982	900,630	575,500	2,568,090	1,746,162	3,468,720	2,321,662
1983	901,030	575,500	2,584,290	2,032,432	3,485,320	2,607,932
1984	903,030	575,500	2,576,290	2,082,782	3,479,320	2,658,282
1985	903,030	575,500	2,576,290	2,118,332	3,479,320	2,693,832
1986	903,030	830,500	2,587,790	2,118,282	3,490,820	2,948,782
1987	903,030	832,560	2,587,790	2,013,282	3,490,820	2,845,842
1988	903,303	835,860	2,587,790	2,010,557	3,490,820	2,846,417
1989	903,303	835,860	2,615,290	2,010,557	3,518,320	2,846,417
1990	903,030	835,860	2,639,690	2,010,307	3,542,720	2,846,167
1991	903,030	835,860	3,133,690	2,007,657	4,036,720	2,843,517

TABLE A-2

Generation of Electric Energy (Megawatt-hours)

New Brunswick - Saskatchewan
1978 - 1991

Year	Hydro Generation NB	Hydro Generation SASK	Thermal Generation NB	Thermal Generation SASK	Total Generation NB	Total Generation SASK
1978	2,049,561	2,546,035	5,785,182	6,315,557	7,834,743	8,861,592
1979	3,136,313	2,415,003	6,081,785	6,703,364	9,218,098	9,118,367
1980	2,689,623	2,548,752	6,633,648	6,654,798	9,323,271	9,203,550
1981	3,865,584	3,102,246	5,128,600	6,580,557	8,994,184	9,682,803
1982	2,644,555	2,359,988	5,790,019	7,485,972	8,434,594	9,845,960
1983	3,132,229	2,210,061	8,525,152	8,179,067	11,657,381	10,389,128
1984	3,121,271	1,705,218	9,274,680	9,837,514	12,395,951	11,542,732
1985	2,286,258	1,940,656	9,114,376	9,897,343	11,400,634	11,837,999
1986	3,184,357	3,767,036	9,038,055	8,132,627	12,222,412	11,899,663
1987	2,245,576	3,188,872	10,387,748	9,267,299	12,633,324	12,456,171
1988	2,614,784	2,343,328	13,316,772	10,615,969	15,931,556	12,959,297
1989	2,388,978	2,838,568	15,155,041	10,687,837	17,544,019	13,526,405
1990	3,532,364	4,214,995	13,219,088	9,326,408	16,751,452	13,541,403
1991	3,002,801	4,213,745	12,804,671	9,384,506	15,807,472	13,598,251

TABLE A-3

Sources and Consumption of Electrical Energy (Megawatt-hours)

New Brunswick
1970 - 1991

Year	Production	Exports (-)	Imports (+)	Provincial transfers (+)	Consumption (=)
1970	5,141,823	756,822	44,578	-208,225	4,221,354
1971	5,679,695	1,334,716	145,489	127,259	4,617,727
1972	6,269,612	1,884,775	171,112	923,764	5,479,713
1973	6,270,928	2,846,983	56,002	2,328,489	5,808,436
1974	5,570,820	2,496,567	53,279	3,260,817	6,444,489
1975	4,677,380	1,623,770	87,368	3,571,880	6,712,858
1976	6,633,149	2,468,127	100,919	3,382,180	7,648,121
1977	8,180,430	3,542,160	14,318	3,279,953	7,932,541
1978	7,834,743	2,549,523	47,438	3,052,504	8,385,162
1979	9,218,098	3,889,578	23,608	2,883,430	8,235,558
1980	9,323,271	3,876,902	54,483	3,337,540	8,838,392
1981	8,994,184	3,246,148	53,541	3,044,742	8,846,319
1982	8,434,594	3,029,064	70,910	3,052,885	8,529,325
1983	11,657,381	5,266,171	24,527	2,833,608	9,249,345
1984	12,395,951	5,657,290	16,855	3,759,563	10,515,079
1985	11,400,634	6,493,286	412,307	5,194,589	10,514,244
1986	12,222,412	7,007,554	423,710	5,916,290	11,554,858
1987	12,633,324	6,139,665	266,085	5,278,826	12,038,570
1988	15,931,556	5,216,880	215,923	1,767,077	12,697,676
1989	17,544,019	4,640,053	263,502	282,937	13,450,405
1990	16,751,452	4,276,561	161,570	621,546	13,258,007
1991	15,807,472	3,091,699	78,857	903,884	13,698,514

TABLE A-4

Sources and Consumption of Electrical Energy (Megawatt-hours)

Saskatchewan
1970 - 1991

Year	Production	Exports (-)	Imports (+)	Provincial transfers (+)	Consumption (=)
1970	6,011,379	0	765	-610,064	5,402,080
1971	6,075,368	0	0	-389,754	5,685,614
1972	6,746,641	0	0	-424,881	6,321,760
1973	7,437,834	0	0	-372,352	7,065,482
1974	7,388,075	0	0	-89,792	7,298,283
1975	7,089,581	0	0	97,462	7,187,043
1976	7,534,213	0	0	-36,525	7,497,688
1977	8,418,255	0	0	-207,609	8,210,646
1978	8,861,592	0	0	-38,090	8,823,502
1979	9,118,367	0	0	473,551	9,591,918
1980	9,203,550	0	0	623,744	9,827,294
1981	9,682,803	0	0	248,220	9,931,023
1982	9,845,960	59,600	30,700	418,976	10,236,036
1983	10,389,128	81,200	84,300	399,163	10,791,391
1984	11,542,732	85,900	66,300	291,526	11,814,658
1985	11,837,999	163,000	93,200	281,263	12,049,462
1986	11,899,663	150,928	63,734	134,869	11,947,338
1987	12,456,171	113,235	84,127	42,902	12,469,965
1988	12,959,297	56,997	315,132	260,771	13,478,203
1989	13,526,405	74,943	142,184	31,451	13,625,097
1990	13,541,403	121,834	106,651	98,356	13,624,576
1991	13,598,251	139,130	120,099	268,277	13,847,497

APPENDIX B

LABOUR REQUIREMENTS AND QUALIFICATIONS

Tables B-1 through B-19 below show skilled labour requirements and qualifications in a variety of activity categories for a nuclear power facility in the range of 600 to 1300MW. They are meant as guidelines only and the source of the material presented in these tables is: *Manpower Development for Nuclear Power: A Guidebook* by the International Atomic Energy Agency (Vienna: 1980).

In addition to the educational and training levels listed, many positions require additional training such as a basic course in nuclear power, nuclear safety and/or nuclear power plant technology depending on the specific job description. For these course requirements, more precise educational requirements and recommended experience levels, please see Chapter 1 of the IAEA document.

The following university degree codes have been used throughout.

University Degree Codes	
BAE	Bachelor of Arts in Economics
BAJ	Bachelor of Arts in Journalism
BBA	Bachelor of Business Administration (Commerce)
BCS	Bachelor of Computer Science
BSC	Bachelor of Science
BEng	Bachelor of Engineering
BLS	Bachelor of Library Science
LLB	Bachelor of Law
MAE	Master of Arts in Economics
MBA	Master of Business Administration
MEng	Master of Engineering
MSC	Master of Science
PhD	Doctor of Philosophy

TABLE B-1

Pre-Project Activities

Title/Group	Number	Education/Training
Manager	1	MEng (power plant engineering)
Nuclear power programme planning	5-10	4-8 BEng (large projects) 1-2 BAE (project evaluation)
Power system planning	4-7	2-3 BEng (electric power) 1-2 BAE (energy economics) 1-2 BCS (programming)
Feasibility studies	10-15	7-12 BEng (interdisciplinary experience) 2 BAE (nuclear power) 1 LLB (general)
Site survey (criteria for selection)	5-7	BSC, BEng (geology, seismology ecology, hydrology)
Site qualification (site selection)	12-15	BSC, BEng (as for site survey)
Total	37-55	MEng 1 BEng 13-23 BAE 4-6 LLB 1 BCS 1-2 BSC, BEng 17-22

TABLE B-2

Project Management (utility)

Title/Group	Number	Education/Training
Project manager	1	MEng (nuclear power technology)
Deputy project manager	1	MEng (nuclear power technology)
Legal advisor	1	LLB (contracts)
Planning & scheduling	4-6	BEng (project experience)
Engineering manager	1	MEng (nuclear plant design)
Engineering supervisors: Nuclear engineering Mechanical engineering Electrical engineering Control & instrumentation Civil engineering Fuel management Site	7	 BEng (or BSC nuclear physics) BEng (mechanical) BEng (electrical) BEng (electronics) BEng (civil) BEng (mechanical or metallurgical) BEng (civil)
Engineering staff	15-20	BEng (mechanical, electrical, civil, metallurgical, physics)
Technician staff	5-7	Draftsmen
Safety & licensing	4-6	1 MEng (nuclear) 3-5 BEng (nuclear physics/chemistry)
Quality assurance	4-5	1 MEng (mechanical engineering) 3-4 BEng (mechanical, electrical, civil)
Training & personnel management	3-4	1 MEng (teaching experience) 2-3 BEng (education courses)
Finance & commercial	7-10	1 MBA (or MAE) 3-5 BAE (or business, engineering) 3-4 Accountants
Administration & public relations	3-5	1 BBA (experience) 1-2 BEng (technical advisors) 1-2 BAJ

Total	56-74	MEng 6 BEng 35-47 LLB 1 MBA 1 BAE 3-5 BBA 1 BAJ 1-2 Accountants 3-4 Draftsmen 5-7

TABLE B-3

Project Management (main contractor)

Title/Group	Number	Education/Training
Project manager	1	MEng (mechanical, electrical or nuclear)
Planning & scheduling	1	BEng (large projects)
Group supervisors of engineering staff (below)	5-7	4-6 MEng (see groups below) 1 BBA (commercial group)
Nuclear group	3-4	BEng (nuclear, mechanical, electronics)
Conventional group	7-9	BEng (civil, mechanical, chemical)
Electrical, instrumentation & control group	4-5	BEng (electrical, electronics)
Licensing group	4-6	BEng (nuclear, mechanical, civil,, electrical)
Commercial group	5-7	2-3 BBA or BAE (management) 3-4 Accountants
Total	30-40	MEng 5-7 BEng 19-25 BBA, BAE 3-4 Accountants 3-4

TABLE B-4

Project Engineering

Title/Group	Number	Education/Training
Project engineering manager	1	MEng (mechanical, electrical or nuclear)
Deputy manager	1	MEng (nuclear, mechanical, electrical)
Group supervisors	10-15	BEng (see groups below)
Nuclear engineering area	90-120	70-90 BEng (assorted specialties) 20-30 Technicians (draftsmen, computing)
Civil engineering area	90-130	40-60 BEng (civil engineering) 50-70 Technicians (draftsmen, computing)
Mechanical engineering area	50-65	20-25 BEng (mechanical engineering) 30-40 Technicians (draftsmen, mechanical design)
Electrical engineering area	45-50	15-20 BEng (electrical engineering) 20-30 Technicians, Draftsmen, Electricians
Control & instrumentation engineering area	23-35	13-15 BEng (electronics, computers, electrical) 10-20 Technicians (electronics, computers, draftsmen)
Other engineering areas	10-13	BEng (chemistry, physics, codes & standards, quality control & cost control)
Total	310-430	MEng 2 BEng 178-238 Technicians 130-190

