POINT LEPREAU

NEW BRUNSWICK NUCLEAR GENERATION STATION

ENVIRONMENTAL ASSESSMENT PANEL REPORT

TO THE

MINISTER OF THE ENVIRONMENT

MAY 1975

Government of Canada | Gouvernement du Canada

Environmental Assessment Review | Examen des évaluations environnementales

REPORT TO: THE MINISTER OF THE ENVIRONMENT

FROM: THE ENVIRONMENTAL ASSESSMENT PANEL

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NEW BRUNSWICK NUCLEAR GENERATION STATION

INTRODUCTION

At the First Ministers' Conference on Energy held in January 1974, the federal government announced a policy providing financing assistance for the construction of the first nuclear power unit in each province. In February 1974, the Premier of New Brunewlck applied for this assistance for a nuclear power atatlon proposed by the New Brunewlck Electric Power Commission. Cabinet approved financing assistance for this specific project In May 1974. This approval brought the project under the federal Environmental Assessment and Review Process, and, the Department of Energy, Mines and Resources, as the proponent department, notified the Department of the Environment in June 1974. This report la prerented by the Environmental Assessment Panel following the submission of the project by EM&R.

BACKGROUND

As part of its planning, the New Brunswick Electric Power Commission (NBEPC), In late 1973 and early 1974, coneldered environmental aspects of several possible nuclear power sites. The federal Department of the Environment (DOE) was asked by the Department of Energy, Mines and Resources (EM&R) to advise on the relative environmental eultablllty of three possible sites. On October 9, DOE gave the following advice, "with suitable precautions to protect the environment the nuclear plant could be built on any of these three sites. In terms of relative ranking the prospective sites at Point Caplan and Point Lepreau are equally

● ulcable and the site at Quinn Point is less suitable. The only additional point that we wish to make is that from the point of view of protection of fisheries we are impressed by the large diluting capacity In the Bay of Fundy. It should be clear that these comparisons were made on the basis of general environmental data. Once a definite site is selected it will be necessary to have an environmental impact statement in depth prepared for the site and submitted to us".

The Environmental Assessment Panel Chairman issued a document "Guidelines for Preparation Of Environmental Impact Statement for a Nuclear Power Generating Station at Point Lepreau" to EM°R which transmitted them to the New Brunswick Electric Power Commission in Octobct 1974. NBEPC was unable to fulfil1 all requirements of the guidelines on time for committed project decisions by February 1, 1975. Consequently, guidelines for a preliminary environmental impact statement vere issued by the Panel Chairman In November 1974.

The NBEPC submitted "Preliminary Environmental Impact Statement - Lepreau Nuclear Generating Station" on February 21, 1975.

The Environmental Assessment Panel reviewed the submission, arranged for and received a review of the statement by DOE scientists and participated with New Brunswick officials in receiving public opinion at a public meeting at Saint John, New Brunswick on April 3, 1975.

REPORT ON THE PUBLIC MEETING

Fifty-eight (±) briefs vere received by the Panel from individuals and representatives of varloue groups in an approximate ratio of 5 to 1 against the project. The over-riding theme of the majority of the briefs was concern over safety of nuclear plants; the likelihood of accidents and the problem of storing and disposing of spent fuel. In almost similar fashion the need for the propoeed plant was questioned and the irrelevancy of the NBEPC's figures was brought up repeatedly. Another general

theme was *a* dissatisfaction vlth the opportunities provided for public participation. There was criticism of the haste with vhlch the project is being pushed through; of the adequacy of the Preliminary Environmental Impact Statement and of the Environmental Assessment and Review (EAR) process in general. The purpose of the public meeting was attacked In light of Premier Hatfield's announcement that In this case It had no relevance to decision-making . In two instances, there was epeclflc criticism of Mme Sauvé for allegedly not carrying out the EAR process as announced. On the environmental side fear was expressed for harm to the fisheries resource of the Bay of Fundy which is the mainstay of the local economy. The plant operation requires large quantities of vater for cooling (385,000 gallons per minute). It vae alleged that passage through the plant may kill *or* damage small aquatic life by mechanical or thermal shock and that the disposal of heated water Into the Bay may cause further damage In the form of thermal shock and disruption of natural heat regimes. It was alleged that treating cooling water for plant maintenance purposes may further Introduce undesirable chemicals In the Bay's water. Concern was also expressed for the contamination of air and water la the plant's neighbouring areas through routine radioactivity emissions.

On the supporting side briefs pointed out good economic effectr the plant would bring for the area and the province as a whole and that inexpensive energy is required to attract job-producing industries. It was also pointed out that cost of electricity to the average consumer would be reduced and heated wastewater could be used for aquaculture.

