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LEPREAU 2

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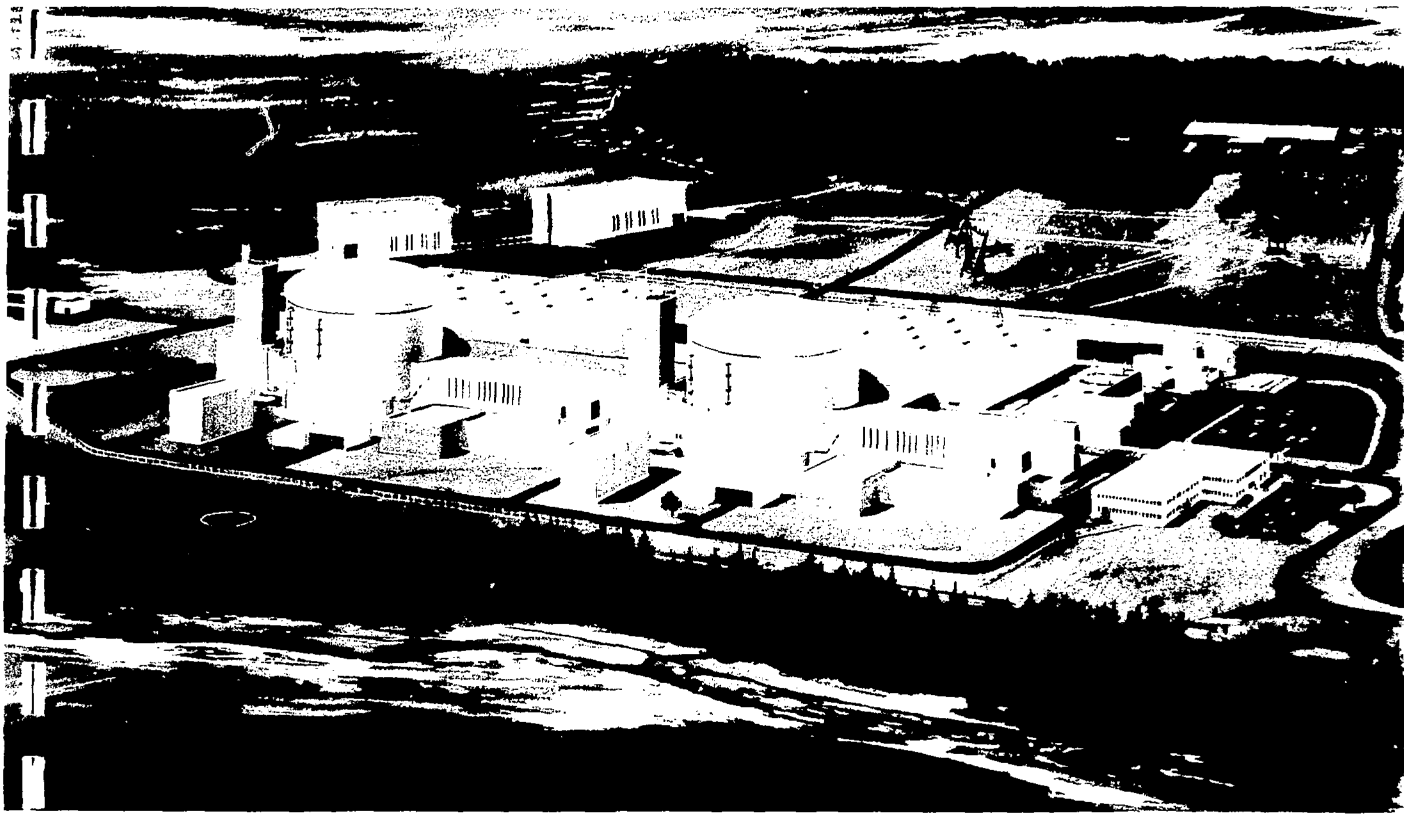
Environmental Impact Statement

SUMMARY



Prepared for

Maritime Nuclear

by

WASHBURN & GILLIS ASSOCIATES LTD.

in association with

SENES CONSULTANTS LIMITED

and

DPA CONSULTING LTD.