TABLE B-5

Procurement

Title/Group	Number	Education/Training
Procurement manager	1	MEng (or MBA or LLB)
Commercial assistant	1-2	MBA (cost control, accounting)
Markets & co-ordination	4-6	1 MEng 3-5 BEng or BBA
Bidding & contracting	9-13	4-6 MEng, MBA or LLB 5-7 Bookkeepers
Monitoring	4-6	1 BEng (inspection) 3-5 Technicians
Expediting	6-12	3-6 BEng 3-6 BBA
Total	25-40	MEng 1 MBA 1-2 MEng, MBA or LLB 5-7 BEng 4-7 BEng or BBA 3-5 BBA 3-6 Bookkeepers 5-7 Technicians 3-5

TABLE B-6

Quality Assurance (QA) - Quality Control (QC)
Utility Activity

Title/Group	Number	Education/Training
Manager	1	MEng (QA/QC experience)
Headquarters staff	5-10	BEng (QA course)
Auditors	6-12	BEng (QA course, some certified)
On-site auditors	5-7	BEng (QA course; some certified)
QA documentation personnel	5-7	Technicians (QA course)
QC laboratory technicians	5-7	Technicians (certified)
Total	27-44	MEng 1 BEng 16-29 QA technicians 5-7 QC technicians 5-7

TABLE B-7

Quality Assurance (QA) - Quality Control (QC)
Project Activity

Title/Group	Number	Education/Training
Headquarters staff	5-7	BEng (QA course)
Site QA/QC technicians	6-10	Technicians
Power system supplier's site QA/QC	5-9	1-3 BEng (QA/QC, NDE) 4-6 Technicians (QA/QC, NDE)
Other suppliers' and contractors QA/QC	37-50	7-10 BEng (QA/QC, NDE) 30-40 Technicians (QC, NDE)
Total	53-76	BEng 13-20 Technicians 40-56

TABLE B-8

Plant Construction

Title/Group	Number	Education/Training
Site manager	1	MEng (civil or mechanical)
Deputy site manager	1	BEng (civil or mechanical)
Superintendents (managers)	5-8	BEng (civil, mechanical, electrical)
Supervisors (chief engineers)	20-25	BEng (mechanical, civil, electrical, electronics)
Supervisors (commercial & administration)	3-5	BBA (administration, accounting)
Professional staff	40-60	BEng (mechanical, civil, electrical)
Technicians	280-400	100-150 Mechanical 70-100 Electrical 60-80 Construction 30-40 Instrumentation 20-30 Miscellaneous
Craftsmen	2000-2700	Skilled construction workers
Total	2350-3200	MEng 1 BEng 66-94 BBA 3-5 Technicians 280-400 Craftsmen 2000-2700

TABLE B-9

Commissioning

Title/Group	Number	Education/Training
Commissioning superintendent	1	MEng (mechanical)
Supervisors	7-9	BEng (mechanical, electrical, nuclear, chemical)
Professional staff	30-40	27-37 BEng (mechanical, electrical, nuclear, electronics, chemical, civil) 3 BSC (physics, chemistry, metallurgy)
Technicians	40-60	10-15 Nuclear 10-15 Mechanical 10-15 Electrical 10-15 Instrumentation & control
Craftsmen	80-120	15-25 Nuclear 20-30 Mechanical 15-25 Electrical 15-20 Instrumentation 15-20 Miscellaneous
Total	158-230	MEng 1 BEng 34-46 BSC 3 Technicians 40-60 Craftsmen 80-120

Appendix B - 10

TABLE B-10

Operation and Maintenance
Operation Division

Title/Group	Number	Education/Training
Plant superintendent	1	MEng (power plant operations)
Plant deputy superintendent	1	MEng (as above)
Operation superintendent	1	MEng (as above)
Shift supervisors	5-6	BEng (mechanical, electrical)
Deputy shift supervisors	5-6	BEng (as above)
Senior control room operators	10-18	Technicians (electrical, mechanical)
Control room operators	10-18	Technicians (as above)
Assistant operators	5-12	Technicians (operators' training)
Field operators	15-24	Technicians (mechanical, electrical)
Total	53-87	MEng 3 BEng 10-12 Technicians 40-72

Appendix B - 11

TABLE B-11

Operation and Maintenance
Maintenance Division

Title/Group	Number	Education/Training
Maintenance superintendent	1	BEng (mechanical)
Maintenance engineers	8-14	BEng
Maintenance supervisors	5-7	Technicians
Maintenance technicians	32-54	15-24 Mechanical 7-10 Electrical 10-20 Instrumentation & control
Maintenance craftsmen	20-35	12-20 Mechanical crafts 5-10 Electrical crafts 3-5 Civil crafts
Total	66-111	BEng 9-15 Technicians 37-61 Craftsmen 20-35

Appendix B - 12

TABLE B-12

Operation and Maintenance
Safety Division

Title/Group	Number	Education/Training
Safety superintendent	1	MEng (nuclear safety)
Industrial safety engineer	1	BEng (industrial safety)
Nuclear safety engineers	2-4	MEng (nuclear safety)
Health physicists	1-2	BSC (Physics)
Safety technicians	10-12	Technicians (Nuclear safety & radiation)
Total	15-20	MEng 3-5 BEng 1 BSC 1-2 Technicians 10-12

TABLE B-13

Operation and Maintenance
Training Division

Title/Group	Number	Education/Training
Training Superintendent	1	MEng (operator training, QA/QC, simulators, radiation protection)
Training engineers	2-3	Technicians (mechanical, electrical, radiation protection)
Training instructors	2-3	MEng (plant systems)
Total	5-7	MEng 3-4 Technicians 2-3

Appendix B - 13

TABLE B-14

Operation and Maintenance
Technical Division

Title/Group	Number	Education/Training
Technical superintendent	1	MEng (nuclear power plants)
Technical engineering staff	8-10	3-4 MEng 3-4 BEng 2 BSC Physics, chemistry
Technicians	15-24	Technicians (Mechanical, electrical, electronics, chemical, computer, draftsmen)
Total	24-35	MEng 4-5 BEng 3-4 BSC 2 Technicians 15-24

TABLE B-15

Operation and Maintenance
Quality Assurance Division

Title/Group	Number	Education/Training
Quality assurance engineers	1-2	BEng (mechanical)
QA/QC technicians & auditors	6-8	Technicians (mechanical, electrical, civil, welding)
Total	7-10	BEng 1-2 Technicians 6-8

TABLE B-16

Nuclear Fuel Cycle
Exploration

Title/Group	Number	Education/Training
Preliminary studies.		
Senior geologist	1	PhD or MSC (geology)
Exploration geologists	1-3	MSC or BSC (geology)
Exploration technicians	1-5	Technicians (geology, mining)
Geochemical surveys.		
Project manager	1	PhD or MSC (geology)
Senior geochemist	1	PhD or MSC (geology)
Geochemists	1-3	MSC or BSC (geology)
Geochemical prospectors	2-6	Technicians (geology, mining)
Senior chemical analyst	1	PhD or MSC (chemistry)
Laboratory technicians	2-3	Technicians (chemistry)
Radiometric & emanometric surveys:		
Senior geologist	1	PhD or MSC (geology)
Geologist-geophysicist	2	MSC (geology/geophysics)
Geologist	2	MSC or BSC (geology)
Technicians	4-8	Technicians (geology, mining)
Electronics	1-2	BEng (electronic)
Surveys	1-2	BSC (surveyor)
Draftsmen	1-2	Technicians (draftsmen)
Exploration & follow-up		
Senior geologist	1	PhD or MSC (geology)
Geologists	3-6	MSC or BSC (geology)
Technicians	6-8	Technicians (geology, mining)
Senior driller	1	BEng (mechanical)
Drillers	4-6	Technicians or craftsmen
Economic geologist	1	BSC or BEng (evaluation)
Geophysicist	1	MSC (geophysics)
Technicians	1-2	Technicians (sample preparation)

Title/Group	Number	Education/Training
Analytical support		
Chemist	1	PhD or MSC (chemical analysis)
Technicians	3	Technicians (chemistry)
Total	45-73	PhD or MSC 7 MSC or BSC 7-14 MSC 3 BSC 1-2 BSC or BEng 1 BEng 2-3 Technicians 24-43

TABLE B-17

Nuclear Fuel Cycle
Fuel Fabrication

Title/Group	Number	Education/Training
Plant manager	1	MEng (metallurgical or mechanical)
Production manager	1	BEng (metallurgical or mechanical)
Quality control manager	1	BEng (metallurgical or chemical)
Manufacturing engineering manager	1	BEng (metallurgical or mechanical)
Production control manager	1	BEng (metallurgical or mechanical)
Nuclear materials control manager	1	BEng (nuclear materials)
Radiation safety officer	1	BSC (physics or biology)
Nuclear safety officer	2-3	BSC (nuclear physics)
Manufacturing foremen	4-6	Technicians- (mechanical)
Inspection foremen	3-4	Technicians (mechanical)
Total	16-20	MEng 1 BEng 5 BSC 3-4 Technicians 7-10

TABLE B-18

Nuclear Fuel Cycle
Waste Management

Title/Group	Number	Education/Training
Plant manager	1	MEng (chemical)
Superintendents for production & maintenance	2	BEng (chemical)
Chiefs of waste treatment facilities	5	BEng (chemical)
Shift supervisors (production)	10	Technicians (mechanical, chemical)
Operators (production)	55	Technicians (as above)
Maintenance chief technicians	5	Technicians (mechanical, electrical, instrumentation, control)
Maintenance technicians	35	Technicians (as above)
Superintendent of technical services	1	MEng (mechanical, chemical or nuclear)
Head of engineering group	1	MEng (mechanical, chemical or nuclear)
Engineers	4	MEng (mechanical, chemical or instrumentation & control)
Planning technicians	1	Technician
Head of QA group	1	MSC (chemistry)
QA/QC engineer	1	BSC (chemistry)
QA/QC technicians	5	Technicians (chemistry)
Safety officer	1	BSC (physics or chemistry)
Health physics technicians	5	Technicians (radiation measurement & protection)

Repair workshop personnel	7	1 Technician 3 Craftsmen (foremen) 3 Craftsmen
Total	140	MEng 7 BEng 7 MSC 1 BSC 2 Technicians 117 Craftsmen 6

Director: Administrative, legal & records management services	1	MBA
Professional staff: Administrative, legal & records management services	5-9	1-2 BAE 1-2 BBA 1-2 BCS 2-3 BLS
Total	45-65	MEng 9-10 MEng or BEng 30-45 MBA 1 BAE 1-2 BBA 1-2 BCS 1-2 BLS 2-3

TABLE B-19

Nuclear licensing and regulation

Title/Group	Number	Education/Training
Head: Regulatory authority	1	MEng (nuclear)
Deputy head: Regulatory authority	1	MEng (nuclear)
Director: Codes & standards	1	MEng (mechanical, civil, electrical or nuclear)
Professional staff: Codes & standards	4-5	MEng (nuclear, civil, electrical or mechanical)
Director: Licensing & assessment	1	MEng (nuclear)
Professional staff. Licensing & assessment	15-25	MEng or BEng (civil, mechanical, nuclear, electrical, or chemical)
Director: Inspection & enforcement	1	MEng (nuclear or mechanical)
Professional staff: Inspection & enforcement	15-20	MEng or BEng (nuclear, chemical civil, mechanical, electronics)

APPENDIX C

RESIDENTIAL, COMMERCIAL AND INDUSTRIAL ELECTRICITY RATES

Appendix C consists of Tables C - 1 through C - 3 and Figures C - 1 through C - 6. The source of all of the data presented in this appendix is: *Energy Statistics Handbook,* Statistics Canada, Catalogue 57-601 for the years shown.

