

March 17, 2011

MEMORANDUM TO: Robert Carlson, Chief
Plant Licensing Branch III-2
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

FROM: Undine Shoop, Chief */RA/*
Health Physics and Human Performance Branch
Division of Inspection and Regional Support
Office of Nuclear Reactor Regulation

SUBJECT: SAFETY EVALUATION INPUT FOR THE BYRON UNITS 1 AND 2,
AND BRAIDWOOD UNITS 1 AND 2 LICENSE AMENDMENT
REQUEST REGARDING LOW TEMPERATURE OVERPRESSURE
PROTECTION AND LOSS OF DECAY HEAT REMOVAL

Plant Names: Byron Units 1 & 2, Braidwood Units 1 & 2
Utility: Exelon Generation Company, LLC
Docket Nos.: 50-454, 50-455, 50-456, and 50-457
License Nos: NPF-37, NPF-66, NPF-72, and NPF-77
TAC Nos.: ME4194, ME4195, ME4196, and ME 4197
Project Manager: Nicholas DiFrancesco
Review Branch: IHPB
Review Status: Complete

The Health Physics and Human Performance Branch (IHPB) has completed its Human Performance review of Exelon Generation Company, LLC (EGC) license amendment request (LAR) to change the Byron and Braidwood licensing bases and Technical Specification 3.4.12 to state: "For the purpose of protecting the decay heat removal function, one or more SI pumps may be capable of injecting into the RCS in MODE 5 and MODE 6 when the reactor vessel head is on provided pressurizer level is \leq 5 percent." The IHPB staff finds the licensee's proposed LAR to be acceptable regarding the human performance aspects of the change. The Health Physics aspects of the LAR, if any, will be addressed separately.

Enclosure:
IHPB Safety Evaluation

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ADAMS Accession No: ML11076A006 *by email

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HEALTH PHYSICS AND HUMAN PERFORMANCE BRANCH (IHPB)
HUMAN PERFORMANCE SAFETY EVALUATION INPUT FOR THE
BYRON UNITS 1 AND 2, AND BRAIDWOOD UNITS 1 AND 2
LICENSE AMENDMENT REQUEST REGARDING LOW TEMPERATURE
OVERPRESSURE PROTECTION AND LOSS OF DECAY HEAT REMOVAL

1.0 INTRODUCTION

By letter dated June 29, 2010 (ADAMS Accession Number ML1018100691), Exelon Generation Company, LLC (EGC), the licensee, submitted a license amendment request (LAR) to change the Operating Licenses and Technical Specifications (TSs) for Byron Units 1 and 2, and Braidwood Units 1 and 2. The LAR proposes to allow the use of one or more SI pumps to inject into the RCS in MODE 5 and MODE 6 when the reactor vessel head is on, provided pressurizer level is ≤ 5 percent, for the purpose of protecting the decay heat removal function. This strategy was approved by NRC in its Safety Evaluation (SE) dated August 31, 1990, but was inadvertently removed from TS during the transition to Improved Technical Specifications (ITS). All four units have been operating using the strategy approved in 1990, that is, procedures, training, displays and controls, and simulation reflect the LTOP strategy approved in 1990.

2.0 REGULATORY EVALUATION

The regulatory requirements and guidance which the Nuclear Regulatory Commission (NRC) staff considered in its review of the LAR are as follows:

- 2.1 Appendix A to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "General Design Criteria (GDC)," *Criterion 19 - Control room*. "A control room shall be provided from which actions can be taken to operate the nuclear power unit safely under normal conditions and to maintain it in a safe condition under accident conditions, including loss-of-coolant accidents.... Equipment at appropriate locations outside the control room shall be provided (1) with a design capability for prompt hot shutdown of the reactor, including necessary instrumentation and controls to maintain the unit in a safe condition during hot shutdown, and (2) with a potential capability for subsequent cold shutdown of the reactor through the use of suitable procedures."
- 2.2 10 CFR 50.120, "Training and qualification of nuclear power plant personnel"
- 2.3 NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants: LWR Edition":
 - Chapter 13 addresses "Conduct of Operation", specific sub-chapters considered in this review were Chapters 13.2.1, "Reactor Operator Requalification Program; Reactor Operator Training", and 13.5.2.1, "Operating and Emergency Operating Procedures".
 - Chapter 18, provides review guidance for "Human Factors Engineering".
- 2.4 NUREG-1764, "Guidance for the Review of Changes to Human Actions;"
- 2.5 GL 82-33, "Supplement 1 to NUREG-0737 - Requirements for Emergency Response Capability";
- 2.6 NUREG-0700, "Human-System Interface Design Review Guidelines" Revision 2;
- 2.7 NUREG-0711, "Human Factors Engineering Program Review Model," Revision 2;
- 2.8 IN 97-78, "Crediting Operator Actions in Place of Automatic Actions and Modifications of Operator Actions, Including Response Times;"
- 2.9 Generic Letter (GL) 88-17, "Loss of Decay Heat Removal"

