



Canadian Nuclear
Safety Commission

Commission canadienne
de sûreté nucléaire

Record of Proceedings, Including Reasons for Decision

In the matter of

Applicant Hydro-Québec

Subject Application to renew the Gentilly-2 Nuclear
Generating Station and its waste management
facility operating licences for a period of 5 years

Dates of Public
Hearing December 10, 2010
April 13 and 14, 2011

RECORD OF PROCEEDINGS

Applicant: Hydro-Québec

Address: 4900 Bécancour Blvd.,
Bécancour, Quebec G9H 3X3

Subject: Application to renew the Gentilly-2 Nuclear Generating Station and its waste management facility operating licences for a period of 5 years

Application received: March 31, 2010

Public hearing dates: December 10, 2010; April 13 and 14, 2011

Location: Canadian Nuclear Safety Commission (CNSC) Public Hearing Room, 280 Slater St., 14th Floor, Ottawa, Ontario
Auberge Godefroy, 17575 Bécancour Boulevard,
St-Grégoire District, Bécancour, Quebec

Members present: M. Binder, Chair R. J. Barriault
D. D. Tolgyesi A. Harvey
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Secretary: M. A. Leblanc
Recording Secretary: S. Gingras / D. Major
Legal Counsel: L. Collard

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Intervenors		Document Number
See Appendix A		
Others		
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Licence: renewed

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Introduction

1. Hydro-Québec applied to the Canadian Nuclear Safety Commission (CNSC)¹ to renew the operating licence for the Gentilly-2 Nuclear Generating Station (NGS) in Bécancour, Quebec, and to combine this licence with the operating licence for its radioactive waste storage facility. The current licences, PERP 10.00/2011 (nuclear generating station) and PEID-W4-319.00/2011 (radioactive waste storage facility) expire June 30, 2011. Hydro-Québec applied for renewal for a five-year period. During this period, Hydro-Québec plans to refurbish the Gentilly-2 NGS; this work is scheduled to begin in fall 2012. Hydro-Québec also applied to continue to be exempted, until December 31, 2011, from clause 6.4.4 of Standard S-99, *Reporting Requirements for Operating Nuclear Power Plants*,² in order to postpone submission of its revised safety analysis report for the Gentilly-2 nuclear reactor.
2. Following the first day of the public hearing, held December 10, 2010, the Commission issued a Record of Decision, which approved Hydro-Québec's application to renew the operating licences for its generating station and radioactive waste storage facility for a period of six months under the same conditions as those of the previous licences.³ The Commission also approved the postponement of the submission of the revised safety analysis report for the Gentilly-2 NGS for a period of six months, to June 30, 2011. Hydro-Québec repeated its application for an extension of the deadline for submitting the safety analysis report to December 31, 2011. The Commission considered this application during Day 2 of the hearing which occurred on April 13 and 14, 2011 in Bécancour, Québec.
3. The Gentilly-2 nuclear facility is on the south shore of the St. Lawrence River, approximately 15 km east of the city of Trois-Rivières, Quebec. The reactor is a CANDU2 PHW (pressurized heavy water) reactor with a design capacity of 675 MW(e) (megawatt electric). The power station went into commercial operation on October 1, 1983.
4. The radioactive waste storage facility is within the exclusion zone⁴ of the Gentilly-2 NGS and includes three distinct areas:
 - the radioactive waste storage area
 - the solid radioactive waste management facility (SRWMF)
 - the used fuel dry storage facility (UFDSF)

¹ The *Canadian Nuclear Safety Commission* is referred to as the "CNSC" when referring to the organization and its staff in general, and as the "Commission" when referring to the tribunal component.

² CNSC standard S-99, *Reporting Requirements for Operating Nuclear Power Plants*, March 2003.

³ Record of Proceedings, Including Reasons for Decision, "Application by Hydro-Quebec for a six-month renewal of the Gentilly-2 Nuclear Generating Station and radioactive waste storage facility operating licences, and for postponement of the submission of the revised safety report for that same station" Date of public hearing: December 10, 2010.

⁴ An exclusion zone is a zone which may be established around a nuclear facility or other radiation source to which access is permitted under controlled conditions and in which residence is normally prohibited.

Issues

5. In considering the application, the Commission was required to decide, pursuant to subsection 24(4) of the *Nuclear Safety and Control Act*⁵ (NSCA):
 - a) whether Hydro-Québec is qualified to carry on the activity that the licences would authorize; and
 - b) whether, in carrying out that activity, Hydro-Québec would make adequate provision for protection of the environment, the health and safety of persons, and the maintenance of national security and measures required to implement national obligations to which Canada has agreed.
6. Several intervenors — including the Coalition Stop Uranium Baie des Chaleurs, Environnement Vert-Plus, the Canadian Nuclear Association, Artistes pour la Paix, the Association de Protection de l'Environnement des Hautes Laurentides (APEHL), Nature Québec, Groupe MCN21, Vertech, the Réseau québécois des groupes écologistes and the Regroupement Municipal Québécois pour un Futur Énergétique Socialement Responsable — raised questions about the future of nuclear energy in Quebec and the province's energy policy. The Commission noted that, as an administrative tribunal, it cannot review these politically based issues. These issues fall under the purview of the government authorities concerned.
7. Several intervenors — including the City of Trois-Rivières, Genivar, the Conseil régional de l'environnement Mauricie, the Fédération des travailleurs et travailleuses du Québec and the Canadian Union of Public Employees, Professionnel-le-s de la santé pour la survie mondiale, the Canadian Association of Physicians for the Environment and the David Suzuki Foundation, Groupe MACO Inc., the Syndicat professionnel des ingénieurs d'Hydro-Québec and the Coalition Pour que le Québec ait meilleure mine ! — also put forward economic arguments in favour of or against the renewal of the Gentilly-2 NGS licence. These included the number of jobs at the plant, the economic effects of operating the plant and electricity generating costs. The Commission stated that it had heard these arguments, but it could not consider them because they are beyond the scope of this hearing and are not related to the CNSC's mandate.
8. Several intervenors also called for Hydro-Québec to abandon plans to refurbish Gentilly-2 and to immediately decommission and close the plant. They expressed their concerns about the aging of the plant, raised economic arguments against the refurbishment of the plant and expressed the view that alternatives to nuclear energy should be explored. The Commission notes that the decision of whether to proceed with the refurbishment is mainly up to Hydro-Québec shareholders. The purpose of this hearing is to determine Hydro-Québec's ability to continue operating the plant safely and proceed with its safe refurbishment, if such is the will of the Crown Corporation. Hydro-Québec must demonstrate to the Commission that in carrying out its activities it can make adequate provision to protect the health and safety of persons and the

⁵ *Statutes of Canada* (SC) 1997, chapter (c.) 9.

environment. The Commission strongly expects Hydro-Québec to begin refurbishment activities as soon as possible if this option is pursued. The Commission is relying on CNSC staff to provide ongoing and rigorous monitoring of equipment and operational safety. CNSC staff must be convinced of the safety of the Gentilly-2 NGS before authorizing its restart.

Public hearing

9. Pursuant to section 22 of the NSCA, the President of the Commission established a panel (hereinafter referred to as the Commission) to review Hydro-Québec's application. The Commission, in making its decision, considered information presented at a public hearing held on December 10, 2010, in Ottawa, Ontario, and April 13 and 14, 2011, in Bécancour, Quebec. The public hearing was conducted in accordance with the *Canadian Nuclear Safety Commission Rules of Procedure*.⁶ During the public hearing, the Commission received written submissions and heard oral presentations from CNSC staff (CMD 10-H15.C, CMD 10-H15.D, CMD 10-H15.E, CMD 10-H15.F, CMD 10-H15.G and CMD 10-H15.H) and from Hydro-Québec (CMD 10-H15.1B, CMD 10-H15.1C, CMD 10-H15.1D, CMD 10-H15.1E and CMD 10-H15.1F). The Commission also studied the written submissions and oral presentations of 64 intervenors, listed in Appendix A.

Independence of the Commission

10. Some intervenors expressed the view that the Commission does not have the independence necessary to make decisions in accordance with its mission, which is to regulate the use of nuclear energy and materials to protect the health, safety and security of Canadians and the environment; and to implement Canada's international commitments on the peaceful use of nuclear energy.
11. In particular, one intervenor stated that the Commission does not meet the constitutional standard of judicial independence the Commission should have in accordance with the decision of the Supreme Court of Canada in *R. v. Lippé*. The Commission does not agree with this statement. In *Lippé*, the Supreme Court holds that the Charter prescribes constitutional independence not only with respect to the government but also to the parties, as well as all other institutions or pressure groups.⁷ The Commission, as a quasi-judicial administrative tribunal, considers itself independent of all political, governmental or private sector influence.
12. With respect to irremovability within institutional independence (given this criterion was highlighted during the hearing) the Commission simply emphasizes that paragraph 10(5) of the NSCA specifically states that "each permanent member holds office during good behaviour for a term not exceeding five years and may be removed at any time by

⁶ *Statutory Orders and Regulations (SOR)/2000-211.*

⁷ *R. v. Lippé*, [1991] 2 Supreme Court Record (SCR.) pp. 138, 154.

the Governor in Council for cause.” This provision adequately meets the constitutional principles of independence required.

13. In conclusion, the Commission states that it has the independence necessary to fulfill its mandate and that the process in place to obtain the information necessary for making informed decisions is open and transparent.

Decisions

Licence renewals

14. On the basis of its consideration of the matter, as described in more detail in the following sections of this Record of Proceedings, the Commission concludes that Hydro-Québec is qualified to carry on the activities that the renewed licence will authorize and that, in carrying on those activities, it will make adequate provision for the protection of the environment, the health and safety of persons, and the maintenance of national security and necessary measures to implement international obligations to which Canada has agreed.

Accordingly, the Commission, pursuant to section 24 of the NSCA, renews and combines Hydro-Québec’s nuclear power reactor operating licences PERP 10.00/2011 for operation of the Gentilly-2 NGS, and PEID-W4-319.00/2011 for operation of a radioactive waste storage facility. The combined licence, PERP 10.00/2016, is valid from July 1, 2011, to June 30, 2016.

15. By renewing this licence, the Commission also authorizes the activities related to the full refurbishment of the Gentilly-2 NGS.
16. The Commission includes in the licence the conditions recommended by CNSC staff in the draft licence attached to 10-H15.H. According to the proposed licence, Hydro-Québec must perform a scheduled reactor shutdown by December 31, 2011, and obtain the approval of the Commission or a person authorized by the Commission to restart the reactor after that shutdown. Hydro-Québec must also place the reactor in a shutdown state for refurbishment or for the guaranteed shutdown state by December 31, 2012. In addition, Hydro-Québec must obtain the approval of the Commission before refuelling the reactor after the refurbishment.
17. The Commission considered the licence condition handbook, as modified in CMD 10-H15.F. The Commission asks CNSC staff to revise the licence condition handbook to eliminate current ambiguities.

Postponement of the submission of the safety analysis report

18. On the basis of its consideration of the matter, the Commission concludes that Hydro-

Québec's application to continue to be exempted from clause 6.4.4 of Standard S-99 is acceptable, and that Hydro-Québec will continue to make adequate provision for the protection of the environment, the health and safety of persons, and the maintenance of national security and measures required to implement international obligations to which Canada has agreed.

Accordingly, the Commission, pursuant to section 7 of the NSCA, exempts Hydro-Québec from clause 6.4.4 of Standard S-99, *Reporting Requirements for Operating Nuclear Power Plants*, cited in condition 4.6 of the Gentilly-2 NGS operating licence, to December 31, 2011.