May, 1984

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WASHBURN & GILLIS ASSOCIATES LTD
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1984 05 29

Dr. P.R. Cote
General Manager
Maritime Nuclear
P. O. Box 7000
Station A
Fredericton, New Brunswick
E3B 5G4

Dear Dr. Cote:

We are pleased to submit a Summary of the Lepreau 2 Environmental Impact Statement. The report has been designed to address the guidelines issued to Maritime Nuclear by the Environmental Assessment Panel. The summary contains a brief description of the project and outlines our findings.

Although this project has been a joint undertaking of Washburn & Gillis Associates Ltd. in association with SENES Consultants Limited and DPA Consulting Ltd., the project team was assisted by a number of specialists from various firms. Material for several sections of the Environmental Impact Statement was provided by NB Power. A list of the specialists and their contributions follows this letter.

Yours very truly

Owen V. Washburn
President

OVW/ldl
Encl.

CONTRIBUTORS TO THE REPORT

The consulting team for this project was drawn mainly from the staffs of Washburn & Gillis Associates Ltd., SENES Consultants Limited and DPA Consulting Limited. NB Power was responsible for final report reproduction and provided a number of sections of the report. These include:

- Description of the Proposed Unit
- All section on Radioactivity
- Community Cohesion and Lifestyle
- Decommissioning
- Transportation and Long-term Disposal of Used Nuclear Fuel
- Emergency Planning

Major contributions were received from Atomic Energy of Canada Limited for the preparation of the sections of the Environmental Impact Statement on Safety Analysis and Decommissioning.

The consulting team was augmented by a number of specialist consultants. These included:

- Professor Ken Burke (Geology)
- A. H. Jackman (Nuclear Engineering)
- Water Management Services Limited (Groundwater Hydrology)
- Keith Philpott Consulting Limited (Oceanography)
- Drs. P. W. Wisner and J. E. Edinger (Thermal Plume Modelling)
- Helm Associates Ltd. (Construction Impacts)

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SUMMARY

1.0 INTRODUCTION

Maritime Nuclear, a joint undertaking of the New Brunswick Electric Power Commission (NB Power) and Atomic Energy of Canada Limited (AECL), proposes to construct a second CANDU 600 MW nuclear powered generating unit at Point Lepreau adjacent to the existing Lepreau 1 unit. It is currently planned that construction will start in late 1985 and the new unit will enter commercial service in the very early 1990's to meet electricity demands in the New England market. The second unit will be similar to the Lepreau 1 design. Initially, electricity from this second unit will principally be exported to the New England States, and will later be used domestically.

Federally-funded project feasibility studies initiated by Energy, Mines and Resources Canada are now underway and hence the project falls under the umbrella of the federal Environmental Assessment and Review Process (EARP). Due to the substantial implications of the project to the Province of New Brunswick and the existence of a similar environmental assessment process in the province, a joint federal-provincial Review Panel was established to undertake the review and to report to the Ministers of Environment of the two levels of government. This summary has been prepared in response to guidelines issued by the Review Panel.

2.0 PROJECT DESCRIPTION

Point Lepreau Generating Station Unit 1 commenced operation in January 1983. The second unit will be of the same design, and will include an additional reactor building, service building and turbine hall, adjacent to the Unit 1 complex.

The reactor will be of the CANDU type, utilizing heavy water as the primary coolant and moderator. The CANDU reactor is fuelled with natural uranium, in the form of uranium dioxide. The reactor holds 4,560 fuel bundles, each containing 18.5 kg of natural uranium. During normal operation, each unit uses about 110 bundles per week. Neutron absorbing units, both solid and liquid, control the power output of the reactor. Two independent systems ensure reactor shutdown when necessary. One uses gravity-operated shut-off rods, and the other injects a liquid neutron absorber (poison) into the moderator.

The primary heat transport system circulates pressurized heavy water through the reactor fuel channels to absorb the heat produced by fissioning uranium fuel. The heavy water then passes through the steam generators, where the heat boils ordinary water. The resulting steam drives the turbine generator set.

The reactor is controlled by a dual computer regulating system, with one computer controlling the station. If this computer fails the other computer automatically takes over. If unsafe operating conditions are ever detected the protective systems will shut the reactor down, using either of the shutdown systems mentioned above.

The electrical generating equipment, power supply and distribution systems are similar to those for conventional thermal power stations. However, extra standby power systems are incorporated to maintain the nuclear systems in a safe condition should abnormal operating conditions be experienced.