ISSUES ARISING FROM THE REVIEW

The Preliminary Environmental Impact Statement was found to be deficient in many respects. Deficiencies *were* Identified by the Panel, its expert reviewers from DOE and by participants at the public *meeting. The* Preliminary Environmental Impact Statement did not contain information regarding some concerns, did not provide

sufficient data for others and the reliability of some biological data was questioned because It var not based on at least one annual cycle. In its deliberation, the Panel identified major concerns and gape of Information and consequently, the Panel requested and received more information, which has given the Panel sufficient total information on which to base the following collective opinion.

From all of these sources the major concerns identified by the Panel fall into four major categories:

environmental concerns associated with radioactivity;
other environmental concerns;
completion of the assessment; and,
concerns arising from timing and procedures.

1. Environmental Concerns Aesoclated with Radioactivity

a) Chronic diecharge of radioactive material into the air and water as a result of routine plant operation is a long term concern.

The following advice ha8 been received from EM&R.

The *International Commission on Radiological Protection (ICRP)*, using *the beet available data, recommends maximum limits for the mdiation exposure of the general public. A so-called Derived Release Limi t (DRL) is the calculated release which would give the ICRP dose to an individual upending a whole year at the plant boundary.*

The following table shows the measured releases from the Pickering Nuclear Generating Station in 1974, a8 curies and a8 % of the DRL. he Lepreau Nuclear Generating Station will have similar technology to the Pickering Station. Therefore, *the releases from the Lepreau Station will be similar. The important thing to note is that all the releases are measured in terms of tenths of one percent or less of permissible releases.*

RADIOACTIVITY RELEASED IN THE EFFLUENTS OF THE PICKERING GENERATING STATION IN 1974

Effluent	Radionuclide	Total curies released	% of DRL
Airborne	Tritium	2,490	.24
	Iodine 131	.004	.019
	Noble gaeee	4,400	.19
	Particulates	.0338	.065
Liquid	Tritium	14,400	.087
	Gross beta activity	2.61	.29

Some radioactive solid wastes are produced in addition to the spent fuel which is discussed below. These are mostly spent ion discharge resins. The volume amounts to about 10 cubic meters per reactor per year, most of which has a half life of less than a year with an activity in the order of 500 c&es. For interim storage, they will be stored on the site in concrete vaults. In addition, a considerable volume of very slightly active combustible wastes, mostly paper, are produced with a total activity of one curie. While these could be buried, the intention is to burn them in a special incinerator designed to prevent escape of radioactive material.

There ha8 been considerable research, in Canada and elsewhere, on the accumulation of radionuclides by many different kin& of organisms. Particular attention has been paid to tritium, ceeiwn-137 (and cesium-134), cobalt-60, strontium-90 and iodine-131 which are expected to be the mos t important radionuclides which will be discharged in small amounts in the liquid effluent: from power stations. The only significant radionuclides preeent in gaseous discharges would be tritium and radioactive argon. Briefly stated; tritium is present in water molecules and is not concentrated by organisms; cesium-137

(and cesium-134) and strontium-90 have only small concentration factors in marine organisms because of the large amoun t8 of the stable element present in 8ea water; cobalt-60 has higher concentmtion factors (up to 1,500 times that in sea water) in some organiama. Iodine-131 is highly concentrated in some tine organism8 and for this reason the discharge8 of this radionuclide are strictly controtted at very low levels. Noble gases are not concentrated at all by plants or animals.

The Atomic Energy Control Board of Canada regulations take into account both the human doses due to the possible concentration by food organism in the environment and also concentration mechanisms within the human body.

The question of the effect of radioactive discharge8 on organisms other than nun ha8 been discussed at considerable length by a number of expert committees and panels in recent years. One of the most recent of these was an international pane2 of the Committee on Oceanography, U.S. National Academy 0f Sciences. All of these bodies agree that if environmental levels of radiation are based on the protection of man then other organism8 will not be harmed. It must he noted that there is a dissenting opinion from a group in Sebastopol in the U.S.S.R. hey have produced a number of publications which claim observable damage to fish eggs developing in contaminated water where the total doses received were extremely small (Less than 10 per cent above normal background radiation). Other research workers (including some in the U.S.S.R.) have been unable to repeat their results.

The Panel observes that the routine emissions are small when compared to existing background radiation, and their combination represents a small increase In radiation levels.