The Commission will not approve any further extensions for the submission of the report, considering that Hydro-Québec has been granted sufficient time to complete the document.

Issues and Commission findings

19. In making its decision under section 24 of the NSCA, the Commission considered a number of matters relating to Hydro-Québec's qualifications to carry out the proposed activities. It also examined the adequacy of the proposed measures to protect the environment, the health and safety of persons, and the maintenance of national security and measures required to implement national obligations to which Canada has agreed. The following are the principal elements considered by the Commission:
- plant management system
 - human performance management
 - operating performance
 - Gentilly-2 nuclear reactor safety analyses
 - physical design of the plant
 - fitness for service of the plant
 - plant radiation protection program and implementation
 - occupational health and safety program
 - environmental protection program, including waste management
 - emergency preparedness
 - waste management facility
 - non-proliferation and safeguard measures
 - packaging and transport of nuclear substances related to the station
 - preliminary decommissioning plan and financial guarantees in place
 - Aboriginal consultation and public information programs
 - security measures

Management system

20. CNSC staff reported that inspection findings showed that, on the whole, the quality

assurance program meets the requirements of the CSA-N286 standards, *Management System Requirements for Nuclear Power Plants*, as cited in the licence, but that a number of inspected action items remained open owing to a lack of adequate corrective measures to close the enforcement actions. In August 2010, staff called for a recovery plan to address the deficiencies.

21. Hydro-Québec reported that discussion had begun on the strategy to be implemented to generate a change in the culture of quality assurance at all organizational levels of the Gentilly-2 NGS. Contacts with industry specialists were established in order to expand on the recovery plan, which was distributed to CNSC staff in September 2010 and is currently being implemented. CNSC staff reported that Hydro-Québec supported its efforts to improve the state of its management system and that it improved its corrective action program.
22. CNSC staff was satisfied with the stages in the proposed plan. A number of actions had been closed since the first day of the hearing, and CNSC staff notes that the remaining few action items are minor and on schedule. CNSC staff considers the current state of the Gentilly-2 NGS management system to be acceptable and consistent with the overall performance level within the Canadian industry.
23. Groupe MACO Inc. explained in its intervention that the work it carried out at Gentilly-2 was subject to quality assurance programs defined by the CNSC, for which the standards are very high. This intervenor also expressed the view that the work practices at the plant are rigorous, safe and in compliance with current nuclear standards.
24. The Commission asked for more information on the weaknesses identified in Hydro-Québec's quality assurance program and the measures taken to address them. The Hydro-Québec representative confirmed the desire to obtain the necessary rigour in process follow-up and to have adequately defined expectations to the Management Committee. The quality assurance group also made sure, through inspections, that all staff members at the plant are well aware of their respective roles and responsibilities. CNSC staff indicated that an improvement in performance was also related to a corrective action program, which supports Hydro-Québec's ongoing improvement initiatives. CNSC staff noted that it had clearly defined, with Hydro-Québec, the criteria for closing a file.

Conclusion on the management system

25. After reviewing the information presented, the Commission concludes that Hydro-Québec has appropriate management structures in place to adequately carry out the activities under the proposed licence. The Commission expressed its satisfaction with Hydro-Québec's efforts to improve its quality assurance program and to close the many open files.

Human performance management

26. CNSC staff reported that the current state of the situation in human performance management is acceptable.

Staffing

27. Hydro-Québec indicated that an organizational diagnosis had been established to ensure the necessary staffing levels for proper operation of Hydro-Québec and that a strategy was in place to support the next generation of employees.
28. The Commission asked Hydro-Québec whether employee fitness to work tests had been conducted. The Hydro-Québec representative replied that hiring tests had been conducted during the selection process for shift supervisors and first operators. Management must also pass psychometric tests. The Hydro-Québec representative added that managers receive regular training to identify at-risk behaviour. CNSC staff indicated that it was of the opinion that Hydro-Québec staff is highly qualified. CNSC staff also expressed satisfaction with the employee evaluation program at the Gently-2 NGS.

Human factors

29. Hydro-Québec reported that a number of awareness initiatives had been undertaken to demonstrate the importance of quality work and adherence to procedures and rules, and that station managers are aware of the importance of observations and mentoring to support human performance principles.
30. CNSC staff explained that, since 2006, it had conducted inspections on adherence to procedures, the modification management process and operating procedures. These inspections uncovered positive points, and the few action notices issued after the inspections were closed in fall 2010. CNSC staff added that it had reviewed events that led to the discovery of weaknesses in the application of the analysis method used to identify human root causes. However, CNSC staff is of the view that the action notices issued and the noted weaknesses have a minor impact on safety and that the human factors program is acceptable. CNSC staff also indicated that Hydro-Québec had noted these deficiencies in an action plan.

Training program

31. Hydro-Québec reported being in the final implementation stages of a systematic training approach for certified staff. CNSC staff indicated that it was evaluating the quality of the work in detail to ensure the durability of the training and that Hydro-

Québec meets the expectations in this area. CNSC staff expressed its satisfaction with the progress in the implementation of this approach.

32. With respect to non-certified staff, Hydro-Québec stated that a training program is held periodically for new non-technical staff and that new radiation protection and maintenance training programs, as well as a more complete welcome program, are in place. An ongoing radiation protection, safety and environment program is also in place.
33. The CentricoisEs et MauricienNEs pour le déclasséement nucléaire expressed concerns about knowledge transfer with respect to retiring employees. The Commission asked the representative of the Fédération des travailleurs et travailleuses du Québec (FTQ) for its view on the subject. The representative stated that discussions are regularly held with Hydro-Québec to ensure that knowledge transfer is adequate and that suitable replacements are available.

Examination and certification

34. CNSC staff reported that Hydro-Québec was able to maintain a sufficient number of qualified employees to carry out the activities under the licence, and that the examination and certification program at the Gentilly-2 NGS is satisfactory.

Conclusions on human performance management

35. Based on this information, the Commission concludes that Hydro-Québec has suitable human performance management structures and that the operation of the Gentilly-2 NGS shows Hydro-Québec's ability to adequately carry out the activities authorized under its licence.

Operating performance

36. In its intervention, GENIVAR expressed the view that Hydro-Québec's performance is good in terms of safety. However, GENIVAR expects the plant's operating, monitoring and follow-up activities to be carried out rigorously, corrective actions to be applied as soon as deficiencies are observed, and commitments made at the issuance of various government authorizations to be kept.
37. Hydro-Québec reported that the activities related to operation of the Gentilly-2 NGS were evaluated by industry peers in 2008. CNSC staff indicated that it did not have any major concerns about this area of safety because the programs meet regulatory expectations and requirements, and that Hydro-Québec's performance is satisfactory.

Periodic inspection program and operations inspection program

38. Hydro-Québec reported that the Gentilly-2 pressure tube integrity surveillance program was carried out and that inspections were conducted to demonstrate the integrity of these components until refurbishment of the Gentilly-2 NGS.
39. The Commission asked what level of risk is associated with pressure tube aging. The Hydro-Québec representative replied that the risk is non-existent because at the time of refurbishment in fall 2012, the reactor will have been in operation for 201,000 equivalent full-power hours (EFPH), which is less than the estimated design life of the pressure tubes of 210,000 EFPH. CNSC staff replied that the analyses and inspections to be performed, to ensure durability to the end of 2012, should be sufficient and that the shutdown planned later in 2011 will make it possible to confirm the level of safety.
40. Hydro-Québec noted that the Gentilly-2 periodic inspection program is following its course and that its approach regarding durability management was reviewed, which will ensure optimal operation of the systems and equipment in the long term. CNSC staff confirmed that the periodic inspection and operations inspection programs are in place at Gentilly-2.

Assurance of continued plant safety

41. CNSC staff noted that although the assurance of continued plant safety program and its implementation do not meet all the regulatory requirements, the level of associated risk is minor. CNSC staff also indicated that follow-up is being conducted on weaknesses encountered in this area during inspections, that action plans have been submitted by Hydro-Québec and that the requested work is being carried out or is complete. CNSC staff considers the situation to be acceptable.

Part of the implementation of the corrective measures and return on operating experience program

42. CNSC staff explained that Hydro-Québec had submitted an action plan for the work related to corrective measures resulting from reportable events, and CNSC staff closed the subject after evaluating the action plan and Hydro-Québec's responses. CNSC staff is of the view that Hydro-Québec meets regulatory requirements in this area.

Configuration management and modification control program

43. CNSC staff is satisfied that this program and its implementation meet regulatory requirements. Inspections since 2006 have not revealed any problems in the area of approvals and configuration management. An inspection in 2009 revealed non-compliances in the development and verification of modification files, as well as the

execution and supervision of work, which led CNSC staff to call for a quality assurance recovery plan (discussed in the “Management system” section of this Record of Decision).

Plant operating policies and principles

44. CNSC staff reported that Hydro-Québec conducted follow-up of operations in compliance with the operating policies and principles (OP&P) and that no major divergence from the OP&P has occurred since the renewal of the plant’s licence in 2006. CNSC staff is of the view that the program and its implementation meet the regulatory requirements.

Development of the safe operating envelope

45. CNSC staff noted that Hydro-Québec is involved in the limits and conditions working group created by the Canadian Nuclear Utilities Executive Forum (a forum of senior managers of Canadian nuclear utilities) and the CNSC. CNSC staff sent a letter to licence holders requesting a schedule for the safe operating envelope development and implementation program, to which Hydro-Québec replied. CNSC staff considers development in this area to be satisfactory.

Shutdown management

46. Hydro-Québec explained that high priority is accorded to safety in shutdown planning and that a multidisciplinary group analyzes all planned work sequences to ensure that they meet safety requirements. Hydro-Québec noted that elements to be improved during shutdowns were discussed with CNSC staff and that all actions discussed will be completed before the start of the planned shutdown in 2011.
47. Hydro-Québec noted that the unplanned events that have occurred since the plant’s licence was renewed in 2006 have not endangered the environment or the health and safety of the staff or public. During the planned shutdown in 2011, Hydro-Québec also expects to conduct work and inspections that will allow for continued safe operation of the plant until the refurbishment planned for 2012.
48. CNSC staff explained that its inspections during the shutdowns have made it possible to note that good practices have been observed in the management of the guaranteed shutdown state and that occupational safety and security (non-radiological) requirements have been met. The deficiencies noted were the focus of an action plan, and CNSC staff noted improvement in this area.
49. An intervenor remarked on the reduction in the number of planned annual shutdowns reported by Hydro-Québec and expressed his satisfaction.

Events in Japan

50. CNSC staff reported that Hydro-Québec responded to the request by CNSC staff in accordance with paragraph 12(2) of the *General Nuclear Safety and Control Regulations* regarding the lessons learned from the earthquake in Japan. The request was addressed to all major nuclear facilities and asked for the specific measures taken by these facilities. Hydro-Québec's submission includes the proposed measures with a detailed schedule. CNSC staff reported that it had examined Hydro-Québec's proposal and determined that the proposed measures and schedule are acceptable and that the document meets the CNSC's targeted objectives.