Most of the water needed (to cool the reactor, to condense the steam leaving the turbine and for general plant use) will be taken from the Bay of Fundy, passed through the equipment once, and then discharged to the Bay. The intake and outfall are designed to minimize the number of aquatic organisms entering the system and damage to the system. The cooling water temperature will rise in passing through the station. The outfall has been designed to dissipate this heat with minimum biological damage to life in the Bay. The intake and outfall structures built for Unit 1 are large enough to handle the flows for both Units 1 and 2. An additional pumphouse is needed for Unit 2.

The radioactivity generated at a plant of this type has been carefully assessed. Operation of Unit 1 to date has shown that the radioactive releases are orders of magnitude below the levels permitted by the Atomic Energy Control Board (AECB). Similar controls will be exercised for Unit 2. All air exhausts will be filtered and treated before release and the effectiveness of the system will be continuously monitored. Liquid wastes which might be radioactive will be collected, tested and treated before discharge.

Separate, used fuel bays will be provided for Unit 2, where the used fuel will be stored under water until it is transferred to off-site storage or reprocessing facilities. Other solid radioactive wastes will be stored in concrete vaults at the site.

All environmental and radioactivity regulations set out under provincial and federal laws and international guidelines to protect public health and safety have been examined, and this project is being designed to fall well within the regulations thereby established.

3.0 ISSUES OF CONCERN

Input from the public, government agencies, industry, labour, and the scientific community obtained in a scoping process which included local open-house meetings, a workshop in Saint John, and private written submissions, was employed by the Environmental Assessment Panel to identify six priority issues:

1. Impacts on Biological Environment
2. Impacts of Radiation on Humans
3. Impacts on the Socio-Economic Environment
4. Monitoring
5. Emergency Planning, and
6. Decommissioning.

The guidelines set out by the Environmental Assessment Panel outlined the scope and manner requested for addressing these issues.

4.0 FINDINGS

4.1 Impacts on the Biological Environment

4.1.1 Radionuclides

The focus of concern vis-a-vis effects of low levels of radioactivity released from nuclear power plants has been to assess effects on man. The underlying premise is that if adequate protection is offered to individuals working in the plant and living in proximity to the plant, then other species of biota will be adequately protected. This premise is based on assessment of effects of radioactive releases on biota adjacent to sources of radiation throughout the world.

The monitoring programs in place under the direction of the Bedford Institute of Oceanography, as well as those conducted by NB Power, will continue to assess effects on biota adjacent to the plant.

4.1.2 Sewage Discharge

During the construction phase of the proposed facility, the on-site construction work force may reach a peak of approximately 1,500. Upon completion of construction, the combined full-time staff for the Lepreau 1 and 2 Stations will be about 600. Sanitary sewage generated by construction workers and full-time staff on the site will be routed, via a separate sewage system, to the existing extended aeration sewage treatment plant which presently serves Lepreau 1. This sewage treatment plant has been approved as adequate to treat the sanitary wastes from both units. The treated effluent which will be discharged to Indian Cove, on the west side of Point Lepreau, will meet provincial standards for treated sanitary sewage.

Discharge of treated sewage is anticipated to have no adverse impacts on the receiving marine environment in light of the high degree of flushing which occurs in Indian Cove due to tidal action and the high degree of natural oxygen present in the Bay of Fundy. Bacteriological constituents in the effluent, which normally occur in effluent from all sanitary sewage treatment plants, will undergo rapid natural dieoff. Current patterns in the vicinity of the outfall will be generally offshore.

It is anticipated that the project will not result in a significant increase in housing in the surrounding unincorporated areas. In order to avoid potential increases in bacteriological contamination, for any developments which do occur, regulatory authorities must ensure that applicable provincial standards for construction and operation of domestic sewage treatment facilities are followed and that contamination of shellfish areas does not occur.

4.1.3 Heavy Metals

Chemicals which will be used during the operation of the proposed Lepreau 2 Generating Station do not include any which can be considered heavy metals. Therefore, there will be no discharges from the facility of heavy metals to the receiving environment.

4.1.4 Organic and Inorganic Compounds

A variety of organic and inorganic compounds will be used at the proposed facility, primarily in the treatment of raw fresh water for its subsequent usage as potable supply and as boiler feedwater. Organic compounds will be used in the water treatment system as coagulating agents to remove undesirable constituents from the raw water. The organic compounds will form a sludge which will be deposited in lined lagoons and consequently will not be released to the natural environment.

