

Integrated Safety Review for the Point Lepreau Refurbishment for Life Extension

by

C.K. Scott, Atlantic Nuclear Services Ltd.
R. Jeppesen, CNUS
A.R. McKenzie, Atlantic Nuclear Services Ltd.
M.-A. Petrilli, Atomic Energy of Canada Limited
P.D. Thompson, New Brunswick Power

Prepared for Presentation at the
23rd Annual Conference of the
Canadian Nuclear Society

2-5 June 2002
Toronto

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Abstract

An Integrated Safety Review (ISR) is being performed to support NB Power's licensing effort in support of the project to refurbish the Point Lepreau GS for an extended operating life. The review is being done to meet the requirements of a Periodic Safety Review (PSR) as developed by the IAEA. The purpose of this paper is to describe the methodology that has been developed to perform the Integrated Safety Review.

1. Introduction

Phase I of the Refurbishment Project was a scope definition study. [Ref 1,2] This included an extensive safety and licensing review to assess the licensing of the station for life extension. After NB Power had undertaken the safety review, the Canadian Nuclear Safety Commission (CNSC) suggested it be compared with the scope of a Periodic Safety Review as defined by the IAEA [Ref. 3].

The Refurbishment Team's activities to assess and plan for the refurbishment of the plant relate directly to the requirements of a PSR as described in the IAEA Safety Guide [Ref. 3]. They performed a safety design review, plant condition assessment and safety analysis review which are three of the safety factors to be included in a PSR. Reviews in these three areas are a large portion of the level of effort required for a PSR.

There are several reviews and performance improvement projects underway at the Point Lepreau Station that overlap with the requirements of a PSR as described by the IAEA. For example, the environmental qualification program qualifies safety equipment to be operable under the harsh environmental conditions that might be encountered in an accident. This is a safety factor which would be addressed by a PSR. Also, a significant reorganization of the management processes is in progress to improve Quality Assurance and the work processes necessary for high quality, safe operation of the plant. These activities also relate to the scope of a PSR.

Thus, we were left with the following tasks to demonstrate that the scope of a PSR has been covered.

1. Review the refurbishment work against the scope described in the PSR guide;

2. Review the station programs and the current improvements against the scope of the PSR guide;
3. Identify the areas of a PSR not covered by the refurbishment project and station programs; and,
4. Complete the areas not addressed by current reviews and integrate all the work into a comprehensive safety assessment as covered by a PSR.

Since we were bringing together work already done by others with the work we are doing, we chose to call our project an Integrated Safety Review (ISR). Its intent is to demonstrate that the scope and intent of a PSR have been met.

The IAEA Guide for conduct of a PSR recognizes that the scope and methodology for a PSR depends upon the country in which it is being performed. Factors that will affect the scope and methodology for a PSR in Canada include:

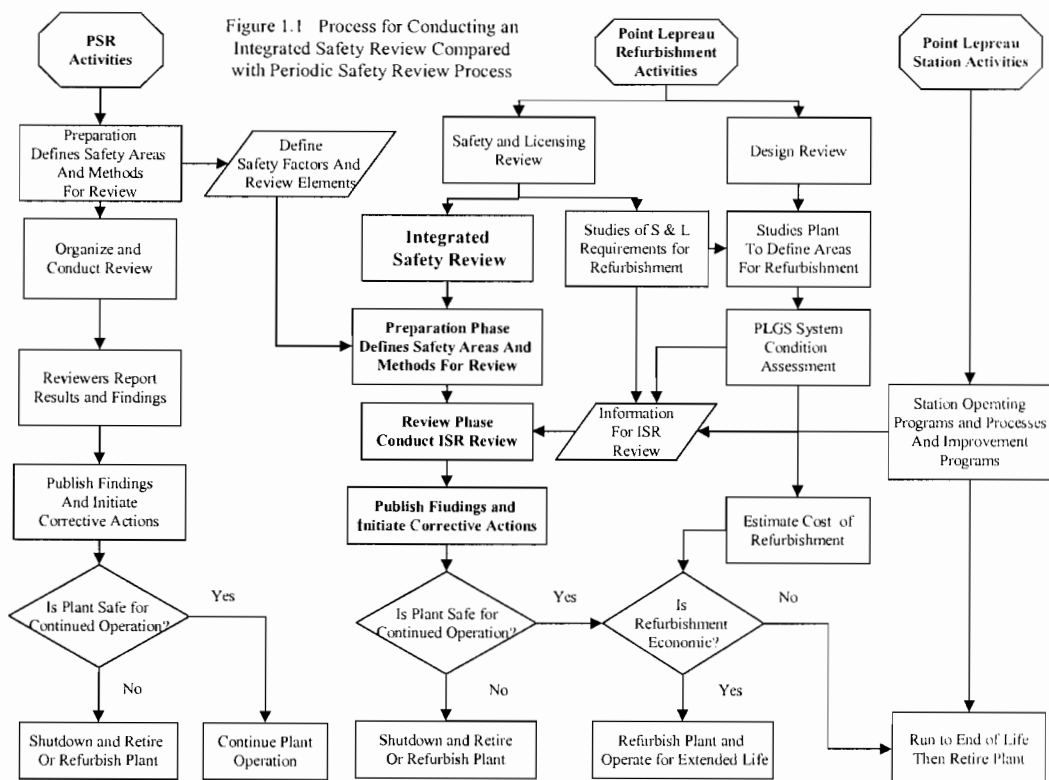
1. National Safety Standards (CSA and CNSC Regulatory Documents)
2. The Canadian regulatory process (i.e., a two year licence renewal and Safety Report update every three years).
3. Ongoing Safety & Licensing programs, CANDU industry experience and generic licensing issues (e.g., Generic Licensing Actions)