Shale gas

51. In its intervention, the Comité des citoyens et citoyennes pour la protection de l'environnement maskoutain (CCCPEM) expressed concern about the exploration and exploitation of shale gas under Gentilly-2 and its impact on plant safety. The Commission requested more information on the subject. CNSC staff indicated that it had communicated with Quebec's Department of Natural Resources and Wildlife, which had reportedly issued a licence to drill near the station, to discuss the potential problem and to notify it of the Commission's exclusive jurisdiction in the area of nuclear safety. Hydro-Québec also expressed its opposition to a drilling project of this kind under the station and stated that it had made its position very clear to the Government of Quebec. Hydro-Québec also stated that it would keep the CNSC informed on the subject.
52. The Commission is concerned about potential shale gas exploration activities near nuclear power stations because of the possible impact of these activities on the safety of the facilities. The Commission asked CNSC staff to continue communicating with the Government of Quebec on the basis of the Commission's concerns and to inform the Commission if any difficulties arise.

Uranium exploration, mining and use

53. Several intervenors expressed their opposition to the renewal of the Gentilly-2 NGS operating licence, expressing the view that uranium extraction produces pollution and poses risks for workers and the public.
54. In response to comments requested by the Commission, CNSC staff noted that the uranium mining industry is also regulated by the CNSC and that the industry is safe and does not pose any undue risk to the public or the environment. CNSC staff added that the latest studies on the health of uranium miners show their health to be on par with that of the general population.

Conclusions on operating performance

55. After reviewing the information presented, the Commission concludes that the operating performance demonstrates Hydro-Québec's ability to successfully carry out the activities under the requested licence, to protect the environment and adequately safeguard the health and safety of persons. The Commission is also satisfied with the actions of CNSC and Hydro-Québec staff with respect to the events in Japan. The Commission notes that the regulation of uranium mines in Canada is beyond the scope of this hearing.

Safety analyses

56. The Commission examined the issues related to the safety analysis as well as safety problems.
57. CNSC staff noted that it did not have any concerns about this issue because Hydro-Québec meets regulatory requirements in this area.

Deterministic safety analysis

Safety analysis report update

58. Hydro-Québec applied to maintain its exemption from clause 6.4.4 of Standard S-99, in order that it might postpone the submission of its revised safety analysis report for the Gentilly-2 nuclear reactor to December 31, 2011.
59. CNSC staff indicated that Hydro-Québec had provided all the necessary documentation for its application to postpone the report and that it was satisfied with the documentation. CNSC staff upholds its recommendation to approve the application to postpone submission of the report to December 31, 2011.
60. The Commission pointed out that the last safety report was completed in 2005 and asked CNSC staff about the methods used to ensure acceptable safety margins until the refurbishment of the plant. CNSC staff explained that the safety report update is an administrative tool compiling all the safety studies that have each been updated. Consequently, the impact on risk is minor. CNSC staff added that it had determined the analyses required from Hydro-Québec to ensure safe operation of the plant until refurbishment. CNSC staff also indicated that analyses that consider the aging of the plant until the end of 2011 are available and that Hydro-Québec will submit the revised analyses to cover the period from December 2011 to refurbishment.
61. The Commission asked whether CNSC staff had any concerns about the analyses.

CNSC staff replied that the Gentilly-2 plant operates within an analyzed envelope that adequately takes the aging of the primary heat transport system into consideration. CNSC staff added that there is a power reduction of approximately 1% per year to account for the aging of the primary heat transport system. The purpose of this voluntary reduction is to ensure reactor safety. CNSC staff stated that Hydro-Québec has a good program in place to manage the impact of aging on safety and that the proposed approach does not raise any concerns.

62. An intervenor expressed concerns about the extensions for the safety report update, expressing the view that Hydro-Québec could have submitted a revised safety report in 2008. In response to the Commission's questions, CNSC staff noted the purely administrative nature of the document and stated that Hydro-Québec had conducted important new studies to ensure adequate refurbishment in accordance with current standards.

Probabilistic safety assessments

63. CNSC staff reported that a probabilistic safety assessment in accordance with Standard S-294, *Probabilistic Safety Assessment (PSA) for Nuclear Power Plants*⁸, is required under the operating licence. CNSC staff added that Hydro-Québec provided a document describing the PSA methodology and concluded, on the basis of a primary analysis of the methodology, that it was acceptable. CNSC staff plans to complete its detailed review of the PSA in spring 2012.

Safety issues

64. CNSC staff indicated that Hydro-Québec continued its efforts to resolve Generic Action Items (GAIs) and safety issues related to CANDU nuclear plants. Five GAIs were open in fall 2011, four of which were addressed by studies and research conducted by the CANDU Owners Group. One was closed in winter 2011, and Hydro-Québec has applied to close another GAI, which is currently being reviewed by the CNSC. CNSC staff considers the situation acceptable and is of the view that it will not have an impact on plant safety.
65. Hydro-Québec reported that it had continued to provide analyses in response to concerns expressed by CNSC staff about specific action items at the plant and industry-wide GAIs. Hydro-Québec added that three important GAIs were closed between 2007 and 2009: one on an analysis of hydrogen behaviour in containment; another on molten fuel-moderator interaction; and the last on moderator temperature distribution prediction.
66. CNSC staff indicated that a work group was established to respond to certain questions related to positive void reactivity and large loss-of-coolant accident (LOCA) safety margins. The industry decided to proceed with an analytical demonstration of the effectiveness of the emergency systems and is currently working on a solution.

⁸ CNSC Standard S-294, *Probabilistic Safety Assessment (PSA) for Nuclear Power Plants*, April 2005.

Temporary compensatory measures were implemented to manage the risk related to large LOCA safety margins. CNSC staff added that the criteria surrounding large LOCAs are becoming more and more well known and that an increased safety margin is no longer necessary. This is considered a beyond-design-basis event (events outside the scenarios for which the plant was designed). According to CNSC staff, this is an internationally accepted decision.

Positive void reactivity coefficient

67. Some intervenors expressed concerns about the positive void reactivity coefficient. In particular, they stated that this characteristic prevents CANDU reactors from meeting international standards and that a new CANDU nuclear generating station could no longer be built in Canada today. The Commission asked CNSC staff to comment on the issue. CNSC staff replied that these statements are inaccurate, noting that the CNSC's regulatory framework, under which void reactivity is managed, allows CANDU reactors to meet international standards. Also, according to CNSC staff, the current regulatory framework covering the positive void reactivity coefficient contains no contraindications for constructing CANDU 6-type reactors in Canada today.
68. Certain intervenors asked why Hydro-Québec had not started using a new fuel that could have reduced or eliminated the positive reactivity coefficient. In response to comments requested by the Commission, Hydro-Québec explained that Bruce Power had conducted a number of tests on the new fuel, but that the results were not convincing. Consequently, Hydro-Québec proposed a different approach to resolve the problem.
69. CNSC staff explained that the positive void reactivity coefficient is a characteristic of CANDU reactors, the reactivity of which increases during a large LOCA. This characteristic has been recognized for more than 40 years, and the reactor shutdown systems are designed with this in mind. CNSC staff added that research is being conducted to define the scope of the safety margin in place and that current analyses of large LOCAs do not put the safety of the Gentilly-2 NGS into question.

Conclusions on the design and analysis

70. Based on this information, the Commission concludes that the design and safety analysis for the Gentilly-2 NGS are acceptable for the purposes of the licence. More particularly, the Commission has no specific concerns about the positive void reactivity coefficient and, in light of the information submitted, is satisfied that this problem is well managed.
71. The Commission approves the postponement of the submission of the revised safety report for the Gentilly-2 NGS to December 31, 2011, given that the postponement does not have any immediate consequences on plant safety since all necessary safety analyses have been completed. However, the Commission will not approve any further

extensions for submission of the report, considering that Hydro-Québec has been granted sufficient time to complete the document.

Physical design of the plant

72. CNSC staff reported that it considers Hydro-Québec's performance in this area acceptable.

Plant safety

73. CNSC staff indicated that Hydro-Québec plans to install a number of new pieces of equipment during the refurbishment planned for the Gentilly-2 NGS to improve safety. For example, hydrogen recombiners would be installed to prevent problems with the possibility of hydrogen in the air during major accidents. Equipment necessary to cool the vessel through cooling water intake and to filter the gases discharged from the reactor building would also be installed. These measures have been applied to address the lessons learned from the incidents in Japan.
74. In its intervention, International Safety Research Inc. (ISR) expressed its agreement with a number of intervenors about the fact that zero-risk does not exist, but that it is for this reason that extensive analyses are conducted on nuclear plants to determine the levels of acceptable risk. ISR added that the safety analyses are also re-evaluated as new information becomes available.
75. The Commission asked for the ISR representative's opinion on the differences in performance between CANDU reactors and nuclear reactors of different designs around the world. The intervenor replied that the design of CANDU reactors seemed more solid. In particular, the intervenor noted that, in the event of an accident, the estimated time before the core of the reactor sustains any damage is much longer with CANDU reactors than it is with other designs.
76. In its intervention, Pluritec-Johnson Vermette, expressed the view that a reactor's emergency shutdown systems are effective and among the safest designs in the world.
77. An intervenor expressed concerns about the water-filled bays containing used fuel at Gentilly-2. The Commission asked Hydro-Québec for information on the subject. The Hydro-Québec representative explained that the bays are at ground level, inside a building and are designed to resist earthquakes. The Hydro-Québec representative added that in the event of a major incident, it would be 13 days before the first row of fuel would be exposed to the air. He also noted that because CANDU fuel is made with natural uranium (which is not enriched), less heat is generated than with the fuel used in Japan.

Seismicity

78. CNSC staff reported that the current site of the Gentilly-2 NGS was chosen for all of its characteristics, including spectral responses to earthquakes, and that the recent events in Japan do not put this choice in question. CNSC staff added that the systems that ensure safety following an earthquake were checked for their resistance to earthquakes and to make sure they were working properly. The plant is also designed to ensure cooling of the fuel after an earthquake. CNSC staff reported that it intends to learn from the events in Japan and possibly revise Canadian requirements accordingly. CNSC staff is of the view that an earthquake in the Bécancour region would not seriously threaten the plant.
79. A representative of the Geological Survey of Canada at Natural Resources Canada (NRCan) gave a detailed presentation on earthquakes in Eastern Canada. He explained that large earthquakes (of a magnitude of 7.7 or greater) are concentrated in the subduction zones, zones where one plate slides over another. These zones are located along the belt bordering the Pacific Ocean (which includes Japan) and the Indian Ocean. Eastern Canada is located in the Canadian Shield, where seismic activity is rare. Seismic activity in that geological area is felt along the edge of the Shield, along the junction of the major geological provinces, including the Appalachians. Most of the quakes in that region occur in zones known to be the most active, notably Charlevoix, as a result of the Astrobleme (meteorite fall), and along the St. Lawrence, which constitutes an adjustment zone between the Shield and the Appalachians. However, this is low-intensity seismic activity.
80. The Commission asked what the highest magnitude earthquake around the Gentilly-2 NGS could be. The NRCan representative explained that the impacts of an earthquake are estimated through calculations that consider several factors, including distance⁹. Therefore, it is impossible to estimate the magnitude of an earthquake at a specific location. The NRCan representative added that the largest earthquake in the last 350 years in eastern Canada happened in Charlevoix, which is too far away to cause any damage to the Gentilly-2 NGS.
81. Several intervenors expressed concerns about the impact of an earthquake on the Gentilly-2 NGS. In particular, they wondered about the consequences on the Gentilly-2 nuclear reactor if the Hydro-Québec network electrical supply were to fail. In response to comments requested by the Commission, the Hydro-Québec representative explained the series of events, as outlined in the safety analysis; i.e., the activation of the various emergency supply systems at the plant. The Hydro-Québec representative also explained that, in the event of a total loss of electricity (including the emergency generators), the Gentilly-2 nuclear reactor can be cooled by natural convection, which can be effective for several days. In response to the recent tragedy in Japan, Hydro-Québec plans to install a system to connect to the river in order to supply the nuclear

⁹ The Commission notes that other factors influencing the magnitude of an earthquake are the size of the fault caused by the movement, the depth of the hypocentre in relation to the surface and the nature of the rock massif.

reactor with water, if necessary.