Tables C - 1, C - 2, and C - 3 respectively, show province-by-province comparisons of residential, commercial and industrial electiricity rates for the period 1978-1991.

Figures C - 1 throught C - 6 present the same data graphically, highlighting comparisons of electricity rate movements in New Brunswick with those in Saskatchewan and Nova Scotia. Comparisons of these are also made to calculated Canada-wide average residential, commercial and industrial electricity rates.

TABLE C-1

CANADA-WIDE RESIDENTIAL ELECTRICITY RATES

Cents per Kwh (taxes included)
Based on Monthly Consumption of 1,000 Kwh

	NFLD	PEI	NS	NB	QUE	ONT	MAN	SASK	ALTA	BC
1978	3.40	5.50	4.20	3.50	2.30	2.70	2.90	2.90	2.40	3.20
1979	3.80	6.20	4.70	4.30	2.60	2.90	3.30	3.10	2.60	3.30
1980	4.13	7.04	4.97	4.74	2.96	3.20	3.32	3.40	2.84	3.67
1981	4.52	8.95	4.97	5.14	3.28	3.57	3.32	3.87	3.28	3.83
1982	5.32	10.86	4.97	5.28	3.75	3.98	3.32	4.16	3.90	4.53
1983	5.56	10.74	6.44	5.32	4.04	4.27	3.51	4.46	4.55	4.76
1984	5.81	11.17	6.57	5.90	4.22	4.69	3.88	4.95	4.97	5.09
1985	6.85	10.98	6.57	6.43	4.32	5.09	4.11	5.19	5.17	5.59
1986	7.00	8.49	7.09	6.54	4.52	5.29	4.25	5.54	5.12	5.47
1987	6.97	8.29	7.26	6.54	4.74	5.63	4.61	6.05	5.07	5.49
1988	7.02	9.36	7.26	6.54	4.93	5.99	4.92	6.68	5.01	5.49
1989	6.83	9.13	7.66	6.46	5.16	6.40	5.40	7.10	5.24	5.51
1990	7.34	9.91	7.96	6.46	5.46	6.97	5.47	7.10	5.24	6.39
1991	8.28	11.22	8.91	7.37	6.20	8.30	6.03	7.60	6.79	6.45

Source: *Energy Statistics Handbook*, Statistics Canada 57-601.

TABLE C-2

CANADA-WIDE COMMERCIAL ELECTRICITY RATES

Cents per Kwh (taxes included)
Based on Monthly consumption of 500,000 Kwh

	NFLD	PEI	NS	NB	QUE	ONT	MAN	SASK	ALTA	BC
1978	2.70	5.40	4.00	3.50	1.90	2.20	2.00	2.50	1.90	2.20
1979	3.30	6.10	4.50	4.50	2.20	2.50	2.40	2.70	2.00	2.30
1980	3.42	6.87	4.76	5.05	2.64	2.73	2.40	2.97	2.15	2.48
1981	3.68	8.74	4.76	5.45	2.93	3.00	2.40	3.28	2.52	2.78
1982	4.25	10.48	4.76	5.59	3.47	3.33	2.40	3.78	2.99	3.24
1983	4.48	10.44	5.95	5.93	3.73	3.56	2.54	4.09	3.46	3.48
1984	4.68	11.10	6.20	6.25	3.92	3.90	2.81	4.61	3.75	3.78
1985	5.92	11.16	6.20	6.43	3.99	4.24	2.98	4.94	3.85	3.93
1986	5.98	8.48	6.69	6.47	4.17	4.41	3.09	5.32	3.81	3.98
1987	5.97	6.61	6.85	6.47	4.37	4.66	3.40	5.64	3.76	4.00
1988	6.08	6.78	6.85	6.47	4.54	4.94	3.64	6.29	3.72	4.00
1989	5.79	6.40	7.07	6.47	4.72	5.29	3.80	6.10	3.89	4.01
1990	5.90	9.34	7.28	6.47	4.91	5.74	3.93	6.10	3.89	4.12
1991	6.60	10.33	8.10	7.41	5.55	6.82	4.34	6.99	4.14	4.47

Source: *Energy Statistics Handbook*, Statistics Canada 57-601.

TABLE C-3

CANADA-WIDE INDUSTRIAL ELECTRICITY RATES

Cents per Kwh (taxes included)
Based on consumption of 3,100,000 Kwh

	NFLD	PEI	NS	NB	QUE	ONT	MAN	SASK	ALTA	BC
1978	2.30	4.30	2.80	2.20	1.60	2.10	1.70	2.20	1.40	1.20
1979	2.80	5.00	3.20	2.70	1.90	2.30	2.00	2.50	1.80	1.40
1980	2.95	5.69	3.36	3.11	2.26	2.45	2.01	2.75	1.90	1.62
1981	3.28	7.84	3.36	3.39	2.54	2.70	2.01	3.01	2.21	2.00
1982	3.94	9.47	3.36	3.50	2.83	3.00	2.04	3.45	2.46	2.47
1983	4.17	9.43	4.13	3.72	3.04	3.21	2.18	3.74	2.85	2.74
1984	4.34	10.22	4.33	3.81	2.97	3.52	2.36	4.29	3.24	2.99
1985	5.61	10.76	4.33	4.19	2.84	3.85	2.49	4.51	3.20	3.10
1986	5.66	7.58	4.68	4.24	3.08	4.13	2.52	4.80	3.17	3.15
1987	5.06	5.72	4.79	4.24	3.12	4.23	2.77	5.16	3.17	3.15
1988	5.58	6.45	4.79	4.24	3.25	4.49	2.94	4.36	3.10	3.15
1989	5.06	6.22	4.98	4.24	3.38	4.89	3.14	4.51	3.24	3.16
1990	4.85	6.90	5.18	4.24	3.47	5.15	3.51	4.51	3.24	3.25
1991	5.09	7.88	5.38	4.53	3.50	5.56	3.56	4.51	4.09	3.30

Source: *Energy Statistics Handbook*, Statistics Canada 57-601.