The Panel concluded that in view of the uncertainties, the effects of radioactive discharges should be continually monitored within the immediate ecosystem andthatresearch should be initiated on the short and long term effects on representative organisms. Therefore, should the proposal proceed, a detailed monitoring program aimed at determining the lethal and sublethal cffecta of radionuclides in the environment of the Point Lepreau station, should be undertaken and continued until it is clearly shown that further work will not significantly contribute more Information.

b) Plans to manage the highly radioactive spent fuel

The Panel is advised by EM&R that:

All but a small fraction of one percent of the radioactive substances discharged from the plant is contained in the fuel. The Point Lepreau station will include facilities for onsite underwater storage for the spent fuel produced over about ten years of operation. Before the end of that time, used fuel will be shipped to a central fuel storage facility. Logical sites would be in the provinces of the largest users of nuclear power. The radioactive fission products are in the safest possible form for shipping, as they are contained in the solid, insoluble (in water) uranium oxide fuel, sealed in the highly corrosion-resistant fuel sheathings. Fuel at this stage will be handled in heavily shielded flasks, weighing perhaps SO tons, and it would be extremely difficult for hijackers to obtain dangerous substances such as plutonium from this source. hey are never released from this containment unless it is desired to process the used fuel chemically to recover the fraction of one percent of plutonium that it contains. Commercial reprocessing of fuel has not yet been demonstrated a8 viable but is under aative developmental research.

The Panel feels that the government policy with regard to long term storage, and ultimate disposal of highly radioactive wastes should be developed expeditiously. Furthermore, in development of thfs policy, public discussion on the salient points should take place.

c) The possibility of radioactive emissions into the environment through the plant malfunction for any reason

The following advice was received from EM&R:

i) Reliability, accidents & liability

The basic approach in Canadian reactor safety phitosophy is *'defence* in *depth'. The design is audited both internally in the design organization and by the Atomic Energy Control Board. The highest quality* of *materials and construction methods are employed together with thorough inspection and testing. For safety and reliability there* is *considerable use* of *redundancy and fail-safe systems.*

A *second level of protection is provided by independent, reliable and testable* protective *systems. These systems are designed to shut the plant down safely and to take other automatic action in the event of any malfunction in the basic operating systems. The* protective *systems are designed so that they can be monitored and tested regularly to* ensure *that they will operate when called upon. Finally, the reactor and its systems* are *housed in a containment building designed to minimise the release to the environment of any radioactive material which tight happen to escape from the operating systems.*

Canadian nuclear power plants are *designed so that, even in the ewnt* of *the worst malfunction or failure to* the *operating systems, e.g. complete severence of' the largest pipe, no person outside the plant boundary would be exposed to more* than *500 mrem (which is the*

allowable annual exposure for members of the public). Even in the extremely remote situation where a serious failure of the plant operating systems was accompanied by failure of the independent protective systems, the basic characteristics of the CANDU system, combined with the effectiveness of the containment building, would limit the maximum radiation dose to any pereon outside the p&at boundary, to less than 25 rem.

ii) Sabotage

Sabotage of the nuclear part of a nuclear power station would be very diffioul t. The reactor itself is encased in thick, conorete radiation shielding which, in turn, along with a22 of the reactor boiler systems is housed inside the concrete containment building to which access is tightly controlled. To carry out sabotage on the operational controls and safety systems would require an intimate knowledge of the design and construction of the station. Interlocks on access doors and systems controls are 80 designed a8 to make sabotage very difficult or readily detected.

The Panel concludes that for saboteurs, more effective chaos could be created through other means than sabotage of a nuclear plant. H&ever, in the event of well planned sabotage there could be a significant releaee of highly toxic radioactive materials. The built-in multiple protective systems of nuclear plants will give a higher degree of safety than other facilities with similar potential hazards, and make such a release of toxic substances highly unlikely.

The Panel observes that the prime objective of the Atomic Energy Control Board (AECB) licencing process is to minimize malfunction and accidental releases of radioactive substances. AECB have established design

and operating criteria to fulfill these objectives.

The Panel, after discussion with AECB hae confidence in the AECB's regulatory approach.

2. Other Environmental Concerns

Other environmental effects considered by the Panel to be of significance are detailed below.

a) Cooling Water Effects

As proposed, • a water will be used as the medium to transfer waste heat from the plant to the sea. The water will be pumped at a rate of 385,000 imperial gallons per minute through condensers where its temperature will be raised by 11.1°C, after which the heated water will be released Into the sea. The entrance is screened In order to protect fish from harm and to protect the condenser from fouling. This process will cause the following detrimental environmental effects:

i) some aquatic life will come In contact with the entrance screens where it will be held and will be unable to escape (called impingement). The number of fish destroyed will be affected by the location of the entrance, both horizontally and vertically within the water column, and by the type of screening.

ii) the aquatic life which passes through the screen 16 entrained and will pass through the pump6 and the condenser. This phenomenen will cause some mortality from physical damage and thermal shock depending upon the characteristics of design and the temperature rise, which is In turn Inversely related to the quantity of water pumped through the condensers. The length of time that the

organisms are subjected to the high temperatures is also a factor; this is dependent upon the velocity in the outlet pipe and the length of the outlet pipe.

iii) the discharge of the heated effluent Into the sea will have some effect on the life In the sea. The Immediate area may be avoided by certain species of fish, while other aquatic life may find the area attractive. Bottom and shore creatures in the immediate vicinity may also be affected, either adversely or advantageously.