Pressure boundaries

82. CNSC staff expressed the view that the design program meets the requirements of standard N285.0, *General Requirements for Pressure Retaining Systems and Components in CANDU Nuclear Power Plants*, and B51, *Boiler, Pressure Vessel, and Pressure Piping Code*. CNSC staff added that Hydro-Québec had announced its intention to have the revision of the quality control program for pressure retaining systems and components approved by December 31, 2011, and to complete implementation by June 2012. CNSC staff is satisfied with this schedule and does not believe there is any impact on plant safety.

Conclusions on the physical design

83. Based on the information provided, the Commission concludes that the physical design of the Gentilly-2 NGS is adequate and, in particular, that the plant's systems are strong enough to withstand an earthquake of a magnitude reasonably foreseeable in the Bécancour area.

Fitness for service of the station

84. CNSC staff reported that compliance in this area is acceptable and that the non-compliances identified had little impact on safety and were adequately addressed by Hydro-Québec.

Maintenance

85. Hydro-Québec reported that since 2007, a number of changes had been made to the equipment maintenance program to ensure its compliance with industry standards and good practices in North America. Hydro-Québec added that over the last few years it had implemented a maintenance optimization project, which places priority on systems that are important for safety. Hydro-Québec also developed a process to manage maintenance until the refurbishment outage.
86. CNSC staff is of the view that the maintenance program implemented at Hydro-Québec meets the regulatory requirements and is satisfactory. CNSC staff added that inspections of the operational practices were conducted during the last two planned shutdowns. Good practices were noted, and non-compliances related to communication were addressed in an action plan by Hydro-Québec and follow-up by CNSC staff. There were no serious process failures. CNSC staff considers the management of these situations to be satisfactory and in compliance with regulatory requirements.

Structural integrity

87. CNSC staff reported that it was satisfied with the results of the inspection campaign conducted by Hydro-Québec on the reactor feeder pipes. The pipes are considered fit for service until April 2012, and other measures must be taken by Hydro-Québec for operation after this date.
88. CNSC staff indicated that the steam generators at the Gentilly-2 NGS have functioned well since the licence was renewed in 2006. CNSC added that inspections showed that the steam generators are fit for service until May 2012, and that after this date, Hydro-Québec must have a revised provision approved or conduct new inspections. CNSC staff also reported that it had agreed to an 18-month extension of the five-year period specified by CSA Standard N285.4, *Periodic Inspection of CANDU Nuclear Power Plant Components*, to allow Hydro-Québec to conduct a visual inspection of a section of the steam generators. Hydro-Québec has until December 31, 2011, to conduct the inspection or obtain an exemption.
89. CNSC staff reported that Hydro-Québec recently submitted its operational plan, which will include all aging mechanisms (and their impacts) and fuel channel operating limits in the submissions to follow, in compliance with current standards. CNSC staff added that the periodic inspections required under CSA Standard N285.4 validate the condition of the components for the years to come.
90. The Commission called for comments on the effectiveness of the programs implemented by Hydro-Québec to determine the condition of these components. CNSC staff replied that some inspection schedules had not been followed. Consequently, Hydro-Québec rewrote its framework document to prevent recurrence of an error of this kind. CNSC staff considers the consequences of this weakness to be minor, mainly because of the good condition of the components to be inspected. CNSC staff intends to continue monitoring this issue to verify the corrective measures implemented by Hydro-Québec.
91. CNSC staff indicated that Hydro-Québec continued to have certain problems concerning the development and implementation of its periodic inspection program for the plant's key components. Hydro-Québec increased the number of inspections during planned shutdowns in 2006 and 2008 to catch up on periodic inspections, which is considered acceptable by CNSC staff. Hydro-Québec presented a new version of DR-22, "Periodic Inspection Program," and CNSC staff plans to send its comments on the document by summer 2011.

Concrete containment structure

92. CNSC staff reported that it had begun discussions with Hydro-Québec to establish a periodic inspection program for the concrete containment structure because Hydro-

Québec has not carried out all the inspections of the components of the containment structure required by CSA Standard N287.7, *In-service examination and testing requirements for concrete containment structures for CANDU nuclear power plants*.

93. CNSC noted that the leak rate from the reactor building to the exterior is approximately 0.5%, which is very close to Hydro-Québec's repair criteria, well below the safety analysis limit of 5%. Hydro-Québec plans to implement corrective measures during the refurbishment work.
94. CNSC staff indicated it had asked for and received information from Hydro-Québec on the alkali-aggregate reaction in concrete. Hydro-Québec stated that it has the latest tools for analyzing the situation and controlling the effects of the reaction, and that it does not pose any safety problems until the refurbishment outage planned for 2012. The Commission asked Hydro-Québec for more information on the subject. The Hydro-Québec representative replied by saying that the reaction is present in all of Hydro-Québec's concrete structures and that the Crown Corporation has developed expertise in this area. The models and measurements allow Hydro-Québec to confirm that the reactor building is fit for service for another 25 years and that necessary repairs can be predicted.
95. CNSC staff added that it had asked Hydro-Québec to submit a management plan for approval, by July 31, 2011, on the aging of the concrete containment structure and other structures related to safety.¹⁰ CNSC staff is of the view that this issue will not have any impact on plant safety before the end of 2012.

Reliability of safety-related systems

96. Hydro-Québec reported that the observed reliability of all major safety-related systems exceeded the baseline for these systems.
97. CNSC staff reported that Hydro-Québec's reliability program is properly organized and maintained. CNSC staff considers that the performance of key safety-related systems has met the safety objectives and that Hydro-Québec has submitted adequate reports on the state of the plant's reliability. Consequently, CNSC staff concludes that Hydro-Québec's reliability program meets the regulatory requirements and is satisfactory.

Equipment environmental qualification

98. Hydro-Québec reported that the equipment environmental qualification maintenance program is in place and that a review is being conducted to evaluate the scope of the

¹⁰ CNSC staff confirmed after the hearing that the management plan for concrete structures other than the containment structure is expected to be received after December 31, 2011. CNSC staff is satisfied that this does not pose any risks to plant safety.

work required to initiate the second life cycle of the Gentilly-2 NGS. Action follow-up will be part of the refurbishment project. CNSC staff indicated that the deficiencies identified during an inspection program in 2006 do not have any immediate impact on plant safety and that Hydro-Québec invested large sums in order to address all the action notices. CNSC staff considers the program satisfactory.

99. The Commission asked for more information on the subject. Hydro-Québec explained that the measures necessary for environmental qualification had been categorized in order of priority and that critical equipment has been identified. CNSC staff noted that this item is included in the licence conditions handbook.
100. A member of the Nuclear Engineering Institute of the l'École Polytechnique de Montréal reviewed the documentation submitted to the Commission for the renewal of Hydro-Québec's licence and is of the opinion that the equipment environmental qualification program is being carried out in a satisfactory manner.

Conclusions on fitness for service

101. The Commission is satisfied with Hydro-Québec's inspection and life cycle management programs for key safety-related systems. Based on the information submitted, the Commission concludes that the equipment used at the Gentilly-2 NGS is fit for service.

Radiation protection

102. Hydro-Québec reported that over the last few years it had made numerous improvements to the radiation protection program, particularly in terms of documentation, control of worker exposure and work practices, and the use of new devices and equipment.
103. CNSC staff considers the radiation protection program and its implementation to be in compliance with regulatory requirements and expectations.

Radiation protection program frameworks in place

104. Hydro-Québec reported that a number of documents had to be revised or issued to comply with the document structure of Hydro-Québec's Nuclear Production Directorate. Hydro-Québec added that all the requested documents had been issued before December 31, 2010. CNSC staff confirmed this information and noted that it had analyzed and approved the documents submitted by Hydro-Québec. CNSC staff also indicated that Hydro-Québec had completed several initiatives related to radiation protection and that this subject had therefore been closed.

Inspections

105. Hydro-Québec reported that problems were raised during a CNSC inspection in 2009, but that an action plan had been submitted. The actions are to be completed during summer 2011. CNSC staff confirmed this information, and noted that other inspections had been carried out and that the radiation protection program items were evaluated through regular compliance audit activities. CNSC staff also indicated that all actions followed-up under subjects related to radiation protection inspections are closed for the most part or will likely be completed before the end of 2011.

Implementation of the radiation protection program

106. Hydro-Québec added that neither the regulatory dose limit of 50 millisieverts (mSv) nor the administrative dose limit of 20 mSv was reached. CNSC staff confirmed this information. Hydro-Québec added that its action level of 2 mSv was exceeded twice and that a reminder on good practices was given and that a follow-up on the radiation protection unit was done.
107. Hydro-Québec indicated that since human performance is the main cause of events reported in radiation protection, Hydro-Québec's radiation protection group communicates its expectations via several internal media to help reduce the number of events.
108. CNSC staff indicated that Hydro-Québec had established a radiation protection action plan aimed at strengthening and improving radiation protection practices. CNSC staff is continuously monitoring the implementation of this improvement plan, which was spread over the authorization period. CNSC staff is satisfied that the radiation protection program improvement measures will ensure effective implementation of good practices in radiation safety at the plant.
109. Hydro-Québec reported that one of the improvements to radiation protection practices also resulted in a reduction in collective doses in both operational and outage periods. A number of strategies are used to reduce these doses. Hydro-Québec also noted that it had improved its respiratory protection program in 2010. CNSC staff confirmed a reduction in internal collective doses, which can be attributed to the radiation protection improvement initiatives. CNSC staff added that Hydro-Québec had applied the ALARA (As Low As Reasonably Achievable) principle.
110. With respect to the other events reported in accordance with Standard S-99, Hydro-Québec noted that only one event related to radiation protection occurred. The other three were deficiencies identified in radiation protection that were more to do with a weakness in quality assurance.
111. The Canadian Nuclear Workers Council, locals of the Canadian Union of Public

Employees and the FTQ showed their support for the renewal of the Gentilly-2 NGS licence, expressing the view that all the necessary precautions are taken to protect the health of workers at the plant. A number of intervenors expressed their concerns about the health of workers at the Gentilly-2 NGS. In particular, one intervenor accused Hydro-Québec of not sending all dosimeter doses to the National Dose Registry. The Commission requested more information on the subject. The Hydro-Québec representative stated that the company had sent all the information on radiation doses received from Hydro-Québec workers, as required by the Act. CNSC staff described a typical plant radiation protection program and stated that Hydro-Québec must send the doses of all contract, temporary and permanent workers to the National Dose Registry. CNSC staff added that the Gentilly-2 NGS dosimetry service is licensed and is constantly monitored.

Conclusions on radiation protection

112. After reviewing the information presented, the Commission is of the opinion that the radiation protection program and its implementation meet the regulatory requirements and are adequate to protect the workers at the Gentilly-2 NGS. The Commission requests CNSC staff to continue to ensure that all worker radiation information is submitted to the National Dose Registry.