FIGURE C1

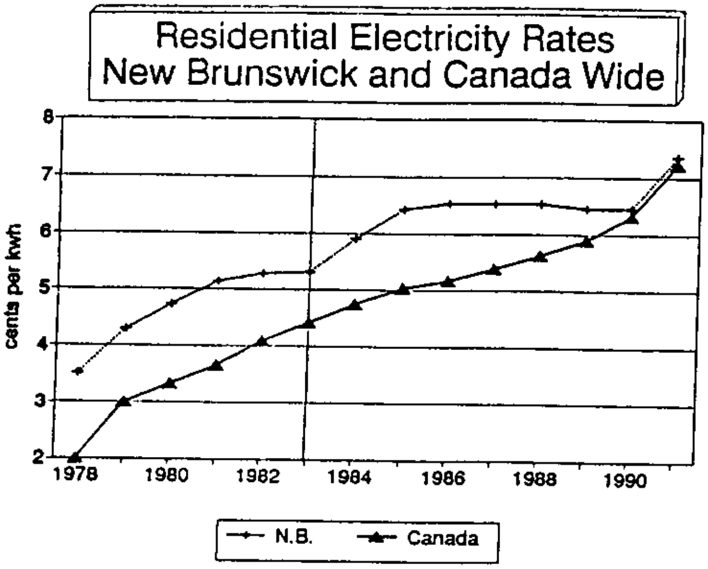


FIGURE C2

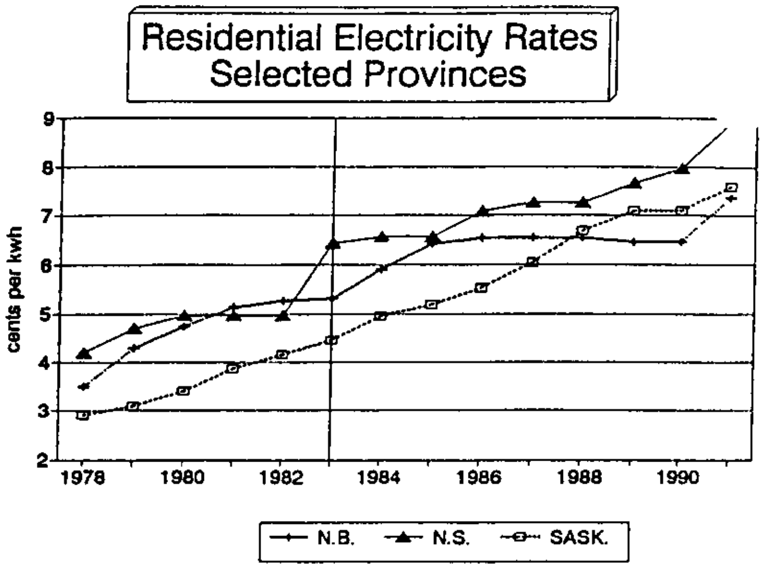


FIGURE C3

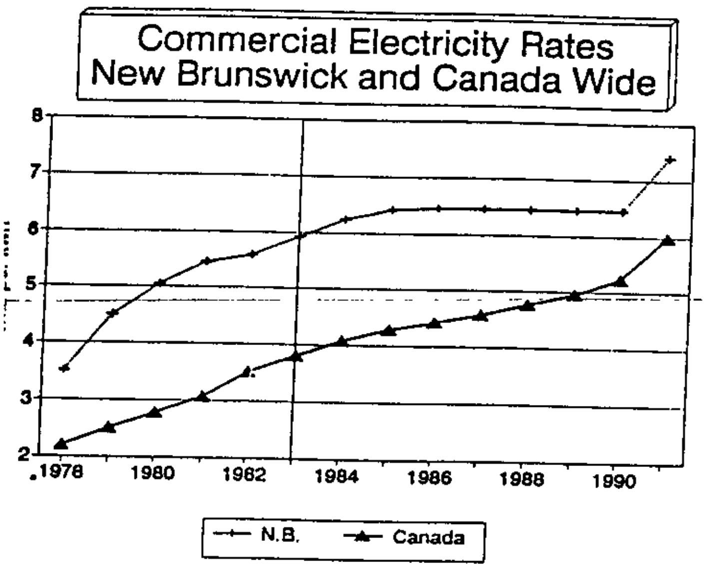


FIGURE C4

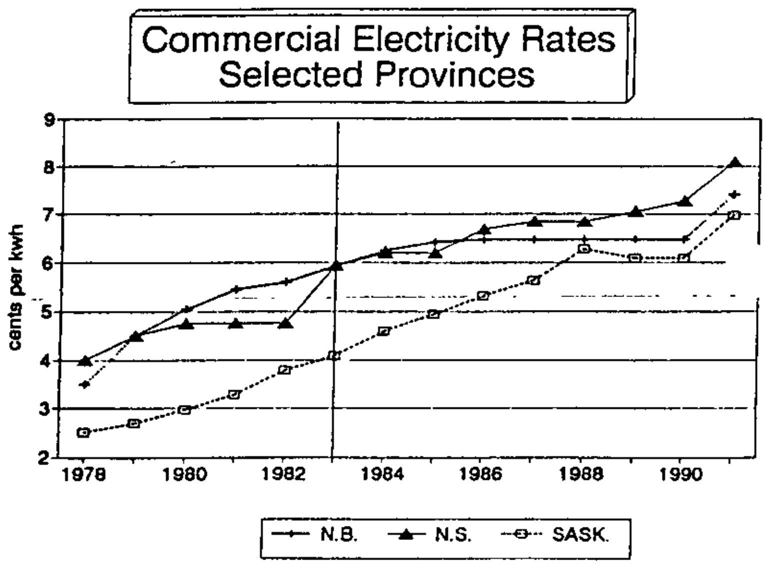


FIGURE C5

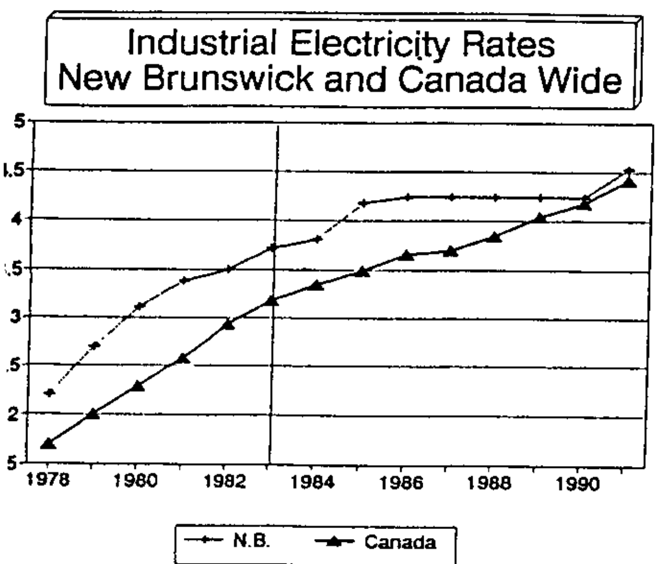
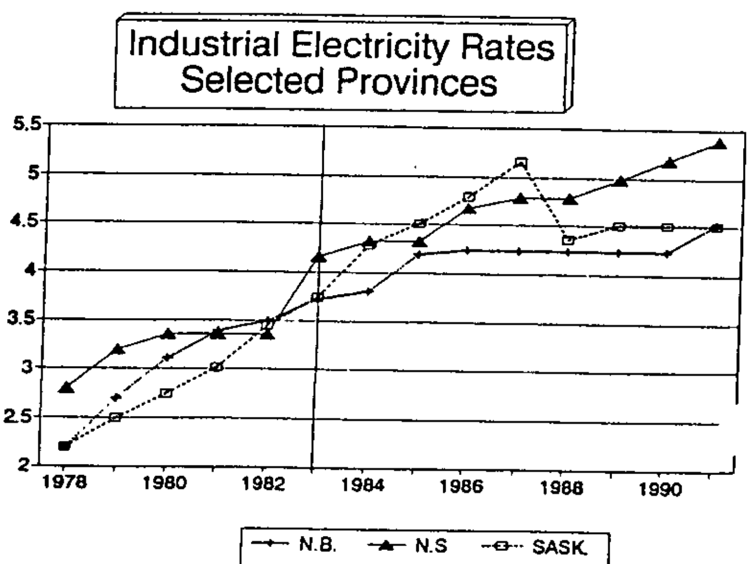


FIGURE C6



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CASE HISTORY REVIEW OF SOCIO-ECONOMIC IMPACT ASSESSMENT - POINT LEPREAU NUCLEAR GENERATING STATION

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1.0 INTRODUCTION

Initiated in 1978, the Canadian Nuclear Fuel Waste Management Program was established to develop the concept of deep underground disposal of nuclear fuel waste. Disposal of nuclear fuel waste would be within the plutonic rock of the Canadian Shield. Atomic Energy of Canada Ltd. (AECL) is currently preparing an environmental impact statement (EIS) concerning the disposal concept. The current review, being carried out under the Federal Environmental Assessment and Review Process (EARP), is required to ensure that this concept is technically effective and feasible, as well as environmentally and socially acceptable. The selection of an appropriate disposal site will not be carried out until the disposal concept has been fully reviewed and approved by the relevant governments and regulatory authorities.

Following public scoping meetings in 1990, EARP guidelines for preparation of the EIS were issued to AECL in March 1992. One requirement of the guidelines is the discussion of relevant case studies which may provide information on the socio-economic impacts which may likely be anticipated from such a facility development. Specifically, the guidelines indicate that the EIS is to include the following:

- Justification of the selection of the case studies under consideration.
- Justification of the selection of specific activities or aspects of these major projects used as analogues for comparative purposes.
- Evaluation of the change or impacts, over appropriate periods, that could be viewed directly or indirectly as having resulted from activities or aspects of the major projects selected as analogues.
- Identification of the geographical extent of changes or impacts associated with these projects.
- Determination of important indicators that have signalled these changes or impacts.
- Conclusions on what can be learned as part of the current knowledge base with respect to possible social, economic, and environmental impacts of the concept.

In partial fulfilment of this requirement, AECL has requested that Washburn & Gillis Associates Ltd. review and summarize the socio-economic impact assessment and site selection studies prepared for the Point Lepreau Nuclear Generating Station (GS). The following report summarizes previous impact assessment results, site selection studies, and impact monitoring conducted in association with the Point Lepreau GS.

1.1 Background

NB Power operates the only nuclear generating station in Atlantic Canada, located at Point Lepreau, New Brunswick. The Point Lepreau Nuclear GS is located on the Lepreau peninsula, on the Bay of Fundy, 40 km southwest of the City of Saint John (Figure 1-1). The GS currently consists of a single CANDU 600 unit with a total net generating capacity of 630,000 kW, with provision made for as many as three additional reactors at a future date.

Site approval of the Point Lepreau site was granted on October 18, 1974 by the Atomic Energy Control Board (AECB), following an extensive site selection study. Construction was started in May 1975 and completed in late 1981. Development of the Point Lepreau GS represented the single largest capital development initiative in the Province's history. Peak construction labour force employed 3,300 workers at the site[1]. An operating license was granted to the plant in July 1982, with plant start-up commencing that same month. First electrical power was generated by the plant on September 11, 1982, with commercial operation beginning on January 31, 1983. Operation manpower requirements include up to 375 employees.

Development of the nuclear station began in the early 1970s with a site selection exercise and proceeded through an environmental impact assessment (EIA) of the proposed development. The EIA conducted represented the first development proposal to undergo the EARP process. The AECB, as the regulator of the project, recommended to the Minister of Energy Mines and Resources that the project be referred to the Minister of the

[1] Washburn & Gillis Associates Ltd. 1984

WASHBURN & GILLIS ASSOCIATES LTD.

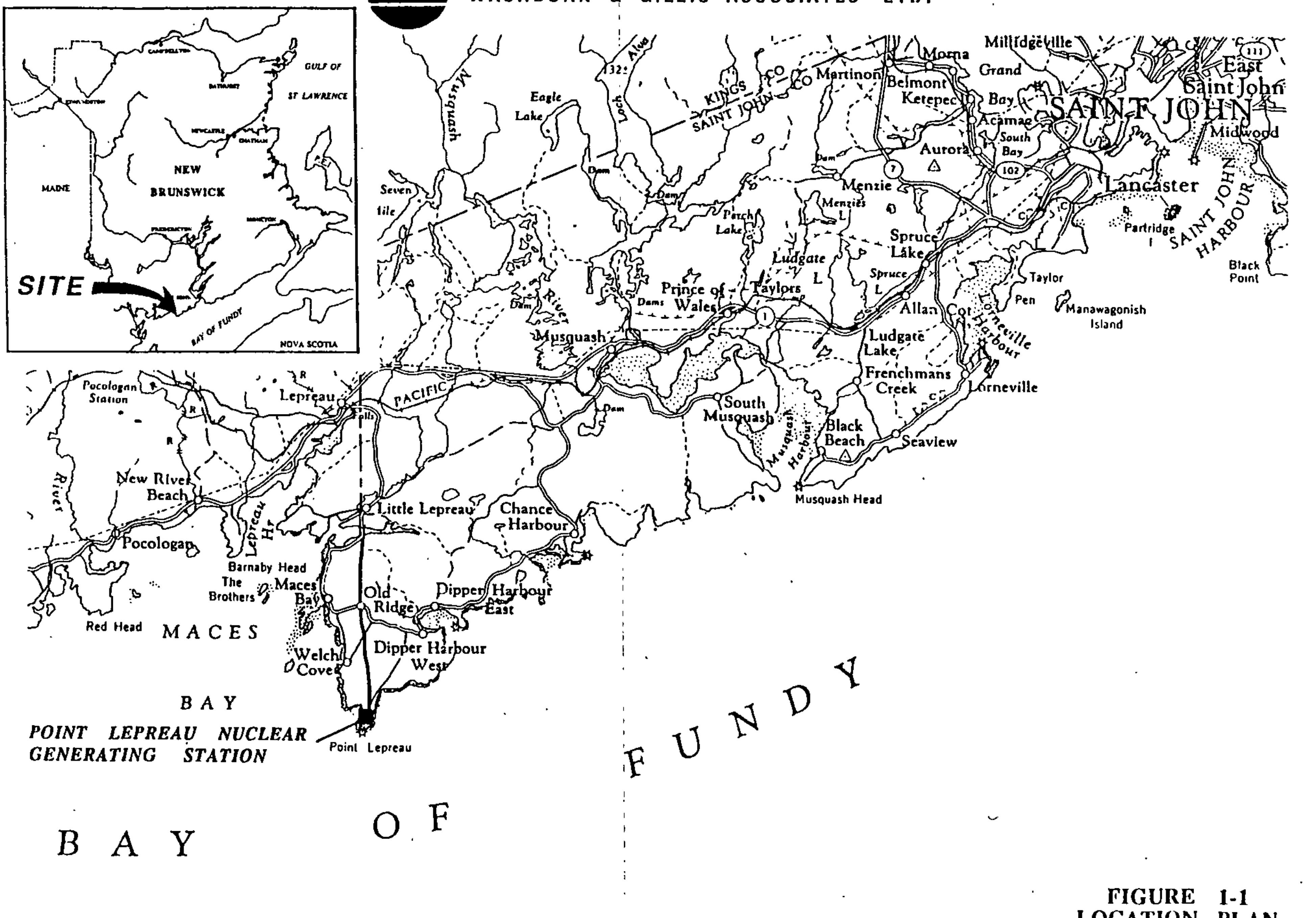

FIGURE I-1
LOCATION PLAN

Environment under the terms of the EARP Guideline Order. A joint federal and provincial panel was appointed which reviewed the documentation for the project and recommended approval with conditions. Selection of Point Lepreau as a case study for subsequent assessments is obvious in part, due to the ground breaking work conducted under the then new EARP assessment process. As well, the assessment conducted has direct relevance to the current waste management assessment, being directly related to the impacts on the environment of the Canadian nuclear industry.