Oil used for lubrication purposes will be separated from plant drainage water in specialized sumps. This oil will be periodically removed from the plant site, and will not be discharged to the environment.

Inorganic compounds will be used at the facility primarily for the treatment of boiler feedwater. These inorganic compounds will dissociate to form inorganic ions which, when discharged at low levels of concentration, will be innocuous and will have no adverse effect on the natural environment.

4.1.5 Entrainment and Impingement

The operation of the proposed Lepreau 2 plant requires that quantities of water be drawn from the Bay of Fundy and passed through the plant in order to remove excess heat from the reactor. The water is passed through screens before entering the reactor in order to prevent debris from entering the reactor. Any organisms drawn into the plant along with the water are said to be entrained. The action of organisms striking the screens is called impingement.

The effect of both entrainment and impingement on aquatic life in the Bay of Fundy and near Point Lepreau has been assessed. The assessment focused on determining effects on small organisms (phytoplankton and zooplankton, which ultimately provide food for the important fish stocks) and various ages and species of fish which make up the important commercial fish stocks.

The assessment considered several factors, including the volumes of water expected to be used to cool the plant relative to the volume moving in and out of the Bay together with the exchange of water associated with the currents and tides in the vicinity, and the fish habitat and densities of small weak-swimming or non-swimming organisms (phytoplankton, zooplankton and larval fish) reported in the vicinity. The Bay of Fundy and the Point Lepreau area have very high tides and strong currents which result in continual replacement of water masses and organisms in the vicinity of the plant. Weak-swimming or non-swimming organisms are moved into and out of the area with every tide. Also, most of the important fish species harvested commercially in the area do not spawn (reproduce) in the immediate vicinity of Point Lepreau. The spawning grounds for these species are elsewhere in the Bay of Fundy or outside the Bay. Species which may spawn in the Lepreau area, for example certain species of flatfish, also spawn in many other locations along the coast. Very few larval fish (newly hatched fish) were reported from sampling programs conducted in the vicinity of Point Lepreau. These sampling programs also reported low numbers of plankton in the vicinity. The assessment concluded that the effects of operating the plant on stocks of these organisms in the Bay would be too small to be measurable.

The cooling water will be withdrawn from the Bay through an intake structure located 10 m below mean low tide, and some 600 m offshore. This intake has been specifically designed to avoid capture (entrainment) of larger fish. Operation of the Lepreau 1 plant, which uses the same facility, suggests that very few larger fish are taken. The analysis of effects on larger fish indicates that the effect of operating the Lepreau 2 cooling water system would not be measurable on the fish stocks in the Bay.

4.1.6 Effect of the Thermal Plume

Water taken from the Bay to cool the reactor will have a higher temperature on leaving the plant. During the cold months, when low cooling water flows are used, the temperature of water leaving the condenser may be as high as 26°C above the temperature in the Bay. During warm months, with higher flows, the temperature on leaving the condenser will be 13°C above the temperature in the Bay. The heated water is discharged into the Bay offshore through an outfall structure which is designed to quickly mix the heated water with the receiving water in the Bay. The mixing caused by the outfall, coupled with the amount of mixing in the vicinity of the structure due to currents and tides in the area, will result in a thermal plume (area with temperatures higher than 3°C above the bay temperature) with an area less than 6 hectares in both the warm and cold months.

The effect of the warm water on populations of organisms in the vicinity of the outfall will be slight due to several factors. First, the movement of water near the outfall will result in continued replacement of drifting organisms in the vicinity. Secondly, the warm water will rise off the bottom, and will have very little contact with communities of organisms living on the bottom. Also the actual temperature increase should not be sufficiently large to significantly affect communities of drifting organisms.

The warm water will at times contact the intertidal area (shore area between high and low tides) and could affect the extensive growth of plants which are in this area. Analysis of the anticipated temperature increases and the response of these plants to such increases suggest that, if anything, there may only be a slight increase in growth of these plants.

4.1.7 Cumulative Biological Effects

In considering biological effects, it is concluded that Point Lepreau is an excellent site for a generating station such as that proposed. Lepreau area provides neither critical spawning nor nursery habitat for the commercial fish stocks. The amount of water movement in the vicinity results in continual replacement of organisms which do reside in the area.