Occupational health and safety (non-radiological)

113. Hydro-Québec reported that in 2009, more than one million hours were worked without a lost time accident. Several steps were taken to achieve this goal. CNSC staff confirmed that in 2008 and 2009, there were no lost time accidents for 405 consecutive days.
114. CNSC staff noted that Quebec occupational health and safety legislation applies to the Gentilly-2 nuclear power plant. Provincial inspectors regularly inspect the plant.
115. CNSC staff indicated that the safety manual, the main document for the plant's health and safety program, is among the documents provided by Hydro-Québec to the CNSC. CNSC staff considers that the implementation of the health and safety program meets expectations.
116. Hydro-Québec reported that the respiratory protection program was the subject of discussions with CNSC staff and that corrective measures have been put in place. CNSC staff confirmed that an inspection of the respiratory protection program had revealed that Hydro-Québec did not meet all the regulatory requirements, and that Hydro-Québec took action to correct these cases of non-compliance. CNSC staff closed that action item in January 2011.
117. CNSC staff reported that monitoring rounds revealed satisfactory compliance with respect to the wearing of personal protective equipment. Some of opportunities for

improvement were reported, and Hydro-Québec is in the process of implementing corrective measures that CNSC staff considers adequate.

118. CNSC staff indicated that the accident severity rate (ASR) had increased in 2007 and 2008, but dropped back to 0 in 2009 after Hydro-Québec enhanced its monitoring. This indicator rose again in 2010. CNSC staff considers that the situation should be monitored. The Commission asked Hydro-Québec to comment. The Hydro-Québec representative responded that site surveillance had been very tight in 2009, but had subsequently slackened off. In order to determine the causes of this situation, Hydro-Québec submitted an action plan to CNSC staff. The Hydro-Québec representative also noted that the ASR is far below that of other Hydro-Québec divisions and that most of the accidents in 2010 are attributable to inattention, and not poor working practices or equipment failure.
119. CNSC staff noted an improvement in performance in this area, due in particular to better program management. CNSC staff has no major concerns in this regard, and is of the opinion that the programs meet requirements and that Hydro-Québec's performance is satisfactory.
120. Upon consideration of the information provided, the Commission considers that Hydro-Québec's performance in terms of the non-radiological health and safety of its workers is acceptable.

Environmental protection

121. Hydro-Québec reported that it had revised its estimation of public doses since 2006. In 2009, the estimated public dose from the plant and its waste management facility was 0.00118 mSv, 1,000 times less than the maximum acceptable public dose of 1 mSv. Hydro-Québec noted that this dose estimation is comparable to that of other Canadian nuclear generating stations.
122. CNSC staff considers that the existing environmental protection programs meet the regulatory requirements and expectations, and that Hydro-Québec's performance in this regard is satisfactory.

Canadian Environmental Assessment Act

123. Before making a licensing decision, the Commission must be satisfied that all applicable requirements of the *Canadian Environmental Assessment Act*¹¹ (CEAA) have been met.
124. CNSC staff indicated that it needed to determine whether it would need to conduct an environmental assessment (EA). Since the licence renewal is not for the purpose

¹¹S.C. 1992, c. 37.

of enabling a project, it determined that an EA was not required pursuant to subsection 5(1) of the CEEA.

125. The Commission is satisfied that all applicable requirements of the CEEA have been met.

Environmental management system

126. Hydro-Québec reported that it had successfully implemented an environmental management system specific to its Nuclear Generation Directorate. The Gentilly-2 NGS was also accredited to ISO standard 14001 in December 2009.
127. CNSC staff reported that it had performed an audit of the environmental management system in March 2006. Since that time, Hydro-Québec has executed all the corrective action items raised.

Effluent and environmental monitoring programs

128. Hydro-Québec indicated that it applies sophisticated environmental monitoring programs, which include the measurement of an array of physicochemical and radiological parameters for various environmental components. A new physicochemical environmental monitoring program was agreed to with provincial environmental authorities in 2008 pursuant to the requirements with respect to authorizations received for the construction and operation of the solid radioactive waste management facility. The radiological environmental monitoring program is being revised; since 2009, it includes all the new monitoring measures related to the commissioning of the solid radioactive waste management facility.
129. CNSC staff reported that it had conducted an inspection of the monitoring of effluents and the environment in March 2008. CNSC staff concluded from that inspection that Hydro-Québec satisfied the requirements for the various activities inspected, although some deficiencies were identified. Hydro-Québec responded to the deficiencies raised, and presented an action plan. CNSC staff added that Hydro-Québec expects to complete the required actions by the end of June 2011, which CNSC staff considers acceptable.
130. Hydro-Québec reported that liquid and gaseous radiological releases are well below regulatory limits, within 1% of the applicable derived release limits (DRLs). CNSC staff confirmed that the station's releases are below the DRLs at all times, and are consequently below action levels. Hydro-Québec also noted that radiological environmental monitoring results are still well below regulatory limits, which CNSC staff confirmed.
131. The Commission requested more information on the estimated dose for the critical

group (a homogeneous group of members of the public receiving the highest dose of radiation from a defined source). Hydro-Québec responded that a retrospective method has been used since 2006, where actual data was collected from members of the public living closest to the plant.

132. The Commission requested further information on the environmental monitoring activities of CNSC staff and other agencies. The Environmental Control Centre representative explained that their group does sampling and verifies environmental chemical and radiological contamination under accident conditions. The Quebec Ministry of Agriculture, Fisheries and Food (MAPAQ) representative explained that an annual analytical program is in place whereby produce in the vicinity of the Gentilly-2 plant is sampled and analyzed to determine radioactivity levels. That representative confirmed that MAPAQ had no concerns with respect to the results of such sampling.
133. CNSC staff explained that a working group, made up of representatives of the Quebec Ministry of Sustainable Development, Environment and Parks (MDDEP), CNSC staff and Hydro-Québec personnel, was established to implement emission limits that would meet the requirements of both the Ministry of the Environment and the CNSC. CNSC staff added that the environmental program proposed by Hydro-Québec is based on calculations for predicting levels of radiological substances in the environment, and is analyzed by CNSC staff. CNSC staff also takes into account data reported by Hydro-Québec to examine trends over time and deviations from expected results, and conducts inspections of the program to verify its effectiveness. This work is being done in collaboration with the Quebec Ministry of the Environment. Université Laval established and ran an independent environmental monitoring program, as well, for several years, at the request of Hydro-Québec. CNSC staff added that a new laboratory will soon be operational at the CNSC and that two programs will soon be launched: a sampling program near the nuclear generating stations and facilities, and a reference sample program to ensure that licence holders have an appropriate quality control program.
134. The Health Professionals for Global Survival, the Canadian Association of Physicians for the Environment and the David Suzuki Foundation cited several epidemiological studies that demonstrate a link between emissions from nuclear power plants and cancer. The Commission requested further information on the subject. CNSC staff explained that the studies were repeated using more stringent analysis methods, and it was demonstrated that there was no causal relationship between exposure to radiation from nuclear generating stations and cancer, with observations often being insignificant and implausible, radioactivity levels being very low and often within natural radioactivity levels measured in the area.
135. The Commission requested comments on one intervenor's statement that birth defects had been observed in the vicinity of the Gentilly-2 plant. The representative of the Agence de la santé et des services sociaux explained that the relatively high number of malformations in the late 1980s has been studied, and that no causal relationship with the Gentilly-2 NGS or any other environmental factor has been demonstrated. The

representative added that the matter had been followed up, and that no other birth defects of the same type as those recorded in the late 1980s near the station have been recorded since.

Tritium

136. Several intervenors expressed their concerns regarding the emission of tritium from the Gentilly-2 NGS into the atmosphere and its effects on human health and the environment. The Commission requested further information on the subject. CNSC staff responded that it had evaluated the effects of the release of radionuclides (including tritium) by nuclear power stations on flora and fauna in the 1990s under the *Canadian Environmental Protection Act*.¹² That evaluation enabled CNSC staff to conclude that emissions from Canadian generating stations did not pose a risk to the environment, and were therefore not considered to be a toxic substance. The Environment Canada representative noted that the ministry had also studied the routine emissions of power reactors, and had found that those emissions are well below international guidelines, above which adverse effects on fish have been observed.
137. Some intervenors expressed concerns regarding the level of tritium in the food and milk in the vicinity of the plant. The Commission requested comments from Hydro-Québec. The Hydro-Québec representative responded that samples of milk and food are taken from near the plant in accordance with the company's environmental monitoring program, and that the tests reveal almost undetectable levels of tritium. The Hydro-Québec representative also noted that tritium from the plant is no longer detectable in the St. Lawrence River at a distance of approximately 500 m from the plant.
138. Several intervenors also criticized the standard limit of 7,000 Bq/L of tritium recommended in the Guidelines for Canadian Drinking Water Quality, considering this level much too high in comparison to standards in other countries. CNSC staff stated that the tritium levels in all sources of drinking water and all groundwater outside the Gentilly-2 nuclear power plant site are below 18 Bq/L,¹³ and these measurements are verified by inspection programs that have been carried out over many years.

Derived Release Limits

139. Hydro-Québec reported that it had committed to revising its Derived Release Limits (DRLs) by the end of 2010, and in the meantime using temporary DRLs lower than those currently used. CNSC staff explained that Hydro-Québec had been formally advised that its DRLs needed to be updated, and confirmed the use of temporary DRLs

¹² L.C. 1999, ch.33

¹³ In 2009, the Ontario Drinking Water Advisory Council made a recommendation to the Ontario Ministry of the Environment to revise the standard for potable water in Ontario to 20 Bq/L, which is lower than the Canadian federal drinking water guideline of 7,000 Bq/L.

until the new DRLs were accepted. The new DRLs were revised and accepted by CNSC staff in 2011, and are referred to in the proposed licence.

Environmental impact of waste management

140. CNSC staff reported that measures have been taken by Hydro-Québec to manage waste and minimize its volume. Other minimization possibilities have yet to be developed. Hazardous materials that are not radiologically contaminated, or that are below the CNSC's unconditional clearance levels, are sent to the hazardous materials recovery centre in Saint-Hyacinthe. CNSC staff is satisfied with the actions of Hydro-Québec in this area.
141. An intervenor expressed concerns about the possibility of waste from the Gentilly-2 nuclear plant ending up in Africa, to the detriment of the health of the local population. The Commission requested comments from Hydro-Québec on the subject. The Hydro-Québec representative explained that Hydro-Québec contracts with U.S. companies to send part of its waste to the U.S., and ensures that the company is accredited and meets the applicable regulatory requirements for processing such waste.
142. Regarding the solid radioactive waste management facility (SRWMF), CNSC staff reported that for each phase of construction of the facility, Hydro-Québec must produce and submit an environmental protection plan. The SRWMF has been built, and Phase I is operational. Mitigation measures and the monitoring program provided for in the environmental impact assessment, which was approved by the Commission in 2006,¹⁴ have been implemented throughout the various phases. CNSC staff is satisfied with the actions proposed by Hydro-Québec in this area.
143. Hydro-Québec noted that the concentrations of carbon-14 (C-14) in the atmosphere at the radioactive waste storage area (RWSA) have been the subject of special attention since the last licence renewal. Hydro-Québec added that since 2004, ambient C-14 levels have fluctuated on a seasonal basis in comparison with a constant average over time, but that no significant increase has been noted. C-14 levels are practically nil at the exclusion zone boundaries. Hydro-Québec identified the causes of the emissions, and has partially remedied the situation. The 2009 annual report shows a drop in the yearly average C-14 concentration. CNSC staff confirmed the information presented by Hydro-Québec, and noted that a follow-up on C-14 concentrations at the RWSA is planned.