Following the start-up and successful initial operation of the first unit at Point Lepreau, Maritime Nuclear, a joint undertaking of AECL and NB Power proposed the construction of a second 600 MW unit at Point Lepreau (Lepreau 2). AECL, as a federal Crown Corporation and as a partner in Maritime Nuclear decided that it would participate in the federal Environmental Assessment and Review Process (EARP). It was also decided that the Canada Department of Energy, Mines and Resources (EMR) would act as the initiating agency for the purposes of the EARP. Since NB Power is a provincial Crown Corporation, the New Brunswick Environmental Impact Assessment Policy was also applicable to the project. An agreement was struck between Environment New Brunswick and the Federal Environmental Assessment and Review Office (FEARO) which administers and supports EARP, that there would be one environmental assessment process to avoid duplication.

A joint federal/provincial panel was struck to undertake the review and to report to the Ministers of the Environment of the two levels of government. An EIA has been conducted for the proposed Lepreau 2 plant expansion, and is discussed in this report as it relates to observed impacts from the original development. Public concerns and development issues relative to the existing facility are also included in the discussion to present an overview of ongoing concerns relative to such developments.

The Lepreau 2 EIA served two functions: (1) it met the objectives of assessing the implications of construction and operation of a second unit at Lepreau; (2) more pertinent to the subject of this report, it caused a focused appraisal of the construction and operation of the first unit at Lepreau. The appraisal included all aspects of the biophysical and socio-economic environment, including the existing levels of community participation and communications.

Yet a third project has been proposed and initiated at Point Lepreau, namely the construction of additional storage facilities for nuclear fuel waste. This project was reviewed under the Provincial and Federal Environmental Assessment Procedures, with the result that an EIA was not considered to be necessary under either process. There was, however, a series of public information sessions held in conjunction with the project.

1.2 Approach and Constraints

Given the extensive documentation available as a result of the projects described in section 1.1, the initial task was to assemble relevant documents. Documents were obtained which were prepared by the various proponents, the regulatory review bodies, and organisations responsible for ongoing activities. In addition to these documents discussions were held with individuals responsible for many of the pertinent activities undertaken during the environmental approval process for the Lepreau GS.

While there is a good base of information, there was a general lack of precision in the definition of boundaries during the socio-economic assessment for both the existing Lepreau GS as well as for Lepreau 2. This lack of precision has been noted in a review of the economic analysis in the Lepreau 2 EIS by an independent reviewer hired by the Lepreau 2 Panel[2]. The reviewer indicated that the lack of information available at this level and the mobility of the workforce at this level may have made analysis at this precision misleading. The lack of precision in socio-economic boundary definition makes subsequent analysis of the information, which is the subject of this report, extremely difficult. Therefore boundaries have been described only where they clearly reflect those defined in the original documents.

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[2] Mattard, 1984

2.0 SITE SELECTION AND SOCIO-ECONOMIC IMPACT ASSESSMENT APPROACH

2.1 Site Selection Approach

In the early 1970s, the high cost of foreign oil sources prompted NB Power to investigate the development of a nuclear power plant for the Province. Site selection exercises were begun and resulted in the preparation of the following four reports (plus various addenda):

- Comparison of Environmental Factors Relating to Alternative Sites for a Nuclear Generating Station and Heavy Water Plant (November 1973)
- Comparison of Environmental Factors Relating to Alternative Sites for a Nuclear Generating Station, Final Edition (May 1974)
- Comparative Environmental Study of Intake and Outfall Conditions at Three Alternative Sites for a Nuclear Generating Station, Final Edition (May 1974)
- Review of Reports on Site Selection for New Brunswick Nuclear Power Plant (July 1974)

Site requirements for such a development were determined to include the following features[3]:

- statutory requirements: a 1000- metre habitation exclusion zone surrounding the facility
- land availability : requirement for 1200 by 2000 foot property, plus a 1000-metre exclusion zone
- access: good transportation facilities available close to the site, sufficient to transport heavy reactor equipment

[3] Montreal Engineering Company Ltd. 1974

- water supply: requirement for 1100 cubic feet per second (cfs) of cooling water for the reactor, which would undergo a maximum 24°F increase in temperature, and 13.5 cfs of freshwater

- topography/hydrography: coastal site with low elevation and stable shoreline

- geology: bedrock close to surface, with no active faults within a 10-mile radius or major passive faults within a 1-mile radius of site

- environment: environmental compatibility, stable and sound foundation, and adequate and reliable water source at each site.

- transmission: adequate electrical transmission facilities

- infrastructure: requirements include supply of building materials, industrial maintenance and repair facilities, construction work force within a 30-mile area, permanent housing for plant staff, shopping facilities, social services, recreational services, hotels, and restaurants

2.1.1 Results of Site Selection Exercise

Initial consideration of sites in NB included 18 prospective sites throughout the Province. Three potential sites on the east coast of NB were rejected from further assessment due to shallow coastal bathymetry, packed ice, and littoral drift characteristic of that coast. Two potential inland sites were rejected as a result of insufficient water supply for reactor needs. Point Lepreau was selected for further consideration from a list of five south coast sites. Quinn Point and Point Caplin, both on the south shore of Chaleur Bay, were selected for further assessment from eight potential north coast sites.

Subsequent analysis of the comparative merits of the three remaining candidate sites was conducted, in terms of the proposed facility's impact on public health and safety, the socio-economic, and community consequences and impairment of site ecology. On the basis of these criteria, the Point Lepreau site was selected due to the following features:

- Lowest total cost of construction.
- Best ability to maintain construction schedule.
- Environmental effects most limited.
- Availability of construction materials.
- Availability of services.
- Fewest number of people to be relocated.

In addition most of the land required within the 3000 m exclusion zone identified belonged to the federal government related to the operation of a lighthouse at Point Lepreau.

2.2 Socio-Economic Impact Assessment (SEIA) Approach

In considering the approach to a SEIA for the Point Lepreau GS, it is important to recognize the period involved. The impact assessment for the Point Lepreau GS was the first EIA conducted under the Federal Government's EARP Guideline Order. The early 1970s was also a time when impact assessment and, particularly, socio-economic impact assessment was in its infancy in Canada. Protocols for social impact prediction, measurement and monitoring were not well developed. The parties responsible for the SEIA basically reviewed the approaches taken for impact assessments in other jurisdictions and complemented this information with information on the technical requirements for the project.

The approach taken to for the SEIA of the Point Lepreau GS can be considered as comprising of two parts; In the first part, the focus was on the ability of the existing socio-economic infrastructure to accommodate and successfully complete a project such as was being considered. This part considered, for example: work force, accommodations, recreation facilities, local transportation network (including highways, railways, and spurs), retail outlets, and community services (including fire protection, hospitals, police, and education). The interim impact report, produced in March 1975, indicated that the availability of work force and accommodations were the two most critical components of the socio-economic environment relative to the plant. The later final impact report assessed these two components in detail. Local planning regulations were assessed relative to their pertinence to the proposed undertaking.

The second component of the SEIA involved assessment of the potential effects of the undertaking on the local environment. This undertaking included an attempt to inform the general public about the project and the various components of the construction and operation of the project. These information sessions were accompanied by efforts to obtain comments and opinions from local residents regarding their concerns.

3.0 INITIAL COMMUNITY CONCERNS

In understanding the initial community concerns associated with the Point Lepreau GS, it is important to consider the community setting into which the project was introduced. The local area, within 20 km of Point Lepreau, at the time the project was being considered (and to a major extent today) consisted of a combination of rural housing and small settlements. The primary industries were resource-based with principle emphasis on the fishing industry, forestry, and tourism[4]. Local residents were directly or indirectly employed in the fishing industry or with one of a small number of industrial operations in the area. Families tend to remain in the area for generations and the level of home ownership is high. There exists a tradition of exchange of labour and goods conducted outside the monetary system. A number of residents were and continue to be employed in Saint John (i.e., the largest city in New Brunswick, with a population in excess of 100,000).

A general information program on nuclear power was begun in New Brunswick in 1972, coinciding with NB Power system planners studies on nuclear power as an energy source. The information program included presentations to schools, teachers, community service clubs, and other organizations by NB Power staff[5]. The effort continued with information meetings in 1974 and the establishment of an information office in 1975. The program was designed to facilitate a flow of information from the project to the public, and to quickly and accurately respond to concerns and requests for information.

The generally rural nature of the population and the link to the fisheries resources were responsible for much of the initial concerns regarding the Point Lepreau GS. The concerns associated with the Point Lepreau GS, expressed by local residents, can be identified in two groups: (1) those to do with nuclear power in general; (2) those to do with the potential disruption to the existing community during the construction phase of the project[6].

[4] Thompson, 1985

[5] Thompson 1985

[6] Stairs 1992

Thirty-three local residents were interviewed during the SEIA for the Point Lepreau GS, to ascertain attitudes regarding the potential development of a nuclear power station in this close-knit rural area[7]. The survey indicated a general resentment and scepticism regarding any potential development in the area, due to concerns such as noise, pollution, and increased costs. Most people expressed concern regarding the potential socio-economic impacts of the proposed development and the majority did not view the project in a positive light. The most apprehension was expressed regarding impacts such as an influx of non-local people, higher costs, and increased crime as a result of the development. Concern was raised regarding possible impacts on the herring and lobster stocks in the vicinity and possible atmospheric contamination.

The possibility of accidental releases of radioactive materials and requirements for evacuation were also raised by local residents. Possible benefits foreseen from the development included desirable employment, and improved shopping and educational facilities. While potential for such positive benefits was seen, it was not seen as outweighing potential negative impacts.

Local residents exhibited a general distrust for the project at the outset and perceived a threat to traditional authorities, such as the churches and opinion leaders. These attitudes were partially overcome early in the project through public participation in the decision-making process. Socio-economic concerns, such as provision of worker housing, and property, and concerns such as a barge landing site, were resolved to the satisfaction of local residents through their participation in the site selection process[8].

Media interest in Point Lepreau was high throughout the construction and early operation stages. Nearly half of the 2700 local newspaper articles on NB Power during the period 1975 to 1982 related to the Point Lepreau GS. NB Power developed a policy of dealing with the media in a very open and forthright manner, and thus managed to gain and maintain credibility with the media.

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[7] McLaren Atlantic Ltd. 1977

[8] Thompson, 1993, personal communication

4.0 POTENTIAL EFFECTS IDENTIFIED

This section outlines the potential effects identified in the assessments prepared for the Lepreau GS. Mitigative measures are described in section 5 and actual impacts which were identified are described in section 7. Potential socio-economic impacts were predicted in the Point Lepreau EIS to be relatively minor as a result of the proposed development[9]. Construction labour shortages were predicted in the short-term, necessitating the migration of construction workers into the area. Construction of the plant was viewed by the proponent and the Province as a potential economic benefit to local communities as a result of construction-related job creation. The plant was also proposed to supply approximately 225 permanent operating positions upon completion. Due to a surplus in available housing in Saint John near the end of the assessment period, the influx of construction workers and the provision of housing for permanent staff was seen as a potential benefit to the local economy. Housing provision in the immediate vicinity of the plant was anticipated to be minimal.