In accordance with the generic risk categories established in Appendix A to NUREG-1764, the task sequence, initiating Safety Injection, reviewed herein, is considered “risk-important” due to the fact that it is required to prevent core uncovering when the decay heat removal function is lost. Because of its risk importance, the IHPB staff performed a “Level One” review, i.e., the most stringent of the graded reviews possible under the guidance of NUREG-1764.

Note: The IHPB assessment of risk is only for purposes of scoping the IHPB review and may conflict with the licensee’s assessment of risk importance or that of other branches, and should not be considered as an accurate assessment of risk when compared to other methods, especially, those using plant-specific data and NRC-accepted methods of Probabilistic Risk Analysis and Human Reliability Analysis, PRA/HRA.

3.0 TECHNICAL EVALUATION

3.1 Description of Operator Action(s) Added/Changed/Deleted

As a result of its review of operator actions, the licensee has identified no new operator actions that are required, nor any actions that are affected by the proposed LAR, including any effects on the time available for, or the time required to, perform operator actions (from Supplement dated 1/13/2011, ADAMS Accession Number ML1101400692). The addition of the note allowing SI pumps to be available will reflect current plant operation, in practice since its original NRC approval in 1990. No changes to procedures are needed to support the proposed license amendment.

3.2 Operating Experience Review

The licensee stated in its Supplement dated 8/24/2010, “... the NRC previously granted a license amendment for Braidwood Station and Byron Station (i.e., 8/31/1990) to allow use of an SI pump in Mode 5 and in Mode 6 when the reactor vessel head is on and with (sic) pressurizer level is ≤ 5 percent. In addition, the TS for other pressurized water reactors in the U.S. nuclear power industry have been reviewed. TS 3.4.12 for Callaway Plant, Unit No. 1, (i.e., ADAMS Accession Number ML053110040) contains wording similar to the proposed license amendment. TS 3.4.12 for Wolf Creek Generating Station, Unit 1, (i.e., ADAMS Accession Number ML052720315) also contains a similar note.” The staff agrees with the licensee’s assessment and finds the licensee’s position on operating experience acceptable.

3.3 Functional Requirements Analysis and Function Allocation

Because the operator actions associated with the proposed note are not new actions, a re-analysis of the functional requirements analysis and function allocation were not necessary. If the licensee’s engineering analysis had shown that the required tasks had changed since their original approval in 1990, the staff would have expected a reconsideration of allocation of this function. However, this was not the case, (per licensee statements in Supplement dated 1/13/2011, ADAMS Accession Number ML1101400692) and so, there was no need for either a new or revised functional requirements analysis or a reallocation of function. The staff finds the EGC approach acceptable based on the fact that there have been no substantial change to any of the actions associated with the proposed note since its original approval by the NRC in 1990.

3.4 Task Analysis

Because this operator action is not a new action, the only aspect requiring reanalysis was the confirmation of time constraints for the action sequence. The licensee's review of modification history of the simulator did not identify any changes that would appreciably impact the time for initiating SI to the RCS in response to a loss of decay heat removal event. Based on this review, and reviews of station procedures and standards, no issues involving modifications were identified that could have added to the workload of operators in a manner that would prevent them from timely initiation of SI.

There were minor changes to the stroke times for the following valves:

<u>Valve No.</u>	<u>Description</u>
1/2S18802A/B	RCS hot leg injection valves
1/2S18809A	RH to cold legs A and D isolation valves
1/2S18821	SI pump to cold legs isolation valves

The licensee further stated that the changes in stroke times for the above valves would not prevent timely initiation of SI to the RCS in response to a loss of decay heat removal event.