¹⁴Record of Proceedings, Including Reasons for Decision, *Environmental Assessment Screening Report for the Proposed Modifications to the Gentilly Radioactive Waste Management Facilities and the Refurbishment and Continued Operation of the Gentilly-2 Nuclear Generating Station until 2035*; hearing date: November 7 and 8, 2006.

Tritium in the groundwater at the RWSA

144. Hydro-Québec reported that, following the observation in 1997 of an upward trend in groundwater tritium around the RWSA, piezometers were installed to collect more information. These measures helped to determine that the source of tritium contamination is associated with waste incineration activities carried out by Atomic Energy of Canada Limited in the early 1970s.
145. Hydro-Québec indicated that several groundwater samples have been collected from beneath the RWSA as part of a monitoring program, and concluded that the layer of tritiated water is virtually stagnant and that the concentration of tritium has been reduced by a factor of approximately 10 in the last 30 years. Tritium activity in groundwater becomes practically nil at a distance of 300 metres from the RWSA. CNSC staff confirmed this information, and indicated that Hydro-Québec submits the results of tritium levels in groundwater, seepage and surface water in its annual reports. The tritium concentrations measured are all below the Canadian guideline of 7,000 Bq/L for drinking water, and CNSC staff noted that the groundwater outside the exclusion zone has not been affected by the contamination in the deep zone surrounding the RWSA. CNSC staff considers that the situation is well contained, and that it presents no danger to the public or the environment.
146. The Environment Canada representative indicated that the ministry was aware of all the measures taken, that it received all the annual environmental monitoring reports, and that it was in regular contact with CNSC staff on the subject.

Accidental releases

147. CNSC staff reported that between early 2006 and May 2010, 15 spills were the subject of detailed reports. CNSC staff considers that Hydro-Québec responded appropriately to those spills and that there were no impacts to the environment to report.

Effluent temperature and fish caught in the inlet header

148. CNSC staff explained that the effect of outlet channel effluent temperature on fish has been discussed with other federal authorities (Environment Canada and Fisheries and Oceans Canada) and Hydro-Québec. Hydro-Québec has conducted several studies on the impacts of thermal shock, and the results of those studies were for the most part satisfactory. Some impacts had not yet been studied, and at the request of CNSC staff, Hydro-Québec submitted an action plan. Hydro-Québec indicated that it had solved part of the problem by implementing a procedure for reducing power gradually during shutdowns, which will allow for a gradual decrease in water temperature. A boom has also been put in place. The effect of the boom is being monitored in parallel with the study on fish health. An action plan follow-up will enable CNSC staff to accurately confirm the impact of the risk.

149. The Commission requested Environment Canada's opinion on the matter. The Environment Canada representative responded that the Department's primary concern lies in the impact of thermal effluent on aquatic fauna, not in terms of fish mortality (which has already been addressed), but in terms of their development. CNSC staff asked Hydro-Québec to follow up on the matter.

Conclusion on environmental protection

150. According to the information provided, the Commission concludes that Hydro-Québec is applying and will continue to apply the necessary measures for protecting the public and the environment. In particular, the Commission is of the opinion that the effluent and environmental monitoring program is effective, that tritium emission levels are acceptable, and that the groundwater beneath the RWSA is properly controlled. The Commission is also satisfied with the actions taken by Hydro-Québec regarding the plant's impact on fish mortality and morbidity near the outlet channel.

Emergency preparedness and fire protection

Emergency preparedness

151. CNSC staff reported that Hydro-Québec proposed changes to its onsite emergency measures plan at Gentilly-2. CNSC staff considers that the proposed changes improve the document, and that the document continues to meet the CNSC's expectations outlined in regulatory guide G-225, *Emergency Planning at Class I Nuclear Facilities and Uranium Mines and Mills*. CNSC staff recommended that the document be accepted, and the new version will be incorporated into the licence conditions handbook (LCH).
152. CNSC staff indicated that it had made no negative findings with respect to the implementation of emergency preparedness during the review of the quarterly reports. CNSC staff also indicated that it considers that the emergency preparedness programs comply with regulatory requirements and that Hydro-Québec's performance in this area is satisfactory.
153. Hydro-Québec reported that it periodically carries out major exercises to test its capacity to effectively manage and respond to emergencies. CNSC staff indicated that in 2008 Hydro-Québec carried out an exercise on the implementation of onsite emergency measures at Gentilly-2 and that the company demonstrated its capacity to effectively manage a radiological emergency. The action items and recommendations resulting from the review of that exercise were closed in February 2010.
154. The Commission asked whether a study had been conducted on the impact of a plane crashing into Gentilly-2. The Hydro-Québec representative responded that one had, as

the procedures in place for responding to a serious accident do not take into account the cause of the accident. CNSC staff confirmed this assertion.

155. Hydro-Québec also indicated its involvement in the offsite nuclear emergency measures plan for Gentilly-2 (PMUNE-G2) and the civil protection plan of the Municipality of Bécancour.
156. CNSC staff explained that PMUNE-G2 was established by the Organisation de sécurité civile du Québec (OSCQ), which coordinates responses concerning the protection of the public, the environment and the food chain in the event of an accident — radiological or other — at the plant. OSCQ has a conventional public alert system that does not currently involve a siren system. OSCQ uses more conventional methods, such as emergency service corps and other media for alerting the public. The Municipality of Bécancour has launched an invitation to tender to select and install an optimized public alert system. A committee is responsible for selecting the most suitable system.
157. The Commission requested more information on the current public alert system. The Hydro-Québec representative responded that in the event of an accident, the Municipality of Bécancour is responsible for evacuation of the area around Gentilly-2, and that Hydro-Québec's procedures include notifying several organizations of the accident, including Sécurité civile, the Municipality of Bécancour and MDDEP. CNSC staff makes sure that there is proper communication between Hydro-Québec and the local authorities. CNSC staff also took part in the exercises conducted by those authorities, and ensures that they occur with the appropriate frequency. The Mayor of Bécancour, who is also Warden of the Regional County Municipality (RCM) of Bécancour, explained in detail all the measures to be taken and the equipment available in the event of an emergency. The director of civil protection for the Mauricie and Centre-du-Québec regions noted that the municipalities are responsible for the safety of persons and property within their respective territories, and gave a brief description of the offsite emergency plan that would be implemented in the event of a major incident at the Gentilly-2 NGS.
158. The Commission asked Hydro-Québec whether an assessment had been conducted of the impact of potential accidents in the Bécancour industrial park, in particular in the event of a chemical spill. The Hydro-Québec representative responded that such situations have been analyzed, and that Hydro-Québec is involved in developing emergency measures specific to the industrial park, taking into account in particular the potential impact one plant can have on others in the event of an accident. CNSC staff expressed its agreement with this assertion.
159. One intervenor expressed concerns regarding information provided to those living farther away from the plant (10 km or more), with respect to existing emergency measures. The Bécancour Warden described in detail the methods for informing the public, and noted the importance of updating the information regularly.

Estimated impacts of a nuclear accident

160. Several intervenors expressed serious concerns about fallout from a possible nuclear accident and the consequences of that fallout. CNSC staff explained that mathematical models have been developed to estimate levels of radioactivity outside the plant. Analyses are performed for radioactive releases to the air and the St. Lawrence River. Those models are available and ready to be used to estimate radiation levels outside the plant so that the appropriate measures can be taken in the event of an accident. CNSC staff added that, as part of the environmental assessment for the refurbishment of Gentilly-2 presented at a public hearing by the Commission in 2006, safety analyses were conducted to estimate the effects of a serious accident on the public. A severe accident was selected and conservative weather conditions were used to estimate the maximum impact of an accident at the plant. CNSC staff indicated that those analyses were used to validate the emergency preparedness plans in the Bécancour region and demonstrated that the system in place for protecting the public in such an event is realistic.
161. In response to comments from some intervenors on the impact that an accident would have far from the plant, CNSC staff noted that since public doses would be below action levels within a relatively short radius around the plant, they would be measurable; however, their effects would be negligible.
162. Certain intervenors, including the CentricoisEs et MauricienNEs pour le déclasséement nucléaire and the Environmental Coalition of Prince Edward Island, expressed concerns regarding the *Nuclear Liability Act* and the capping of benefits at \$75M. The Commission requested more information on the subject. CNSC staff explained that this legislation came into force in 1976 to assure the public that a process for quickly compensating potential victims of a nuclear accident had been put in place. This act also requires that operators of nuclear power plants purchase insurance up to \$75M. CNSC staff added that new legislative provisions have been tabled in Parliament, but that the bill has not yet been adopted. The new provisions would increase the maximum compensation to \$650M.

Fire protection

163. Hydro-Québec reported that its fire protection program is currently based on CSA standard N293-07.95, *Fire Protection for CANDU Nuclear Power Plants*. Hydro-Québec added that inspections and assessments had revealed deficiencies in that program. CNSC staff confirmed this assertion, and noted that a meeting took place in October 2010 to clarify the criteria for closing action items, and that the deficiencies did not pose an immediate risk to the safety of persons or the environment.
164. Hydro-Québec noted that a complete revision of the program began in 2010 to integrate the requirements of the new CSA standard N293-07, and will be completed in

2012. CNSC staff confirmed this assertion, and considers the risk of Hydro-Québec not being capable of complying with the new CSA standard to be minor.

165. Hydro-Québec stated that improvements to the fire protection facilities are included among the plant refurbishment activities. The company also noted that work is under way to replace the fire protection loop on the Gentilly-2 site. CNSC staff considers Hydro-Québec's strategy for improving its fire protection system to be acceptable overall. Hydro-Québec intends to present a comprehensive execution plan for the activities identified to the CNSC in spring 2011.¹⁵ The proposed LCH includes the criteria for closing this item.

Conclusion on emergency preparedness and fire protection

166. On the basis of this information, the Commission concludes that Hydro-Québec's emergency preparedness measures and fire protection measures are adequate for the period of operation authorized under the current licence.

Waste management

167. CNSC staff expressed satisfaction with the performance of Hydro-Québec in this area. Programs comply with regulatory requirements and expectations. CNSC staff also noted that most of the programs and procedures that apply to the Gentilly-2 NGS also apply to the waste management facility.
168. Hydro-Québec reported that Phase 1 of the RWSA expansion project was commissioned in 2008 and that it meets the plant's current operational needs for low- and intermediate-level waste. Construction of phase 2 of the SRWMF is nearing completion. CNSC staff reported that it had inspected the SRWMF and UFDSF sites, and confirmed that the ongoing work is being done in an orderly and safe manner. The processes and controls implemented by Hydro-Québec ensure that the welding structures being built at the SRWMF and UFDSF comply with the design and the plans and specifications approved by the CNSC.
169. Hydro-Québec indicated that since 2004, the directives and action notices resulting from compliance inspections have all been closed. CNSC staff noted that the deficiencies identified had no significant impact on the safety of the UFDSF facilities and that Hydro-Québec promptly implemented the appropriate corrective measures. CNSC staff also reported that since January 2007, several notices of non-compliance related to radioprotection were issued following those inspections. CNSC staff also indicated that Hydro-Québec made the necessary corrections. The improvements to be made to the radiation-measuring equipment do not compromise the health and safety of persons, as alternative procedures are in force. CNSC staff also noted that radiation exposures of Hydro-Québec personnel did not exceed regulatory doses.

¹⁵CNSC staff confirms that this comprehensive plan was received on March 18, 2011.