Regional, community, and neighbourhood recreation facilities were assessed. Both the community and the neighbourhood facilities were viewed as insufficient to provide recreational opportunities for a large additional population. Potential negative impacts from such usage were anticipated to include the use of local licensed establishments by construction workers, creating stressed situations with local residents. However, due to the decrease in non-resident workers in the area during the period of assessment, this problem was assessed to be temporary and would likely decrease along with pressure on local facilities. Retail expansion necessitated by the plant construction and operation phases was predicted to represent a potential source of $2,400,000 and $2,000,000 into the local economy, respectively.

While the existing highway and railway infrastructure was assessed to be sufficient to meet current and future needs based on potential impacts predicted, two improvements were included in the project design. First, a new 8 km access road to the site (by-passing Maces

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[9] MacLaren Atlantic Ltd. 1977

Bay) was built, routing traffic away from local communities. The purpose for the construction was twofold, to reduce public concern and to improve access to the site. Second, a disused rail line to the site was upgraded and put back into service for conveyance of materials to the site. The line continues to provide opportunity for access. The project was not assessed to have any impact on local air service.

Once the plant operation phase was initiated, service upgrading and expansion was foreseen to be required for fire protection and education services[10]. NB Power and the provincial EMO also recognized the need for emergency preparedness during the operation phase of the project[11]. Increased policing of the area was proposed during the construction phase at the site, falling off once operation began. Hospital services were not expected to be impacted by the development.

One of the major concerns associated with the operation of the facility had to do with the potential for damage to fish stocks. The fish stock which was identified as being of most concern was the Atlantic Salmon population in the coastal rivers of the Bay of Fundy, primarily the Saint John River. There was concern expressed by both the fishermen and the Department of Fisheries & Oceans that the operation of the facility could result in entrainment or impingement of salmon smolts in the plant cooling water system, which would negatively affect populations in Fundy rivers.

[10] MacLaren Atlantic Ltd. 1977

[11] G. Stairs, EMO, personal communications 1993

5.0 MITIGATIVE MEASURES PROPOSED

5.1 Construction Phase Mitigation

Some potential negative impacts were mitigated during the early construction phase. The 1977 impact assessment report assessed impacts to the surrounding communities since construction began in 1974. Construction (upgrading) of the site access road had mitigated the impacts to surrounding communities (i.e., Maces Bay) as a result of site generated traffic, since it bypassed these settlements. As well, pronouncement of various regulatory restrictions (i.e., setback, building, subdivision, and planning/ land use regulations) and provision of a work camp for construction workers mitigated potential public concern and impacts. While the proposed land use regulations were not required to be enforced, worker housing was heavily used by single trades people. As many as 300-500 trades people were housed at the camp during the peak construction period. The work camp provided most of the services required by the residents including recreational facilities. These provisions together with the proximity of Saint John served to limit the negative interactions with local residents.

Four homes (three cottages and one permanent residence) within the exclusion zone around the station were purchased by NB Power. Residents relocated before plant start-up. A lighthouse and associated dwellings on Point Lepreau peninsula have since been fully automated, negating the need for habitation on the Point.

At the time of the original assessment, approximately 1,300 and 2,500 people lived within 8 km and 24 km of the GS, respectively. In developing the GS, NB Power established an effective information base and positive communication flow with area residents, to provide the public with a sound understanding of nuclear power generation and the impacts which were likely to arise as a result. The information program can be described as push pull in that at the outset NB Power provided information which was felt to be required by the public (push). As the project and the public matured there was an increasing requirement for information on the part of the public (pull) which was included in the information provided by NB Power. Part of this information program was the provision of a monthly newsletter, The Beacon. This Fundy shore news bulletin provided local area news and details of upcoming events, as well as information pertinent to the operation of the GS which would be of interest to local residents.

Impacts predicted in the impact assessment report, as a result of continued site development, included increased area employment and economic gains for community retailing, accommodations, and other service sectors[12]. While these were perceived as positive impacts, they carried with them the negative connotation of changing the existing character and structure of the local community. While this change was predicted to be inevitable, it was also suggested that careful monitoring of this change be conducted. The degree of such impacts was related to the speed and amount of growth that would take place because of worker influx into the area. This impact was predicted to be far more significant during the operation phase than the construction phase, due to a permanent change to the community structure as a result of plant operation[13]. The prediction was based on the fact that construction workers tend to be more transient while operations workers tend to become permanent residents.

During the design phase, in response to public concerns regarding potential effects on fish stocks, a state-of-the-art cooling water system was developed by the Proponent. This facility included a velocity cap intake structure located 10 m below low water, a forebay system, and a series of screens to remove debris (including fish) and an outfall design which incorporated a diffuser to prevent localized temperature rises on the surface.

5.2 Operation Phase Mitigation

5.2.1 Staff Requirement

Various staff requirements were designed to mitigate potential negative impacts at the station, especially from accidental occurrences. These requirements were, in part, identified

[12] McLaren Atlantic Ltd., 1977

[13] McLaren Atlantic Ltd. 1977

by the federal regulatory agency, the AECB. These measures include: a plant operator program, stringent staff selection, training programs, use of operating manuals (OMs), station audits, human factors and system design, and adequate staff supervision. NB Power has developed in-house training programs which ensure high quality training for staff on site. This training continues during the employment of the individual.

The AECB has resident engineers on site, whose function is to continually monitor the performance of Point Lepreau and its staff. The AECB staff has access to all activities at the station. In addition, there is an in-house Quality Assurance group whose mission is to ensure that all appropriate operating procedures are followed. Performance of all staff is continuously reviewed on an informal and formal basis. Staff not following the OMs could be subject to severe reprimands and/or dismissed.

As far as possible, layout of systems and controls has followed the guidelines of good human factors designed to minimize the potential for "unforced errors." Systems are designed to be fail-safe with the "defence-in-depth" approach, plus appropriate interlocks and alarms to inhibit or obviate incorrect operator action.

5.2.2 Emergency Planning

In general, emergency plans are prepared in order to facilitate a quick and orderly response to emergencies that may arise from events such as industrial or transportation accidents or natural events such as floods or earthquakes. In the case of the Point Lepreau GS, the AECB established criteria for on-site contingency plans. The federal government in 1976 clearly stated that the Province of NB was to be responsible for off-site emergency planning[14]. The responsibility for this planning was assigned to the EMO. This organization is accountable to the Lieutenant Governor in Council through the Minister of Municipalities, Culture and Housing. Therefore, the NB EMO, formulated an off-site plan. The essential elements of the plan are described below. This information was provided through personnel communication with Mr. Gary Stairs, NB EMO.

[14] Stairs 1992

The plan was developed with direct input from local residents, particularly residents with experience in emergency planning[15]. The implementation of the warden system for example was proposed in late 1979 by local area residents who had previous Women's Army Corps and civil defence experience. During the first three years of nuclear plant operation (1982-1985) an adapted war-time siren system and ad hoc warden service were in place. Initial experience with both proved unsatisfactory due to structural difficulties with the warden system and technical difficulties with the sirens. In 1986, EMO was directed to re-equip and re-structure the warden component of the system. The costs of the warden system are recovered from NB Power.

The 22 member warden service is comprised of a chief, deputy and 20 wardens. The chief or deputy and 12 wardens are on call on a daily basis. The main job of the warden system is to alert residents within 20 kilometres of the Point Lepreau plant in the event of an emergency. Warden service members use their own vehicles which are equipped with portable radios, siren/loud hailers, and emergency lights. They are also equipped with pagers, distinctive hats, jackets and rainware. Coverage is provided 24 hours per day 365 days per year.

Twelve warden zones have been established within the 20 km. radius of Point Lepreau. These zones have been established on the basis of knowledge of local road conditions and population density. Total coverage can be achieved within 45 minutes. The time requirement is to ensure that the wardens drive slowly so that the alert can be heard by residents. The alert is to prompt residents to turn on their radios or TV sets to receive further information or instruction.

The completely re-structured and re-equipped Point Lepreau warden service was involved in the exercise "Courtyard VI" along with other components of the off-site emergency plan on 1990.02.27. The exercise demonstrated exemplary performance of the warden service, also revealing a strong measure of public and media support for the concept. Other areas of the Point Lepreau Off-site Emergency Plan continue to receive the attention of NB EMO

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15 Stairs, 1993

include the Emergency Control Group, (exercised on a regular basis), the Emergency Plan itself, and the emergency broadcast arrangements with the local media. The organization of the plan is focused on a chief warden, a deputy chief and 20 wardens.

The plan was reviewed in some detail as part of the Lepreau 2 EIA process[16]. The review found some aspects of the then existing plan lacking but other aspects (particularly with respect to local contacts) were termed exemplary. The recommendations made by the reviews have been incorporated into existing plans. The features of the emergency plan developed by EMO and now in place, include an on-line demographic database, regular public information, and distribution of potassium iodide pills (which protect against radioactive iodine and are distributed by the NB Department of Health) to every household within 20 km of Point Lepreau.

It is important to recognize that the plan directly deals with the region within 20 km of Lepreau. Outside this area emergency planning is the conducted according to the provincial Emergency Plan which has responsibility for emergency planning vested in the local municipalities. These municipal plans incorporate hospitals, and police, for example, with civic services. The Point Lepreau plan is integrated with the adjacent municipalities and with the U.S.[17] The plan met with the approval of the public, politicians from all parties, and the media[18].

The on-site plan requires certain actions to be initiated at specific radioactive release levels.

The objective of the plan is to control and ameliorate contingency events inside the site in order to protect the public, persons at the plant, and the plant itself. The present on-site plan outlines the responses which would be made to potential on-site contingencies, and the facilities, responsibilities, agreements, and training required to respond to contingencies.

[16] Scanlon and Prawzick 1984

[17] Stairs, personal communication, 1993

[18] Stairs 1992

5.3 Community Consultation

Community consultation ideally provides a forum facilitating co-operation between the community and the proponent, open discussion of concerns, and optional compromise solutions to these concerns. There are two types of community consultation which are ongoing: conducted by NB Power and that by EMO. Five mitigative strategies distinguish the consultative process developed by NB Power:

- An active information program
- Public participation in decision process
- Credibility with the media
- Public access to information
- An open door policy to station and documentation

These elements are described briefly below.

Public Information Program

The Point Lepreau GS was the first project in Canada to come under EARP. Due to the novelty of the process, the attendant public information/participation requirements were not clearly defined by the Environmental Assessment Panel. The assessment process was also compressed by financing requirements and manufacturing lead times.

Although community consultation did not precede the selection of the Point Lepreau site (announced 18 July 1974), a public information program was initiated in 1972, coinciding with NB Power's assessment of alternative nuclear power. In 1972 and 1973, a number of nuclear presentations were made to New Brunswick civic leaders, service clubs, summer exhibitions, teachers, and schools. On 5 March 1974, the Throne Speech to the Legislative Assembly announced the Government's intention to build a 1200 megawatt, two-unit nuclear GS in New Brunswick. Following Premier Hatfield's announcement of the Point Lepreau site, NB Power provided a number of Fundy area community leaders a tour of the Pickering

GS (25 July, 28 August, and 10 September 1974), three public meetings were held in St. George and Saint John, and six community meetings were held in Saint John and Charlotte Counties (August-September 1974).

Public participation in the decision making process

A Point Lepreau Area Citizen's Committee was formed in the summer of 1974 at the initiative of NB Power. Membership in the committee consisted of representatives of local organizations and elected official in the local area. A successor to this committee continues to exist and have periodic meetings with NB Power personnel[19]. The meetings are not held regularly (approximately 3 month intervals) and are normally arranged by NB Power.