The IAEA Guide gives flexibility in the methodology for the performance of a Periodic Safety Review for conformance to these national codes and standards but also suggests that a comprehensive review of the areas of safety covered by the Safety Factors and Review Elements listed in the IAEA Guide be included in the PSR. The unique features of the CANDU power station need to be examined and incorporated into the review.

In this paper we describe the methodology that was developed to demonstrate that NB Power has undertaken safety and licensing reviews that address the scope and intent of a PSR as described in Reference 3.

2. The Integrated Safety Review

A diagrammatic representation of the process for expanding the safety and licensing review of the Refurbishment Project to encompass the scope of a PSR is shown in Figure 1. The figure shows reviews done by the Refurbishment Project as well as current station improvement projects. What remains to be done is to review and augment these work activities to ensure that all elements of a PSR have been considered, to identify any gaps, and to integrate all this work into a safety review that is called an "Integrated Safety Review" (ISR). When an activity such as Plant Condition Assessment is considered for inclusion in the ISR, it will be evaluated to ensure that the objectives and the way in which the work has been done meet the objectives of a PSR.



A comprehensive assessment of overall plant safety is a complex task. Experience shows that dividing it into a number of “safety factors” facilitates the review. Each Safety Factor is reviewed by comparing the station’s processes for the activities covered by it, with current codes, standards and best practices. Gaps in the conformance of station programs and work processes with codes and standards will be reported as “Findings”. Reasonable and practical corrective actions are to be determined and presented with the Findings of the review.

3. Selection of Safety Factors

Safety Factors cover logical groupings of safety related areas of activity which can be classified as either “Condition Factors” or “Programmatic Factors”.

3.1 Condition Factors

The Safety Factors used to classify the condition and safety of the plant design, the condition of the SSC’s, the methodology and status of the safety analysis, and the equipment qualification to function in harsh environmental conditions (i.e. during an accident) are termed “Condition Factors”. Generally these will be reviewed using single activity functions such as the Plant Condition Assessment conducted by the Refurbishment Project and by the review of the environmental qualification activities planned and implemented by the plant technical support staff. These are “one time” activities although it will be necessary to also ensure processes are in place to maintain the plant systems and activities in acceptable condition.

3.2 Programmatic Factors

The Safety Factors covering ongoing activities such as “Conduct of Operations”, “Conduct of Maintenance”, “Management of Ageing” etc. are programmatic by nature and are covered by programs and processes at the station as on going activities. These functions will be performed on a continuous basis for the remaining life of the station. The factors covering these activities will be reviewed by examining and assessing the effectiveness of the programs and processes on which they are based.

The IAEA Safety Guide lists Safety Factors and Review Elements that are suggested for use while performing a PSR. These have been selected to be generally applicable to any type of nuclear power plant located in any country in the world. However, it is suggested that these be modified to suit the type of nuclear plant being reviewed and tailored to the Regulations that govern operation in the country where the plant is located.

The IAEA list of Safety Factors and Review Elements was selected as a starting point for the Point Lepreau ISR. The Safety Factors were adjusted to include the special features of a CANDU reactor and some other minor changes as shown in the following Table.