170. CNSC staff indicated that two significant events had occurred since 2004, (the accidental spill of rain water removed from the cylinder of a CANSTOR¹⁶ module, and the dropping of a filter coming from the primary coolant circuit during its transport to the RWSA). The maximum dose generated by these events is well below prescribed limits and the environmental impact was negligible. CNSC staff noted that Hydro-Québec has applied satisfactory corrective and preventive measures. No significant events have been reported since the submission of the mid-term review in 2007.

Short- and long-term radioactive waste management

171. Hydro-Québec indicated that an improvement plan had been implemented in recent years to better manage conventional and radioactive wastes in the short and medium terms. This resulted in fewer radioactive waste containers on the plant site, a reduction in volume of certain types of waste, and the characterization and sorting of certain historic wastes. Hydro-Québec added that several areas for improvement were presented in the plan and could be implemented.
172. Several intervenors spoke against the renewal of Gentilly-2's licence, maintaining that those wastes are hazardous, that there is no long-term solution for storing them, and that future generations will be grappling with them. The Hydro-Québec representative asserted that funds would be reserved, in trust, to ensure the ability to pay for the future processing and storage of waste produced by the plant. Those funds are on deposit with the Nuclear Waste Management Organization.
173. In its intervention, Greenpeace indicated that it was important for the safety of the community that Hydro-Québec presents the options for the decommissioning of the plant to the public. Greenpeace also indicated that public hearings on the decommissioning strategy and the long-term non-combustible waste management plan should be held in the near future in preparation for the eventual closure of the plant.
174. The Commission requested further information on the scenarios proposed by Hydro-Québec regarding long-term waste management. CNSC staff responded that Hydro-Québec is in communication with other nuclear energy producers to explore possible alternatives for the long-term storage of radioactive waste. Hydro-Québec explained that it developed an action for a period of over 10 years to address the management of these wastes. Hydro-Québec added that it has applied to the Nuclear Waste Management Organization for space on the proposed fuel disposal site for the long-term management of moderately radioactive waste. Hydro-Québec also noted that another option would be to contract with companies specializing in the recovery and treatment of these wastes. Hydro-Québec stated that it has enough space, with the construction of the new waste management facility, to receive all the waste generated by the refurbished plant.
175. With regard to the long-term management of non-combustible waste, the Commission

¹⁶ CANDU Storage, a module used to store spent nuclear fuel.

requested Hydro-Québec to report on the progress of the past four years. Hydro-Québec indicated that new storage facilities for the long-term storage of non-combustible waste have been built and that a program for reducing waste through segregation has been implemented to maximize storage space for the service life of the facilities.

176. With regard to the decommissioning strategy, Hydro-Québec indicated that a preliminary decommissioning plan that includes managing the site to restore it to an industrial site has been submitted to the CNSC. CNSC staff has accepted this preliminary decommissioning plan. In response to a question by the Commission regarding the decommissioning process, CNSC staff explained that once the decision has been made to shut down the station, a public hearing and an environmental assessment will be required before a decommissioning licence can be issued.

Conclusion on waste management

177. On the basis of the information submitted at this hearing, the Commission considers that Hydro-Québec is taking, and will continue to take, all the measures required for the management of waste at the Gentilly-2 NGS.

Non-proliferation and safeguards

178. The CNSC's mandate includes ensuring conformity with measures required to implement Canada's international obligations under the *Treaty on the Non-Proliferation of Nuclear Weapons*. Pursuant to the Treaty, Canada has entered into safeguards agreements with the International Atomic Energy Agency (IAEA). The purpose of these agreements is for the IAEA to provide credible assurance on an annual basis to Canada and to the international community that all declared nuclear material is used for peaceful purposes and that there are no undeclared nuclear materials or activities in this country.
179. Hydro-Québec asserts that it respects Canada's commitments under the *Treaty on the Non-Proliferation of Nuclear Weapons* and the implementation of international safeguards, and that it cooperates fully with the IAEA towards the fulfilment of its mandate.
180. CNSC staff considers that the programs and procedures in this area have been implemented satisfactorily and comply with CNSC regulatory requirements and expectations.
181. CNSC staff reported that a new national approach to integrated safeguards will be used by the IAEA. This new method requires the installation of IAEA equipment in the used fuel bay and in the used fuel dry storage facility (UFDSF). Unexpected delays were encountered during the implementation of this project, but the work on the used fuel bay was completed at the end of February 2010, and the work on the UFDSF was completed in May 2010.

182. Several intervenors expressed the view that Gentilly-2 contributes to the proliferation of nuclear weapons through the wastes it generates. The Commission requested further information on the subject. CNSC staff explained that the nuclear industry is the most regulated industry in the world. CNSC staff added that Canada is a signator of the *Treaty on the Non-Proliferation of Nuclear Weapons*, and therefore all national measures are in place to prevent the Canadian export of nuclear materials for military purposes. IAEA inspectors regularly come to Canada to check fuel cycle activities. CNSC staff also indicated that Canada does not export uranium or nuclear technology to a country that is not also subject to ongoing monitoring and inspections by the IAEA.
183. On the basis of this information, the Commission considers that Hydro-Québec has made, and will continue to make, adequate provisions in the areas of safeguards and non-proliferation to ensure the maintenance of national security and the implementation of the national obligations to which Canada has agreed.

Packaging and transport

184. CNSC staff reported that the proposed licence incorporates this new area, and that Hydro-Québec will have to present new programs and transition plans, which will be documented in the LCH.
185. CNSC staff noted that it had verified the performance of the licensee by reviewing certain procedures and the quarterly reports submitted to verify compliance with the *Packaging and Transport of Nuclear Substances Regulations*.¹⁷ CNSC staff considers that Hydro-Québec is qualified in this area.
186. On the basis of the information provided, the Commission considers Hydro-Québec's performance in this area to be acceptable.

Preliminary decommissioning plan and financial guarantee

187. The Commission asked the licensee to establish a decommissioning plan for the Gentilly-2 NGS. To ensure that sufficient funds are available for the safe and secure decommissioning of the Gentilly-2 site, the Commission requires that an adequate financial guarantee for the execution of the planned activities be instituted and remain acceptable throughout the licence period.
188. Hydro-Québec stated that it had obtained a financial guarantee from the Quebec government that covers all the costs of dismantling and the long-term management of irradiate fuel. CNSC staff reported that it had seen Hydro-Québec's latest submissions, which included a revised preliminary decommissioning plan and Gentilly-2's financial guarantee. CNSC staff is satisfied with Hydro-Québec's responses in its submissions.

¹⁷SOR/2000-208

189. CNSC staff considers that Hydro-Québec meets the regulatory expectations detailed in regulatory documents G-219, *Decommissioning Planning for Licensed Activities*, and G-206, *Financial Guarantees for the Decommissioning of Licensed Activities*.
190. On the basis of this information, the Commission concludes that both the plan and the financial guarantee for the decommissioning of the Gentilly-2 NGS are acceptable.

Aboriginal consultation

191. CNSC staff indicated that the Gentilly-2 NGS is in the Murray Treaty area. This treaty grants the Huron-Wendat nation the right to practice its customs and religion. However, no mention is made in the treaty of its territorial scope. CNSC staff noted that the Huron-Wendat nation did not express particular interest in the licence renewal or the refurbishment.
192. CNSC staff noted that it maintains a record of communications with Aboriginal groups on the refurbishment project. CNSC staff reported that it had taken steps with the Aboriginal communities around Gentilly-2 to discuss the plant refurbishment project. Discussions were held with the Band Council of the Abénakis, and concerns were expressed on issues related to the refurbishment. These concerns were communicated to Hydro-Québec, which offered the Grand Council to provide the answers to the individuals concerned.
193. CNSC staff reported that it had sent a letter to Aboriginal groups informing them of the licence renewal application, the dates and locations of the hearings and the process for submitting an intervention. Staff also asked those groups whether Hydro-Québec had satisfactorily responded to their concerns, and requested that it be informed if such was not the case. CNSC staff followed up this letter with telephone calls in February 2011, and no further comments or concerns were received. On the basis of the information received, CNSC staff considers that the Gentilly-2 refurbishment project will not have a negative impact on Aboriginal rights or the rights provided for in the Murray Treaty.
194. Given the above information, the Commission recognizes that the Aboriginal groups that had been identified as having a potential interest in the decision were informed of the licence renewal and the intervention process, and that the efforts expended by Hydro-Québec and CNSC staff were satisfactory.

Public information

195. Hydro-Québec explained that its public information program (PIP) for Gentilly-2 is designed to adequately and continuously inform the communities concerned, and that the preferred approach is to disseminate the most accurate information possible to provide the public with an adequate understanding of the situation. Hydro-Québec added that the methods used are reviewed and evaluated regularly for their effectiveness in achieving this goal.

196. CNSC staff considers that the PIP for Gentilly-2 submitted by Hydro-Québec at the end of June 2010 reflects public concerns regarding nuclear energy, although some weaknesses exist. CNSC staff also reported that the Gentilly-2 PIP complies with regulatory requirements.
197. In its intervention, International Safety Research Inc. (ISR) indicated that it had completed audits at Gentilly-2 and of nuclear generating plants worldwide. The Commission asked ISR how Hydro-Québec's communication program compares with those of other plants. The ISR representative responded that Gentilly-2's current communication plan will be improved, and that the anticipated program will compare favourably with those of other nuclear stations.
198. The Commission asked the local chapter of the Canadian Union of Public Employees (CUPE) how the unions or employees participate in communication with the community. The CUPE representative responded that information sharing sometimes takes place in a public setting, but that most communication takes place informally between workers and their families. The Municipality of Bécancour shares CUPE's view and acknowledges that the community could be better informed.

Conclusion on public information

199. On the basis of this information, the Commission considers that Hydro-Québec's public information program meets regulatory requirements and allows Hydro-Québec to keep people living in the Gentilly-2 vicinity informed. The Commission encourages CNSC staff to continue to monitor eventual improvements to Hydro-Québec's PIP and to continue to ensure that the program sufficiently informs the local population.

Security

200. Regarding issues of security on the site, the Commission received confidential Commission Member Documents, which were reviewed in a closed session. The Commission also asked Hydro-Québec and CNSC staff a number of questions, also in a closed session.
201. The Commission concludes that Hydro-Québec has applied, and will continue to apply, the appropriate measures for ensuring the physical security of its premises.

Gentilly-2 plant refurbishment project

202. CNSC staff noted that it had completed a review of several safety factor reports to ensure that they contain all the necessary information. CNSC staff is holding discussions with Hydro-Québec to indicate the information missing in the reports submitted. CNSC staff

intends to complete the analyses of the safety factor reports related to the refurbishment by the end of 2011. CNSC staff added that during the refurbishment work it intends to continue its review of the documents submitted, its site inspections and follow-up of various issues. CNSC staff will review Hydro-Québec's submissions regarding the re-commissioning and restart.

203. Hydro-Québec plans to begin refurbishing the Gentilly-2 plant in fall 2012. Hydro-Québec stated it would continue to closely monitor the progress of the refurbishment work at the Point Lepreau and Wolsong plants. The Commission asked Hydro-Québec whether the work completed at those two sites had prompted any changes in the plan. Hydro-Québec confirmed that all the experience feedback from the work at those plants has been incorporated into the planning of the refurbishment project.