Particularly during the early stages of the construction at the project site, the Committee was accepted as a useful forum, both by area residents and NB Power. The members, appointed from communities on the Lepreau peninsula, wanted solutions to current and potential community problems. NB Power provided the liaison officer, periodic meetings with NB Power management, and hall rental fees in recognition of this need. As the project evolved from the more disruptive civil construction phase to mechanical and electrical phases, and as construction traffic was rerouted from the communities to the new plant access road, construction impacts (i.e., noise and construction traffic) diminished and meeting attendance waned.

Credibility with Media

NB Power recognised early in the project the necessity for effective communication linkages with the media. These communications links were established through the creation of a public and media relations group who was responsible for ensuring that the media was granted access to individuals and information in a timely manner.

[19] K. Duguay, NB Power, personal communication 1993

Public access to information

Recognizing potentially disruptive effects of the construction project, NB Power implemented several steps to respect and sustain the traditional lifestyles of the Fundy shore communities. A local history, The Tides of Discipline[20], was partially funded by NB Power. The project newspaper, The Nucleus with a circulation of 2,000, carried articles on local lifestyles and personalities. Local fisherman participated in the site selection for a project dock, thereby avoiding disruption in Dipper Harbour and Welch Cove, the sites initially selected for the dock. Blasting activities were scheduled to minimize effects on herring migration. Interference with fishing seasons and wharf facilities was limited through the combined vigilance of fishermen and community liaison staff. When lobster traps were damaged by a project delivery vessel, fishermen were compensated for their losses, although there were administrative delays in processing the claims. (These delays were caused by the absence of a mechanism to expedite payments and lack of policy on how to verify claims). A time-honoured community picnic was preserved in Duck Pond Cove. "Get acquainted" evenings were held with plant personnel, in-plant tours for area residents were conducted, and literature and film presentations provided. Certain impacts, such as the competition of an industrial wage economy with a traditional barter or volunteer economy were inevitable and perplexing[21]. For instance, traditional means of building a house or herring weir through the exchange of volunteer labour were jeopardized by lucrative overtime employment at the Point Lepreau GS.

Innovative public relations ventures (i.e., construction of a community recreation facility, Trynor Field, and the publication of The Beacon: Point Lepreau Community News Bulletin) met with mixed success. Trynor Field, established on Route 790 between Dipper Harbour and Maces Bay, consists of a baseball diamond, bleachers, and a tennis playing surface. The facility was constructed on NB Power land through volunteer services from local residents and construction firms.

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[20] Thompson 1978

[21] Thompson 1978

The Beacon, with a circulation of 900, was launched on 7 May 1976 and was primarily intended to provide: (1) a statement of NB Power's interest in and availability to local residents; (2) information on construction scheduling (especially marine) and progress; (3) nuclear operations/CANDU information and (4) support for traditional community institutions such as churches, senior citizens groups, Women's Institute, and others. Several unsuccessful attempts were made to shift publication of The Beacon to community control and production, as the quality varied with on-site editorship and staff workload. An unsolicited letter[22] indicated, however, that some 'cohesion' resulted from the news bulletin: "Folks seem to like The Beacon. It brings the communities together as neighbours."

These public consultation programs did doubtlessly serve to mitigate some construction impacts of the project (along with facilitating the assimilation of nuclear operations personnel into local communities). Using an Environment Canada checklist of public participation techniques and methodologies[23], it is evident that, from the outset of environmental assessment in 1974 to plant operations, a majority of these mechanisms were implemented during the project. The project was a new experience for residents and project management alike.

An open door policy to station and documentation

NB Power's "open door" approach to nuclear information was literally extended to the plant. During December 1981 and January 1982, prior to fuel loading, a special effort was made by the utility to encourage as many people as possible to visit the site. Retired NB Power staff were recruited to conduct plant tours and an "Open House" was held. Nearly 5,000 people saw the station first hand during the pre-operational commissioning stages.

EMO, as part of the emergency preparedness plan, has a mandate to continue close communication with local residents. This communication includes regular updating of

[22] Mrs. Harriet Thompson letter to The Beacon Editor, 16 May 1977

[23] Vindasuis 1974

demographic information and regular meetings with the local volunteer wardens. Training is assessed semi-annually or quarterly. There are also periodic exercises to test the system, including annual off-site response tests and occasional mock evacuations.

6.0 MONITORING

6.1 Point Lepreau GS

The Point Lepreau GS is required by AECB and various federal and provincial government regulatory authorities to undertake a number of programs to monitor the effect of the operation on the biophysical and socio-economic environment. The monitoring program includes requirements specified by AECB related to radiation levels in and around the plant, those related to non-radiological effects specified under permits from the Province of NB and those related to the general biophysical environment and recommended by the initial Point Lepreau EARP panel. The monitoring programs associated with AECB permits have been in place continuously; however, other monitoring programs have been lacking. The Lepreau 2 panel report, for example, was critical of certain omissions from the biophysical monitoring program[24]. The Panel felt that transfer of information from Lepreau 1 to the proposed Lepreau 2 operations would have been facilitated by monitoring data. This proved not to be possible in certain areas, as data were not available.

6.1.1 Radiation Levels

Maximum allowable levels of radiation, potentially impacting local residents or workers, are assessed by continual monitoring and sampling of all active plant effluents. Levels observed are compared with Derived Release Limits (DRLs) set by AECB. DRLs represent the maximum allowable amount of radionuclide emissions which are conservatively estimated to result in the maximum permissible individual dose of radiation at the boundary of the station property.

Monitoring of Plant Employees for Radiation Exposure

Several programs are in place to monitor the radiation dose received by plant employees. Every employee wears a thermoluminescent dosimeter which measures exposure to beta and

[24] Minister of Supply and Services Canada 1985

gamma radiation. These dosimeters, which measure cumulative exposure over the period of use, are processed every two weeks. Urine samples from each employee are also analyzed weekly (or more frequently, if required) for tritium. Other more specialized monitors, such as a chair counter and self-serve thyroid monitor, are used as required. As a result of these programs, action is taken to ensure that plant employees do not receive radiation doses above standards set to protect human health.

6.1.2 Community Monitoring

The EMO program was updated (for emergency preparedness purposes) to monitor demographics in the area. The information has not been used for purposes other than emergency response planning. The public information sessions, including scoping workshops, associated with the Lepreau 2 EIA and spent fuel dry canister storage have also served to monitor the levels of community concern regarding the existing operation of Point Lepreau.

7.0 SOCIO-ECONOMIC IMPACTS

7.1 Construction Phase Impacts

The following section describes impacts which have been identified associated with the Point Lepreau GS. Much of the information presented was taken from the Lepreau 2 EIS and the Lepreau 2 Panel Reports.

7.1.1 Labour Force and Accommodations

A brief review of the effects which have been described resulting from construction and subsequent operation of Lepreau 1 are discussed in the following section.

Construction of Lepreau 1 began in 1974, with the plant entering commercial service in January 1983, at a cost approaching $1.45 billion. The project required: 11,000 person-years for on-site management, supervision, engineering, and trades labour; 2,300 person-years for engineering and design; and 1,000 person-years for commissioning.

Construction trade labour, the major direct employment benefit which accrued to the province, costs in the order of $225 million with an overall 85% of labour requirements coming from within NB. Even during the peak construction activity year (1979), 75% of the construction labour force were residents of the Province. Imported labour was primarily required for specialty tasks for which resident experienced workers were unavailable.

The resultant demographic effect within the region is estimated to have been as follows:

- Approximately 30 families moved into the area of the Point Lepreau peninsula during construction.
- 160 single workers lived at the housing camp on-site in 1977, while 300-500 workers lived there during peak construction (1979-80).

- 20-30 men boarded with local residents in the early stages of construction; most left by 1977.
- 10-15 families became permanent residents in the Point Lepreau region as a result of the development.

One impact noted in the area was new housing developments, both permanent residences and mobile homes. In 1975-76, the peninsula and Lepreau-Musquash area reported a total of 107 new building permits. Some existing houses were also vacated during this time, as a result of the migration of families into and out of the community.

The maximum total population influx to the province attributable to project construction is estimated to be in the order of 1,000 persons. For the most part, immigration was concentrated in the Saint John Census Metropolitan Area (CMA), with the remainder distributed over the general southwestern area of the province, between St. Stephen and Saint John. In spite of this influx of workers, the effects on government services in the general southwestern area were minimal, while in large measure economic impacts were deemed to be beneficial. Government services, such as police and fire protection, hospitals, medical clinics, and social services were not unduly strained[25]. The effects on school enrolment in the region served to temporarily reverse a decade of decline and avoided the possible closure of some schools in the general southwestern area.

It has been estimated that the Point Lepreau GS contributed directly and indirectly to the construction of approximately 2,000 dwelling units in the region[26]. During the construction of Lepreau 1, less than 1% of the total construction workforce chose to live in the region of the Point Lepreau peninsula; most non-residents preferred to reside in rental accommodations in the City of Saint John and commute daily to the site.

The Lepreau Generating station was constructed by a variety of unionized and non-unionized labour. The construction phase was plagued by labour strife which resulted in a

[25] Washburn & Gillis Associates Ltd. 1984

[26] Washburn & Gillis Associates Ltd. 1984

longer than anticipated construction period and increased costs. The labour strife can in large part be attributed to import of skilled tradesmen from outside the local hiring areas. The need for imported labour was due to a shortage of skilled labour in the vicinity. This need to import labour and the absence of suppliers of specialized services were the reasons that the predictions of economic benefits to the local areas during the construction phase were not met[27].

7.1.2 Economic Impacts

The direct economic benefits associated with construction of the Point Lepreau GS were less than predicted in the Point Lepreau EIA, due to a shortage of in-province suppliers including trained personnel. A report to the Lepreau 2 panel indicated that the direct potential benefits during construction were restricted due to these factors, while the economic benefits predicted during the operations phase were accurate[28].

The existence of the exclusion zone provided sufficient buffer to eliminate the potential for incompatible land uses immediately adjacent to the site.

Substantial spin-off benefits accrued to New Brunswick, both to manufacturing and service industries. For example, to respond to construction requirements, the Research and Productivity Council (RPC), a provincial research establishment, took on approximately 30 more technicians, engineers, and scientists. After construction, the experience and expertise of these professionals was successfully marketed primarily in the metallurgy and non-destructive testing fields, also providing RPC with the capacity to undertake work related to the pulp and paper industry, off-shore oil and gas exploration, and construction of a CANDU reactor in Korea. These capabilities would not have been developed without the opportunity afforded by the Point Lepreau GS to acquire new skills.

[27] Mallet, 1984

[28] Mallet 1984

Another direct benefit has been the establishment of a chair in Nuclear Engineering at the University of New Brunswick, consisting of two full-time faculty members. Nuclear research programs are offered to graduate and undergraduate, local and international students (e.g., from Romania) in chemical and mechanical engineering.

7.1.3 Government Service Impacts

Government service impacts were virtually negligible in Charlotte County (to the west of the plant) and the City of Saint John. In the former case, the population influx was sufficiently dispersed that no undue strain was placed on any one location. In the latter case, the range and volume of the services available in the metropolitan area easily absorbed all potential impacts.