The staff concludes that revision of the licensee's task analysis is not necessary, because the actions associated with this proposed note to TSs have not changed.

3.5 Staffing

The licensee staffing and qualification are not affected by the proposed LAR. No new or additional staff are required, nor are there any new or additional qualifications required to perform the action sequence within the time constraints established. The staff concludes that no additional staffing or qualifications, or changes thereto, are required, and finds this human performance aspect of the LAR acceptable.

3.6 Probabilistic Risk and Human Reliability Analyses

Probabilistic Risk Analysis and Human Reliability Analysis are outside the scope of review for the Health Physics and Human Performance Branch (IHPB) and, therefore, are not reviewed in this safety evaluation (SE).

3.7 Human-System Interface Design

The licensee stated in its August 24, 2010 submittal (ADAMS Accession Number ML1023606630) that Human-System Interface (HSI) design of the control rooms and the simulator, including the design of the Safety Parameter Display System (SPDS) will not be affected by the proposed LAR. The same controls, displays, and alarms that have been successfully used in the past will continue to be used under the proposed LAR. Based on the fact that no changes are needed to the HSI design, the staff finds the EGC proposal acceptable.

3.8 Procedure Design

The licensee stated in its August 24, 2010 submittal (ADAMS Accession Number ML1023606630) that no procedures are affected by the proposed LAR. Current procedures already reflect the inclusion of the proposed note in TSs. The staff finds the licensee position acceptable based on the fact that no changes to, additions to, or deletions of personnel actions are required to support the proposed LAR.

3.9 Training Program Design

The licensee stated that the operators are trained on a loss of decay heat removal prior to every outage in accordance with INPO Significant Operating Experience Report (SOER) 09-1, "Shutdown Safety." In accordance with the licensee's Shutdown Safety Management Program, operators are briefed at least once per shift on the time to RCS boil and the time to core uncover, as well as the priorities for restoring RCS cooling in the event of a loss of decay heat removal event (e.g., steaming intact/non-isolated steam generators, feed and bleed, refuel cavity to fuel pool cooling, *SI pump hot leg injection*, accumulator injection, and inventory addition from the refueling water storage tank). In addition, an Infrequent Plant Activity (IPA) briefing, which includes Just-In-Time training, is conducted in accordance with Byron operating procedure BOP RC-4 and Braidwood operating procedure BwOP RC-4 for performing a RCS drain prior to lowering level to the reactor vessel flange and whenever the RCS is taken to a reduced inventory condition. (from ML1101400692, dated January 13, 2011). Also, licensed operators will continue to receive training on the abnormal operating procedures for loss of decay heat removal as part of the licensed operator training programs (from August 24, 2010 submittal, ADAMS Accession Number ML1023606630).

Based on the facts that the action sequence will continue to be included in the training program and that the training has been implemented prior to amending the TS, the staff finds that the training to be provided is acceptable.

3.10 Human Factors Verification and Validation

Per NUREG-0711, the scope of HFE design verification may be restricted to the modified HSIs and their interactions with the rest of the HSIs. NUREG-0711 also states that, "Integrated system validation may not be needed when a modification results in minor changes to personnel tasks such that they may reasonably be expected to have little or no overall effect on workload and the likelihood of error." In this case, there were no modifications required to support the proposed change to TS; therefore, the staff concludes that no additional design verification or validation is necessary.

3.11 Human Performance Monitoring Strategy

The actions proposed by this LAR, using SI to mitigate a loss of decay heat removal, will be included in the licensee's Just-in-time (J-I-T) Training prior to every refueling outage. Licensed operators will continue to receive training on the abnormal operating procedures for loss of RH cooling as part of the licensed operator and requalification training programs.

Based on the administrative protections afforded by the licensee's procedure control program against inadvertent change, and by the periodic re-validation provided by J-I-T training prior to each refueling outage, the staff finds the EGC long-term monitoring strategy acceptable.

4.0 CONCLUSION

Based on the evidence provided by EGC, i.e., that no changes to procedures, training, and human interface design are required to support the proposed LAR, and that appropriate administrative controls are being applied to procedures, training, and human interface design to prevent inadvertent changes in the future, the staff concludes that the proposed LAR is acceptable from the human performance point of view. The Health Physics aspects of the LAR, if any, will be addressed separately.

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