The cooling water system, which would be shared with Lepreau 1, was designed with state-of-the-art technology, and located so as to limit entrainment of fish and to maximize dispersion of thermal effluent. Both its design and locale were approved by Fisheries and Oceans Canada.

These factors tend to minimize any effects on the biological communities in the Lepreau area and in the Bay of Fundy.

4.2 Releases of Radioactivity to the Environment

During the normal operation of the unit, small quantities of radioactivity will be released to the air and to the Bay of Fundy. Release limits are established, applied, and monitored at the source of radioactivity. These are known as Derived Emission Limits (DEL's). Limits for radiation doses to individual members of the public, and to the total population within a defined area, are set by the AECB. Population density and meteorological conditions have determined that at Point Lepreau the individual dose is more important and the DEL's are determined for a "critical group" which receives doses higher than the average of the general population.

For both gaseous and liquid emissions, DEL's are calculated by: identifying the major pathways for the source to man; identifying the critical group for each pathway; determining the concentration of each radionuclide which could result in the annual dose limit to a member of the critical group; and determining the continuous emission rate which will maintain this concentration at the exclusion area boundary. Pathways and critical groups are quite different for gaseous and liquid emissions, as are the DEL's. The values for different pathways are sometimes combined so that individuals who conceivably could belong to more than one critical group do not exceed the annual dose limit.

For example, at Point Lepreau there are two important liquid effluent pathways, internal exposure from the ingestion of contaminated seafoods and external exposure from contaminated shoreline sediments and seaweeds. The critical group for internal exposure is local fishermen and their families, and for external exposure is clam diggers and dulse gatherers. It is possible in this instance for an individual to be a member of both critical groups.

With the addition of a second unit at Point Lepreau, the DEL's would become site limits rather than unit limits as they now are for Lepreau 1. Also, the DEL's will be revised before a second unit enters service, firstly, because dilution assumptions for liquid effluents can now be verified using operational data, and secondly, because a "Standard for Deriving Emission Limits" is expected to be published in 1984.

Representative operating data for a six-month period at Lepreau 1 indicate that the gaseous emission was 0.0042 per cent of the DEL, and the liquid was 0.0024 per cent of the DEL. These correspond to an annual radiation exposure to the most exposed members of the local population of about 0.2 µSv* (microsievert) and 0.1 µSv, respectively, compared to a natural background level of about 2,000 µSv per year.

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* A sievert (Sv) is a unit of radiation dose equivalent and is numerically equal to the absorbed dose (in Joules/kilogram (J/kg)) multiplied by various factors which take into account the type of radiation in respect to its relative potential for doing harm. A µSv is one-millionth of a sievert.

As longer-lived radionuclides reach equilibrium, with maturation of the plant, emission rates are expected to increase about 20-fold over the indicated levels. This would be doubled with a second unit reaching maturity, resulting in additional radiation exposure of about 12 μSv/year, or about 0.6 per cent increase over background. This may be compared with a 10 per cent variation in natural background between areas a few kilometres apart in the Lepreau area.

There are two potential health risks from exposure to radiation, an increased probability of contracting a fatal cancer some 10 to 20 years after the exposure, and an increased chance of serious hereditary ill-health in offspring conceived by an exposed parent.

For the general population, the current risk of dying of fatal cancer is about 20 to 25 per cent, and this risk would be increased by less than .001 per cent, or one chance in 100,000, for the most exposed person in the vicinity of Point Lepreau. This is equivalent to the fatal cancer risk attributable to smoking one cigarette per year. A change in risk of this magnitude is statistically insignificant and cannot be detected by a monitoring program.

The risk of serious hereditary ill-health occurring in the first two generations following the exposed parent is about the same as that for cancer (i.e., 1 in 100,000). This is very small when compared to the six per cent incidence of genetically-founded serious ill-health now occurring in the general population.

4.3 Impacts on the Socio-Economic Environment

4.3.1 Employment

Construction Phase

The construction phase of the project will generate 7,800 person-years (i.e., the employment of one person for one full year) of on-site work. Of this total, approximately 5,800 person-years will be for construction trades and contractors' administrative overhead, 1,450 person-years for site management and supervision, and 550 person-years for commissioning the facility.