7.1.4 Municipal Finance

A community's ability to raise revenue is directly related to its assessment base and tax rate. Lepreau and Musquash Parishes (local subdivisions of Charlotte and Saint John Counties) experienced significant increases (greater than 10%) for all years between 1974 and 1981, with the exceptions of Lepreau in the 1976-1977 period and Musquash in the 1978-1979 period. The dramatic increase in the Musquash Parish ($37.4 million) for the interval 1977-1978 is due to the initial assessment of GS buildings. Both Lepreau and Musquash exhibited increases above normal for rural Parish tax bases, which is attributable to activities related to the Point Lepreau development.

During the construction phase, property values in the Point Lepreau and Charlotte County areas do not appear to have been affected. However, in the Saint John CMA, particularly East Saint John, housing prices increased dramatically (approximately 25% appreciation per annum) during the 1974-1978 period, with overall sales volumes peaking in the latter year. Normal rates of appreciation would have been in the order of 7-8 % for these areas. Beginning in 1979, prices began to fall off and market listings reached a peak in 1982, causing a severe depression in property values, which began to return to a normal balance in late 1983. Although this property value cycle correlates closely with construction activity, the results should be interpreted with caution, as precisely during the same periods the housing market throughout North America was experiencing similar dynamics due to poor economic activity and high mortgage rates. It is likely that the initial price appreciation was due to project construction; however, the fall in property values was probably due to high interest rates.

7.1.5 Transportation Impacts

Route 1 links the Bay of Fundy coastal communities from St. Stephen to Saint John as well as the urban centres of Sussex and Moncton to Saint John. This route serves as a main trunk service and is a two-lane all weather road, with the exception of a four-lane portion between Musquash and Saint John.

Route 790 is a two-lane, all weather road which serves as a collector road from the Point Lepreau area communities of Little Lepreau, Maces Bay, Dipper Harbour, and Chance Harbour. During the construction of the Point Lepreau GS, this road was realigned to by-pass Little Lepreau and directly intersect Route 1.

During the construction phase of Point Lepreau, traffic volumes on Routes 1 (between Lepreau and Saint John) and 790 increased substantially. A comparison of the historic Annual Average Daily Traffic (AADT) with the Point Lepreau peak construction years (1979-1980) shows an increase (8.8%) above the normal percentage annual increase in the province (3.6%). A sharp decline was recorded after 1980, reflecting the reduction in construction traffic related to the plant site. However, this must be evaluated with caution, as no data previous to 1979 are available.

Traffic volumes in several selected study locations exhibit peaks in 1979 and 1980, with reductions occurring in 1981 and 1982. Therefore, these AADT increases can reasonably be attributed to vehicular activity related to Point Lepreau GS construction activity.

Traffic volumes remained higher during plant operation than was previously recorded before construction began.

7.2 Operation Phase Impacts

The construction of the Point Lepreau GS resulted in opportunities for several local and regional industries. These industries, including general services such as snow removal, established or expanded during the construction phase and many have continued until the present. In addition to general services there have been a number of industries which have increased capabilities to meet the requirements of the nuclear industry. Nb Power spends approximately $30 million annually in the local (southern NB) area[29]. This estimate is made up of approximately $20 million in annual salaries and $10 million in services. The services contracted include mechanical and electrical contractors and inspection services. Specialised services in inspection (particularly non-destructive testing) were developed by the Research and Productivity Council in Fredericton in response to requirements of the Lepreau GS.

The socio-economic concerns associated with the operation of the facility have been addressed by a combination of efforts of NB Power and EMO. The emergency response plan has been continually refined and upgraded.

While very little in the way of specific biophysical monitoring data exists, the traditional fisheries have continued in the area with little apparent effect which could be attributed to the operation of the Lepreau Generating Station.

NB Power has made it a policy to where possible train residents of New Brunswick so as to enable them to take advantage of employment opportunities at Lepreau. The upgraded capabilities of NB Power, with respect to training of operators and the technical requirements of Point Lepreau, have developed opportunities to export training to various countries. This continues to assist the Province economically, based on export of services, particularly in light of the excellent performance of the existing Point Lepreau facility.

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[29] NB Power purchasing estimate, 1993

8.0 RECENT COMMUNITY CONCERNS

Public attitudes concerning Point Lepreau are generally more positive today than earlier in the project's history. The excellent operation record of the plant and continuous public information efforts undoubtedly have had a favourable impact on public acceptance.

The situation during the Lepreau 2 EIA was very different for that which prevailed during the heavily attended public hearings, which preceded the building of the Point Lepreau GS. During the hearings for Lepreau 2, very few members of the public attended; a local antinuclear group boycotted the process primarily because of concerns regarding the mandate of the Panel which did not include consideration of the role of nuclear power in Canada's energy supply mix; and the assessment panel endorsed the building of the Lepreau 2 project. The comparatively low public input at the public meetings was discussed in the report of the Environmental Assessment Panel. The panel recognized the low turnout and suggested reasons for the low numbers, including: lack of major concerns among local people about the operation of the existing facility; scepticism regarding the review process; reluctance to speak in public; and the boycott by an antinuclear group[30].

Public Reaction to Dry Canister Storage Facility

In the late 1980s, NB Power proposed to construct spent fuel dry storage canisters at the Point Lepreau GS. Up to this point, spent fuel bundles had been stored underwater in a large pool in the plant's spent fuel bay. However, this facility was anticipated to be full in 1992, sooner than was originally expected.

In 1988, the NB Department of Municipal Affairs and Environment granted NB Power approval to proceed with the proposed dry canister development, conditional on full public disclosure of details of the proposal. Public meetings were held in 1990 with AECB and NB Power staff to gauge public concerns regarding this facility and provide accurate information

[30] Minister of Supply and Services Canada 1985

to local citizens regarding the development. Public concern was raised concerning the lack of a formal EIA related to this development. In response to comments from a local environmental coalition, the New Brunswick Conservation Council, and the AECB held a meeting in Saint John to discuss the matter of dry canister storage. As well, a series of scoping sessions was held in the local area to solicit comment from the local public.

In their memorandum recommending approval of the facility, the AECB stated:

> "On the basis of public reactions at the meetings observed by the AECB, media reports and articles, and direct written representations AECB staff conclude that public concern about the (dry storage) proposal is not such that a public review is desirable."

Thus, the proposal was approved and was not referred to the federal Minister of the Environment for a full EIA. Since that time, no level of public concern has been raised regarding this development which would indicate that the decisions of either the provincial or federal regulatory agencies were in error.

9.0 CONCLUSIONS

Recognizing both the concerns regarding employment discussed in 4.0, NB power and the Province of New Brunswick took a number of steps to avoid these problems with proposed Lepreau 2. First NB Power entered into discussions with local representatives to attempt to ensure labour peace during the course of construction of Lepreau 2. NB Power and the Province of NB also undertook to commence training programs for construction personnel in advance of the construction of Lepreau 2. The accelerated training programs were discontinued following postponement of Lepreau 2, however operation training continued.

Experience with the construction of Lepreau 1 demonstrated that problems with the human system could easily overshadow the technical and physical complexities of the project. Lepreau 1 has had an impact on a large land area in Saint John and Charlotte Counties, although the actual development site is located in Saint John County. It appears that some residents of Charlotte County have been under the impression that while they share the risks of Lepreau 1 equally, they do not share the tax revenues from the plant. During the public meetings for Lepreau 2 it was learned that all tax revenues generated by Lepreau 1 are collected by the province, and redistributed according to formulas aimed at responding to needs in each area.

In small communities such as those surrounding the Lepreau site, the influx of large numbers of workers can disrupt traditional lifestyles and existing social networks. This may be either positive or negative depending on the individual's perspective. An increase in housing development, the construction of a new road in the area, and the existence of a large exclusion area around the plant close to their communities, are among a wide range of impacts connected with Lepreau 1 which have affected local residents.

The Environmental Assessment Panel for Lepreau 2 noted that the positive benefits of large projects are generally widespread, whereas any negative effects are generally very localized. Consequently, local people need the support of the Proponent in their effort to mitigate these adverse effects.

The apparent low level of concern in the local population associated with the operation of the facility, which has been referenced may be attributed to (1) the effective operation of the facility; (2) the use of local residents in the facility; (3) continued public information effort by NB Power in the area and (4) the continual refinement of the EMO emergency response program which necessitates extensive local contact.

The construction of the Point Lepreau Nuclear GS did not result in the level of benefit to the local or provincial work force or business community which was anticipated by NB Power or the provincial government. Neither labour nor business were in a position to take advantage of many of the opportunities offered by the project. The situation can be attributed to a lack of training on the part of labour and lack of specialization on the part of business. Labour strife during construction was one result of the absence of the levels of benefits.

The primary conclusion which can be drawn from this is the necessity for careful evaluation of the requirements from labour and industry prior to committing to direct project benefits from large capital projects. NB Power and the provincial government, recognizing the problems with the opportunities for local involvement, planned an intensive program of training prior to the construction of Lepreau 2 so as to ensure local benefit. NB Power also had extensive discussions with local union representatives in an effort to avoid the level of labour strife evidenced during construction of the first unit.

While the local benefits during the construction phase were less than anticipated, the benefits which accrued during the operation have been in line with those anticipated. This can be attributed to a clear understanding by NB Power of the requirements and the lead time between the initiation of the project and the operation of the facility. NB Power used this lead time to ensure the local and regional residents had the opportunity to receive training for the operation of the facility.

The construction and operation of the Lepreau Nuclear GS did result in opportunities for certain New Brunswick industries. These opportunities were recognized and both local and regional companies were either created or expanded to meet requirements. The New

Brunswick Research and Productivity Council for example expanded the range of testing facilities to meet requirements of Point Lepreau. Local firms have benefited through opportunities for electrical and mechanical contracting and general services. In addition, the operator training which has been put in place by NB Power has allowed CANDU operators to be trained in New Brunswick and NB Power personnel to offer services to other countries.

As discussed in earlier sections of this report, NB Power, early in the planning for the Point Lepreau GS, moved to an open public information program. The goal of this program was to address concerns of local residents and residents of New Brunswick. The information program served to ensure communication between NB Power and the community so that problems could be recognized and dealt with in a timely manner. The information program does not guarantee that problems will not arise, however it will facilitate the acceptance of the project by the local populace.

The project has resulted in the preparation of an emergency preparedness plan for the area which is a model for other similar projects. This plan has been prepared and is under the control of the provincial government Emergency Measures Organization. The evolution of the plan and the continued contact with the local population as part of the ongoing application of the plan has assisted in gaining confidence of the local populace.

10.0 RECOMMENDATIONS

Based on the experience gained by the construction and operation of the Point Lepreau Generating Station, a proponent of a project similar in scope (or level of concern) should:

1) ensure that affected stakeholders have a clear understanding of the undertaking

2) ensure that the proponent understands the labour requirements for the proposed undertaking and the potential for meeting these requirements in the local area.

3) develop mechanisms for effectively communicating the project to stakeholders

4) determine where input from other stakeholders (i.e., local residents) is to be sought and ensure mechanisms are in place to facilitate this input and demonstrate to the stakeholders that the input has been considered

5) establish a program to monitor the effectiveness of communications systems and ensure that this program is sufficiently flexible to reflect local concerns in a timely manner.

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