Integrated safety review

204. Hydro-Québec indicated that the integrated safety review (ISR) was completed in May 2010, and that all the documents related to the ISR have been sent to CNSC staff. The action plans, which are documented in the global assessment report and the integrated implementation plan, will be completed after the refurbishment but before the plant's restart. Hydro-Québec asserts that, with these action plans, the condition of the systems important to safety and the various programs in place are adequate for ensuring the reliable and safe operation of the plant until 2040.
205. CNSC staff indicated that Hydro-Québec has undertaken to respect the spirit of the 2008 version of regulatory document RD-360, *Life Extension of Nuclear Power Plants*.¹⁸ CNSC staff indicated that it has begun its review of the documents submitted by Hydro-Québec, and that it is of the opinion that the general approach proposed is acceptable, but that information is missing.

Environmental impact assessment

206. As a corporation whose sole shareholder is the Government of Quebec, Hydro-Québec is subject to the environmental impact assessment and review procedure provided in section 31.1 et seq. of the *Environmental Quality Act*¹⁹ and paragraph 2(m) of the *Regulations Respecting Environmental Impact Assessment and Review*²⁰. Consequently, Hydro-Québec was required to conduct an environmental impact review of the proposed modification to the radioactive waste storage areas at the Gentilly-2 NGS further to a directive from Quebec's Minister of Sustainable Development, Environment and Parks. The environmental impact review was published in January 2004, and the project was the subject of a public hearing by Quebec's Bureau d'audiences publiques sur l'environnement (BAPE), whose report was filed with the Minister in March 2005 and

¹⁸CSNC regulatory document RD-360, *Life Extension of Nuclear Power Plants*, February 2008.

¹⁹ Revised Statutes of Quebec (R.S.Q.), c. Q-2.

²⁰ c. Q-2, section (s.). 9.

published by the latter in May 2005.

207. For the Hydro-Québec project, the CNSC staff ensured, as the responsible authority, that an EA was completed and an EA Screening Report was prepared. The purpose of the EA Screening Report is to enable the Commission, drawing on the environmental effects review and recommendations by CNSC staff, to make a decision on the EA of the project, pursuant to section 20 of the CEAA. Following the public hearing held in Bécancour in November 2006, the Commission concluded that the refurbishment project was unlikely to cause significant adverse environmental effects, given the mitigation described in the EA Screening Report.²¹ The Commission decided that it would not refer the project to the federal Minister of the Environment for review by a panel or for mediation. Consequently, in accordance with paragraph 20(1)(a) of the CEAA, the Commission decided that it would carry out the review of the licence application relating to the refurbishment activities, pursuant to the NSCA.
208. Hydro-Québec reiterated that activities related to the construction of the SRWMF and the refurbishment of the Gentilly-2 NGS are subject to a specific follow-up program for evaluating their impacts on the environment.
209. Hydro-Québec reported that it had conducted several assessments on the impact of the Gentilly-2 plant on the environment, including that on fish in the St. Lawrence River near the plant's outlet channel (this item is discussed in the section on *Environmental protection – Effluent temperature and fish caught in the inlet header* earlier in this document). CNSC staff indicated that it had reviewed the activities of the environmental monitoring program and, with the additional information provided by Hydro-Québec, it has concluded that the information provided is acceptable.

End-of-life operating plan and regulatory plan

210. Hydro-Québec reported that the operating plan was produced following the decision of Hydro-Québec to postpone the refurbishment until fall 2012. According to Hydro-Québec, the end-of-life operating plan of the Gentilly-2 NGS meets the expectations set forth in revised regulatory document RD-360. This plan details the actions and timelines for various activities related to the most sensitive structures in terms of sustainability of the ageing plant. Hydro-Québec is of the opinion that the actions included in the plan ensure the safe operation of the plant. CNSC staff reported that it had approved the operating plan and formulated a regulatory plan that outlines its regulatory licensing and compliance verification activities. The regulatory plan contains requirements that must be met by Hydro-Québec to resume operation of the plant, for which the bulk of the deadlines correspond to the scheduled shutdown of the reactor in 2011.

²¹Record of Proceedings, Including the Reasons for Decision, *Environmental Assessment Screening Report for the Proposed Modifications to the Gentilly Radioactive Waste Management Facilities and the Refurbishment and Continued Operation of the Gentilly-2 Nuclear Generating Station until 2035*, hearing date: November 7 and 8, 2006.

Conclusion on the Gentilly-2 refurbishment project

211. On the basis of the information provided, the Commission considers that Hydro-Québec's activities in preparation for the refurbishment, as well as CNSC staff's activities for regulating this activity, are acceptable.

Licence terms and conditions

212. Hydro-Québec applied for a five-year operating licence. CNSC staff recommends a five-year licence, but with hold points.
213. According to the proposed licence, Hydro-Québec must perform a scheduled reactor shutdown by December 31, 2011, and obtain the approval of the Commission or a person authorized by the Commission to restart the reactor after that shutdown. Hydro-Québec must also place the reactor in a shutdown state for refurbishment or for the guaranteed shutdown state by December 31, 2012. In addition, Hydro-Québec must obtain the approval of the Commission before refuelling the reactor after the refurbishment.
214. On the basis of this information, the Commission concludes that issuing a licence for a period of five years is appropriate. The Commission accepts the licence conditions recommended by CNSC staff. The Commission is also in agreement with the level of delegation of authority regarding the approval to restart the reactor after the planned 2011 extended shutdown and notes that, if relevant, any matter can be heard at a Commission hearing.

Conclusion

215. The Commission has considered the information and submissions of Hydro-Québec, CNSC staff and the intervenors, as presented in the material available for reference on the record.
216. The Commission concludes that, in accordance with the *Canadian Environmental Assessment Act*, an environmental assessment is not required for the renewal of the licence to operate the Gentilly-2 NGS and its waste management facility.
217. The Commission considers that Hydro-Québec meets the requirements of subsection 24(4) of the NSCA. The Commission is of the opinion that Hydro-Québec is qualified to carry out the activities authorized by the amended licences and that, in carrying out those activities, it will make adequate provisions for the protection of the environment, the health and safety of persons, the maintenance of national security, and measures required to implement international obligations to which Canada has agreed.
218. Accordingly, pursuant to section 24 of the NSCA, the Commission renews and combines power reactor operating licence PERP10.00/2011 (nuclear generating station) and PEID-W4-319.00/2011 (radioactive waste storage facility), which authorize Hydro-Québec to

operate the Gentilly-2 NGS and its solid radioactive waste management facility. The renewed licence, PERP 10.00/2016, is valid until June 30, 2016, unless it is suspended, amended, revoked or replaced. By renewing this licence, the Commission also authorizes the activities related to the full refurbishment of the Gentilly-2 NGS.

219. The Commission includes in the licence the conditions as recommended by CNSC staff in CMD 10-H15.H. The Commission took note of the LCH as amended in CMD 10-H15.F. The Commission asks CNSC staff to revise the LCH to eliminate any ambiguities therein.



2011-06-29

Michael Binder
President,
Canadian Nuclear Safety Commission

Date

Appendix A – Intervenors

Intervenors	Document
Claude Lussier	10-H15.2 10-H15.2A
Jean Chatillon	10-H15.3
Association sportive et écologique de Batiscan Inc.	10-H15.4
Gaétan Lebel	10-H15.5
Environmental Coalition of Prince Edward Island	10-H15.6
International Safety Research Inc., represented by Jean-Pierre Létourneau et François Lemay	10-H15.7
Sylvain Dussault	10-H15.8
Environnement Vert-Plus	10-H15.9
Josiane Morinville	10-H15.10
GENIVAR	10-H15.11
Mélanie Aka-Rousseaux	10-H15.12 10-H15.12A
City of Trois-Rivières, represented by Yves Lévesque	10-H15.13
Comité des citoyens et citoyennes pour la protection de l'environnement maskoutain (CCCPEM), represented by Guy Rochefort	10-H15.14
Coalition Stop Uranium Baie des Chaleurs	10-H15.15
Nadia Bouthillette	10-H15.16
Conseil régional de l'environnement Mauricie	10-H15.17
Dessau, represented by René Houle and Guy Hotte	10-H15.18
Canadian Nuclear Association	10-H15.19
Groupe Pluritec & Johnston-Vermette, represented by Luc Vermette and Denys Rancourt	10-H15.20 10-H15.20A
The Canadian Union of Public Employees, local sections 957, 1500, 2000 and 4250, of the Gentilly-2 NGS, represented by Stéphane Bousquet	10-H15.21
Denis Desfossés	10-H15.22
Christophe Buidin	10-H15.23
CentricoisES et MauricienNEs pour le déclasséement nucléaire, represented by Sébastien Bois	10-H15.24
Marcel Jetté	10-H15.25 10-H15.25A
The Provincial Presidents of the Fédération des travailleurs et travailleuses du Québec (FTQ) and local sections 957, 1500, 2000 and 4250 of the Canadian Union of Public Employees, represented by Michel Arsenault, Richard Perreault, Ginette Paul and Benoit Bouchard	10-H15.26
Les Artistes pour la Paix, represented by Pierre Jasmin	10-H15.27 10-H15.27A
Jean-François Gauthier	10-H15.28
Greenpeace Canada, represented by Shawn-Patrick Stensil	10-H15.29
Health Professionals for Global Survival, the Canadian Association of Physicians for the Environment and the David Suzuki Foundation, represented by Éric Notebaert	10-H15.30 10-H15.30A
Hélène Lamothe	10-H15.31

Michel Simard	10-H15.32
Jean Koclas, École Polytechnique de Montréal	10-H15.33 10-H15.33A
Canadian Nuclear Society, Quebec Branch, represented by Gilles Sabourin and Michel Saint-Denis	10-H15.34 10-H15.34A
Syndicat professionnel des ingénieurs d'Hydro-Québec	10-H15.35
Association de Protection de l'Environnement des Hautes-Laurentides (APEHL), represented by François Lapierre	10-H15.36
Sept-Îles Sans Uranium, represented by Claude Francis Huguet and Marc Fafard	10-H15.37
Nature Québec, represented by Christian Simard and Thomas Welt	10-H15.38
Groupe MACO inc.	10-H15.39
Ute Biermann	10-H15.40
Canadian Nuclear Workers' Council, represented by David Shier	10-H15.41
Réal Richer	10-H15.42
Groupe MCN21, represented by Daniel Breton	10-H15.43
Groupe de recherche en écologie sociale, represented by Colette Tardif	10-H15.44
Vertech	10-H15.45
Claude Saint-Jarre	10-H15.46
Réseau québécois des groupes écologistes, represented by Bruno Massé	10-H15.47
Group of citizens and members of the Association retraitées et retraités de l'éducation et des autres services publics du Québec	10-H15.48
François A. Lachapelle, represented by Danielle Boily	10-H15.49 10-H15.49A
Robert Duchesne	10-H15.50 10-H15.50A
Marc-Antoine Montpetit	10-H15.51
Regroupement Municipal Québécois pour un Futur Énergétique Socialement Responsable (RMQ-FÉSR), represented by Gaëtan Ruest	10-H15.52
Jacques Dagenais	10-H15.53
Brigitte A. LeBlanc	10-H15.54
Marie-France Doucet	10-H15.55
Julie Lemieux	10-H15.56
Philippe Giroul	10-H15.57
Zach Ruiter	10-H15.58 10-H15.58A
Coalition Pour que le Québec ait meilleure mine	10-H15.59
Michel Duguay	10-H15.60
Jacques Normandin	10-H15.61
Gaëtan Cloutier	10-H15.62
Rachel Bériault	10-H15.63
Chambre de commerce et d'industrie de Bécancour	10-H15.64
RCM of Bécancour, Municipality of Bécancour and RCM of Bécancour Local Development Centre, represented by Maurice Richard and Jean-Guy Paré	10-H15.65