A precise breakdown of workers on site, by three-month period, is not yet available. However, construction activity is expected to peak in 1988 with 1,636 construction workers on site.

Project Office

A project dedicated engineering office will be established in Fredericton to undertake plant design and purchase of equipment and materials for Lepreau 2. The exact number of staff and skill requirements have not been finalized. However, it has been assumed that approximately 2,100 person-years spread over the project period will be required. It has further been assumed that 66 per cent of this total will be based in Fredericton, with most of the remainder in Ontario. It has been assumed that up to 150 persons will be hired from outside the Fredericton region to assist in staffing the project office, while the remaining staff will be hired locally.

Operation Phase

Approximately 220 people will be required to operate the plant. Lepreau 2 will be operated by NB Power under contract to Maritime Nuclear who will maintain a corporate office in Fredericton consisting of approximately 50 persons.

Multiplier Effects

Spin-off employment effects have been estimated using a computer model. Spin-off employment represents employment generated by project expenditures during construction and operation but not directly used by the project. The results are expressed in person-years.

The construction activity in New Brunswick will create approximately 10,000 direct person-years and 7,500 spin-off person-years of employment. An additional 15,200 person-years of spin-off employment will be created elsewhere in Canada, a substantial portion of which (13,600 person-years) will be in Quebec and Ontario where the majority of the materials will be purchased.

Spin-off employment effects of the plant operation would be in the order of 1,200 person-years. New Brunswick would be the location of 270 direct operation jobs and should expect approximately 285 additional person-years of work due to respending and purchases.

4.3.2 Economic Effects

Economic effects of project expenditures were also estimated using the model. Spin-off effects have been calculated for the Province of New Brunswick and other regions of Canada. The discussion below includes direct plus all spin-off effects.

Construction Phase

For the purposes of the analysis, a total construction expenditure of $1.05 billion ($1983) was used. This was spread over the 1985-1989 period to facilitate data entry to the model. The total effects on New Brunswick manufacturing activity (Value of Shipments) would amount to approximately $2.4 billion, or about 57 per cent of the Canadian total of approximately $4.2 billion.

The total Canadian value of goods and services produced (Gross Domestic Product at Factor Cost) in the construction phase is estimated to be in the order of $1.4 billion, of which approximately $810 million will remain in the Province of New Brunswick.

Operation Phase

Once operation of the plant has begun, the multiplier effects on manufacturing activity will result in an increase on an annual basis of $45 million in New Brunswick. Total value of goods and services produced in Canada would be expected to increase by $210 million, of which approximately 81 per cent or $171 million, will remain in the Province of New Brunswick.

4.3.3 Potential Industrial Spin-Offs

With non-labour construction purchases from within New Brunswick estimated at $208.5 million, the project will have a considerable impact on materials and services suppliers in the province. Many non-labour construction purchases can be obtained within New Brunswick without placing strain on the suppliers. These include aggregate, concrete, structural steel, prefabricated building materials and metal pipes and fittings.

Preference for procurement of goods and services will be directed to New Brunswick suppliers. Within the province, no one region will be given priority over another. Therefore, it is not possible to determine the distribution of benefits to the various parts of the province. However, since the Saint John area contains a large portion of the manufacturing base of the province, it would appear reasonable to conclude that many benefits will be realized by this area. Nevertheless, all other areas of the province also could stand to benefit (dependent upon the level and type of manufacturing activity and the supplier's competitive prices, quality, delivery guarantees and other related factors).

Operation Phase

An estimated $80 million will be spent annually on goods, services, wages and salaries to operate Lepreau 2. Approximately 42 per cent of these expenditures will occur in the province.

As with construction-related expenditures, many of the operating phase benefits will be realized within the Saint John area.

4.3.4 Community Services and Structures

Social effects depend largely upon requirements for imported labour. Presently, unemployment rates in the area are high and are likely to remain so. Therefore, the majority of the total workforce can be obtained from the local labour pool. The impacts on community services are thus not anticipated to be significant.

4.3.5 Community Cohesion, Lifestyles

Experience with the construction of Lepreau 1 demonstrated potential community concerns to do with traffic flows, housing, employment opportunities, recreation facilities, stress on local services, effects on property values and particular construction actions such as use of explosives dynamiting and landing of equipment by sea. All of these concerns are related to lifestyle of the communities in the Lepreau area. Experience with Lepreau 1 has also shown that with consultation and a strong community liaison program some of these concerns can be eliminated and others can be mitigated to the extent that community disruption is minimized.