The Panel obtained the opinion from a competent marine ecological adviser to the proponent's consultant that heavy mortalities from impingement and entrainment would not significantly affect the very large populations of the Bay of Puady. The Panel considers this a reasonable view except in the case of salmon smolts migrating out of the St. John River system. The government of Canada has rpent millions of dollars attempting to rehabilitate the salmon population In the river, largely through the liberation of hatchery-reared smolts. It is imperative that every effort be made to discover the migration patterns of smolt la the vicinity and that the intake rtructurer be sited and designed to avoid significant damage to smolt runs. The marine ecological advleer was also of the opinion that the release of such large quantities of warm water near shore might affect the movements of local fleh populations, mainly of herring but perhapo of smolt as vell at times. He did not consider these effects to be predictable, but strongly advised discovery of the characteristic patterne of movement before construction of the undewater wrke and monitoring of change thereafter. The Panel concurs.

b) Aquaculture

It has been suggested that the waste heat from the proposed plant may be

used for aquacul ture. However, to do so the heat should be confined and continuously available. As noted above, in order to minimize environmental effect8 the heat should be dispersed In the Bay of Fundy ae rapidly as possible. Thisis exactly opposite to the aquaculture need. Also, because the plant will have only one unit, which will be ehut down from time to time, a continuous flow of warm water cannot be guaranteed. Therefore, the Panel conclude6 that thie proposal doe8 not present a practical opportunity for aquacul ture.

c) Use of Additive8

The operatore of the plant may use additive8 such as biocides to defoul the condenser8 Any use of such additives ehould only be undertaken after gaining permission from DOE.

d) Construction Activity

Construction activity can cause environmental effects, for' example, site preparation requires the clearing of vegetation from a large area and the moving of a large amount of earth. Unless vegetation is cleared to natural edge prevailing strong winds will cause extensive windfalls beyond the clearing needed for the plant. Also, the disposal of excavated earth should not interfere with existing drainage patterns - work done to date on both accounts Indicates that theee precautions were not followed. These aspec ta are under federal and provincial regulation8 and the Panel expect8 that regulatory action will be taken to minimize effects.

3. Completion of the assessment

The • roeonent 18 preliminary with respect to the full guidelines "Guidelines for Preparation of Environmental Impact Statement for the Nuclear Pover

Generating Station at Point Lepreau" and is deficient vlth regard to the Preliminary Impact Statement Guidelines la some respects. Some of these deficiencies have been rectified by supply of further Information. The outstanding information is:

a) data on the aquatic life in the Immediate vicinity;

b) the design of the Inlet and outlet structures; and,

c) a statement on the anticipated environmental impact from the proposed fresh water supply facilities.

The above information should be supplied by December 31, 1976.

4. Concerns arising from timing and procedures

Circumstances under vhlch the project was reviewed had many shortcomings. The project construction planning was well advanced before the Environmental Assessment and Review Process was established and before the Preliminary Environmental Impact Statement vae received. This caused an undesirable ehort time for review, reduced its usefulness and caused an unnecessary conflict of Interest situation with the proponent. The Panel recommends that In the future a longer time be allowed for the review of the Impact statement by the public before discussion with the public and that prospective clients be advised that an appropriate lead tlme la required prior to scheduling construction for the environmental aseessment process.

CONCLUSION

Having considered the Environmental Impact Statement, and its deficiencies, and having considered professional and public opinion and having obtained and considered additional information, the Panel is of the opinion that a single unit nuclear power generating station can be built at Point Lepreau without significant adverse environmental effects provlded that the recommendations which follow are implemented.

RECOMMENDATIONS

It is recommended that:

1. The federal loan be approved In principle and that progress payments after December 31, 1976 be made subject to the following conditions:

   a) data on aquatic life in the immediate vicinity be collected by the New Brunswick Electric Power Commission (NBEPC) to the specifications of DOE;

   b) the design by NBEPC of the Inlet and outlet ● tructures,fncludIag fish protection facilities, be based, in part, on the above data, and the designs be approved by DOE;

   c) Environmental Impact Statement be completed as outlined in number 3 abovr.

2. a) a long term monitoring program be Initiated cooperatively by the Government of Canada and NBEPC to determine the environmental cffecte caused by the operation of the station;

   b) a research program be undertaken by the federal government on the short and long term effects of radioactive emissions on representative organisms.

3. A national policy for the storage, disposal and reprocessing of radioactive warte be developed as boon se possible.

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