IAEA PSR Safety Factor Number	IAEA PSR Safety Factor Title	ISR Safety Factor Number	ISR Safety Factor Title
		IF1	Plant Design
SF 1	Actual Physical Condition of the Nuclear Power Plant	IF2	Condition of SSCs Important to Safety
SF 2	Safety Analysis	IF3	Safety and Hazard Analysis
SF 3	Equipment Qualification	IF4	Equipment Qualification
SF 4	Management of Ageing	IF5	Management of Ageing
SF 5	Safety Performance	IF6	Performance Management
SF 6	Use of Experience from Other Plants and Research Findings	IF7	OPEX and the Use of R & D
SF 7	Procedures	IF8	Procedures
SF 8	Organizational and Administrative Factors	IF9	Management and Administration,
SF 9	Human Factors	IF10	Staff Selection and Training
SF 10	Emergency Planning	IF11	Emergency Planning
SF 11	Environmental Impact	IF12	Environmental and Waste Management
		IF13	Radiation Protection
		IF14	Summary Assessment

Notes for Table of Safety Factors

- a) SF1 was divided into two Factors, one to cover design and the other, equipment condition.
- b) Hazard Analysis was added to Safety Analysis.
- c) The "Safety Performance" Factor was changed to "Performance Management" to better reflect the Review Elements/Tasks that it contains.
- d) The Use of Experience was modified to include feedback of in-plant and external experience known as OPEX.
- e) "Human Factors" was found to contain mainly Review Elements describing staffing and training, so the title was changed to reflect this.
- f) "Waste Management" was added to "Environmental Impact" as it was not covered anywhere else.
- g) A "Radiation Protection" Safety Factor was added as this is given special treatment in the Canadian program and internal dose uptake requires special attention due to the tritium hazard in the use of heavy water.

4. Selection of Review Tasks

Safety Factors cover a broad area of the plant safety and contain many separate and distinct activities. In order to ensure that all aspects of plant activities that are related to safety receive appropriate coverage, the scope of the Safety Factors are divided into Review Elements (REs) that cover an activity or process that can be included in a single review task.

For the methodology of the Integrated Safety Review of Point Lepreau, Review Elements are redefined as "tasks" which a reviewer will perform to check the safety concern covered by the RE. A Task Execution Plan will be written for each Review Task (or group of Tasks) and a report will be written upon completion of the work to cover the Safety Concern identified by the Review Element..

Review Tasks (RT's) can be changed or grouped or new RT's may be initiated throughout the conduct of the ISR as the need for new or modified RT's becomes apparent as a result of work in progress. For example, a Review Task covering a group of elements may require specific tasks related to a sub-group of elements. A Table of Safety Factors and Review Tasks for the Point Lepreau ISR has been developed. This serves as a work plan for performing the ISR.

5. Codes, Standards and Practices

The safety review includes a comparison of station practices with the current safety standards codes and best practices. The selection of the standards and practices to be used in the safety review is one of the early critical activities to be performed.

As recommended by the IAEA, our selection is based on the Canadian standards, including regulatory requirements and practices. It is recognized that in some areas there may be no specific Canadian standard applicable for the Review Task. In these cases, internationally recognized practices and standards will be used. Also, the CNSC has indicated that the safety review should not only include new requirements but also anticipated future requirements.

6. The Independent Assessment Group

A work unit called the Independent Assessment Group (IAG) has been formed at Point Lepreau to carry out audits and assessments, to ensure compliance by station staff with procedures which define and control work at the station and specify the way that work must be done. The IAG has also been assigned responsibility to follow up on Areas For Improvement (AFIs) which have resulted from WANO and CNSC audits.

The IAG has a small number of full time staff and normally draws staff for their work from the Point Lepreau work units (for an internal "peer" review) and when appropriate can obtain experienced staff from other stations (external "peers").

It is intended to use the IAG assessment and audit program to confirm conformance with procedures where this is necessary in the conduct of the ISR.

7. Findings and Corrective Actions

Findings, which result from the Integrated Safety Review, will be referred to the Project Manager for NB Power. A decision will be made if a Finding relates to refurbishment or station activities and it will be referred to the responsible organisation (Refurbishment or Station) for implementation of Corrective Actions. Wherever appropriate and practical, a recommended Corrective Action will be included with the Finding.

Point Lepreau has a system for collecting, recording and classifying problems called the Problem Identification and Corrective Action (PICA) System. This system will be used to classify Findings resulting from the ISR in terms of category and severity.

8. Conclusion

A safety review methodology has been developed to demonstrate that the safety and licensing review process for the Point Lepreau Refurbishment together with other station safety reviews meets the scope and intent of a Periodic Safety Review.

In developing the Integrated Safety Review approach, safety factors and review tasks have been developed for CANDU stations. We believe that this basis for a safety

review meets the scope and intent of a PSR and incorporates current Canadian operational practices.

9. References

1. "Possible Refurbishment of Point Lepreau" by R.M. White et.al., paper presented at the 22nd Annual Conference of the Canadian Nuclear Society held in Toronto in June 2001.
2. "Possible Refurbishment of Point Lepreau" by R.M. White et.al., Paper to be presented at the 23rd Annual Conference of the Canadian Nuclear Society, June 2002, Toronto, Ontario.
3. "Periodic Safety Review of Operational Nuclear Power Plants", IAEA Safety Guide 50-SG-012, 1994.