The existence of Lepreau 1 will help to focus the discussions and facilitate communications with regard to community concerns over Lepreau 2. The construction and operation of a second unit will produce less significant changes to the communities than did the first unit. The most effective way of ensuring that community concerns are identified and acted upon expeditiously is the establishment of a community liaison office and an ongoing consultation program. By this means, impacts on the community and its lifestyle can be identified and resolved throughout project construction.

The prior existence of the Lepreau Parish local service district and the evolution of an Advisory Committee to the Minister of Municipal Affairs for the Musquash Parish local service district will enable local communities and Maritime Nuclear to negotiate a comprehensive consultation plan and specific remedies to community concerns.

4.4 Monitoring

4.4.1 Biological Environment

The effects of combining the condenser cooling water system from Lepreau 2 with the existing Lepreau 1 System have been determined not to be significant with respect to the environment in the vicinity of Point Lepreau or in the Bay of Fundy in general. This is due to the absence of particularly sensitive or restricted habitat and the dynamic nature of the bay in the vicinity of Point Lepreau. The Bay of Fundy system near Point Lepreau may be defined as an open ocean system in terms of circulation patterns, exchange rates and dynamics of biological communities. In view of this, it is not considered to be possible to design a monitoring program with sufficient sensitivity to detect the effects of operating the condenser cooling system on the biological systems outside the environs of the plant, and as such no monitoring of these systems is recommended.

4.4.2 Radioactivity

A number of radiation monitoring programs are required for the operation of Lepreau 1. The pre-operational monitoring program and the operational monitoring program for Lepreau 1 both serve as baseline programs for Lepreau 2. In these programs, radiation in a number of environmental substrates including air, well water, sea water, marine sediments, seafood and milk have been monitored. The operational monitoring program for Lepreau 1 has not shown increases in environmental radiation over those values found in the pre-operational monitoring program.

A baseline radiation monitoring program in the Lepreau area is also being undertaken by the Bedford Institute of Oceanography (BIO). This program has the objective of measuring the transport and accumulation of radionuclides in the environment. The program began in 1979 and will continue for at least another five years.

Workers in an operating nuclear plant are monitored for possible exposure to radiation. Programs for monitoring workers include the wearing of film badges which are processed every two weeks, the analysis of urine samples on a weekly basis, and less regular monitoring programs using special detectors such as a self-serve thyroid monitor.

4.4.3 Socio-Economic Environment

It is proposed that a community impact monitoring committee be set up with representatives from local service districts, the New Brunswick Department of Municipal Affairs, the Lepreau 1 Generating Station and senior construction management for Lepreau 2. The committee would have the function of identifying and resolving issues arising in connection with the construction of Lepreau 2. The detailed goals and responsibilities of the committee could be arrived at by mutual agreement.

4.5 Emergency Planning

Emergency planning for the Point Lepreau 2 Generating Station has been largely determined by arrangements set up for Lepreau 1. The on-site contingency planning is conducted by NB Power under licence from AECB. Off-site emergency planning and control is coordinated by the New Brunswick Emergency Measures Organization (NBEMO) through the authority of the Emergency Measures Act. Emergency plans and their interfaces are exercised on a periodic basis.

Off-site emergency planning was initiated in 1976 for Lepreau 1 and, by 1980, had included an extensive demographic survey within twenty kilometres of the Generating Station as well as a community participation program. On December 28, 1980, the On-Site Contingency Plan was approved, and by May 6, 1982 the Off-Site Emergency Plan was approved.

Both the on and off-site emergency plans are based on a hierarchy of emergency action levels which clearly define the response patterns and responsibility centres. The plant Shift Supervisor's requirement to notify NBEMO promptly in a radiation emergency is documented in the plant contingency procedures and in the off-site plan. Other features of the off-site plan include a unique community warden system for emergency public assistance, a siren alerting system (currently under evaluation), the pre-distribution of potassium iodide; and the placement of emergency response guides in Point Lepreau area communities.

Nuclear operations personnel are thoroughly trained and exercised in emergency response procedures. Construction workers' response to an on-site contingency at Lepreau 1 would be modelled after procedures established at other nuclear construction sites in Canada. The public response would be directed through the immediate cooperation of the broadcast media and would follow procedures published in the emergency action cards placed in all Point Lepreau area households. A telecommunications network connects the media to NBEMO via the New Brunswick Information Service and auxiliary public notification systems have been established. The extent of public protective measures would be determined by the specific circumstances of the plant event and environmental conditions rather than strict geographical considerations. A second nuclear unit would not increase the potential geographical scope of the nuclear event.

Maritime Nuclear would likely engage NB Power to operate Lepreau 2 and does not envision difficulty in adapting existing plans and procedures for the second nuclear unit. A common contingency response team would respond to events at either Lepreau 1 or Lepreau 2.

4.6 Decommissioning

Decommissioning refers to the removal of the unit from service, and its transformation into an out-of-service state while protecting the health and safety of workers, the public, and the environment. Lepreau 2 would be expected to be decommissioned by 2030 at the earliest. The exact decommissioning procedure has not yet been established, as new concepts and techniques will evolve as older units are decommissioned. Also, it is important to note that the particular scenario will depend on the specific situation at that time with respect to need of the site for either new generating capacity or for alternative uses. It is to some extent unrealistic to make commercial decisions many years ahead of when they are actually needed.

A decommissioning scenario has been drawn from investigations undertaken with respect to other nuclear plants in Canada (Pickering "A" and Bruce "A", Lepreau 1, and Gentilly 1), from experience gained with the rehabilitation of small research reactors, and with the replacement of pressure tubes and fuel channels at the Pickering "A" station. It is based upon the International Atomic Energy Agency concepts of decommissioning, which define various stages, each involving progressively more decontamination and greater availability of the site for alternate uses, and culminating in Stage 3 which has been called unrestricted site use. These concepts have been adapted to suit the CANDU 600 reactor.

Following an orderly shutdown, as would occur for routine maintenance, the reactor must be defuelled and the heavy water removed. The used fuel will be stored for some five years in the used fuel storage bays to reduce radioactivity before being removed to a permanent repository, or perhaps to a reprocessing facility. The heavy water can be stored safely in drums, or decontaminated and re-used in another reactor. The containment building would be completely sealed. Systems outside the containment building would be decontaminated to minimize inspection and surveillance requirements using a variety of industrially-proven methods. This initial process will take approximately five years. During this time, the Derived

Emission Limits for the station will continue to be in effect, as will all worker radiation protection measures.

The unit would then enter a static mode during which surveillance and regular inspection take place, and during which natural radioactive decay reduces the level of contamination within the containment building. At this time, certain decontaminated facilities outside the containment building could be released to alternate uses. The length of the static mode period is significant. After some 30 years, many of the shorter-lived radionuclides will have decayed, thus decreasing potential exposure to workers. After about 80 years, long-lived radionuclides are predominant, and after 120 years the radiation fields in all systems and components, with the exception of the reactor assembly itself, would be at background (innocuous) levels.

The unit can be completely or partially dismantled following a period of static mode, depending on the demands placed on the site for alternate, or perhaps similar, uses. Systems remaining outside the reactor building can be removed safely, and standard buildings can be dismantled using conventional methods. Contents of the reactor building, excluding the reactor and its vault, may require decontamination, depending on the length of the static mode period, prior to removal, and some may require disposal in a repository. Even after 120 years, the reactor and the shields of its vault will be radioactive due to long-lived radionuclides and would require special dismantling precautions. They would require disposal in a repository, as would the contents from the vault. The other reactor building contents, however, will not be radioactive.

Safe and proven methods exist for the packaging and transport of both low and high level radioactive materials. These methods are carefully regulated by the Atomic Energy Control Board and Transport Canada.

Substantial benefits are gained by maintaining an extended static mode, in terms of reduced radiation exposure of workers, reduced volumes of material to be decontaminated, and reduced volume of material to be transported to a repository. It is reasonable to assume a static mode period of at least 30 years, and it is possible that it could extend to the 80 to 120 year range.

In order to establish the financial requirements of decommissioning, Maritime Nuclear has assumed a 30-year static mode period followed by complete dismantlement of the unit. A component of the contract price for the sale of electricity from the unit will be allocated to meet eventual decommissioning costs. Thus, the burden of the decommissioning cost is born equally by those who also shared equally in the benefits provided by the output of the unit.