Exelon Generation

200 Exelon Way
Kennett Square, PA 19348

www.exeloncorp.com

10 CFR 50.90

NMP1L3264

February 25, 2019

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Nine Mile Point Nuclear Station, Unit 1
Renewed Facility Operating License No. DPR-63
NRC Docket No. 50-220

Subject: Response to Request for Additional Information by the Office of Nuclear Reactor Regulation to Support Review of Nine Mile Point Nuclear Station, Unit 1, License Amendment Request to Revise Technical Specifications 3.3.1 for Primary Containment Oxygen Concentration

References:

1. Letter from J. Barstow (Exelon Generation Company, LLC) to U.S. Nuclear Regulatory Commission, "License Amendment Request-Revise Technical Specifications 3.3.1 for Primary Containment Oxygen Concentration," dated June 26, 2018

2. Email from M. Marshall (Senior Project Manager, U.S Nuclear Regulatory Commission) to R. Reynolds (Exelon), "Nine Mile Point, Unit 1-Request for Additional Information Regarding Primary Containment Oxygen Concentration License Amendment request (L-2018-LLA-0183)," dated January 25, 2019

By letter dated June 26, 2018 (Reference 1), Exelon Generation Company, LLC (Exelon) requested to change the Nine Mile Point Unit 1 (NMP1) Technical Specifications (TS). The proposed amendment request to revise Technical Specifications 3.3.1 for Primary Containment Oxygen Concentration."

On January 25, 2019 (Reference 2), the U.S. Nuclear Regulatory Commission (NRC) identified areas where additional information was necessary to complete the review.

Attachment 1 to this letter contains the NRC's request for additional information immediately followed by Exelon's response. Attachment 2 to this letter contains the revised marked-up TS and Bases pages, replacing the previously submitted marked-up TS and Bases pages and associated inserts submitted with Reference 1.

Exelon has reviewed the information supporting a finding of no significant hazards consideration and the environmental consideration provided to the NRC in Reference 1. The additional information provided in this response does not affect the bases for concluding that the proposed license amendment does not involve a significant hazards consideration. Furthermore, the additional information provided in this response does not affect the bases for concluding that neither an environmental impact statement nor an environmental assessment needs to be prepared in connection with the proposed amendment.

There are no commitments contained in this response.

If you should have any questions regarding this submittal, please contact Ron Reynolds at 610-765-5247.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 25th day of February 2019.

Respectfully,

David T. Gudger for

James Barstow
Director - Licensing & Regulatory Affairs
Exelon Generation Company, LLC

Attachment 1: Response to Request for Additional Information
Attachment 2: Revised Markup Pages

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|---|---|---|
| cc: | USNRC Region I Regional Administrator | w/attachments |
| | USNRC Senior Resident Inspector – NMP | " |
| | USNRC Project Manager, NRR – NMP | " |
| | A. L. Peterson, NYSERDA | " |

**ATTACHMENT 1**

Nine Mile Point Nuclear Station, Unit 1
Renewed Facility Operating License No. DPR-63
NRC Docket No. 50-220

Response to Request for Additional Information

**RAI (1):**

Title 10 of the Code of Federal Regulations (10 CFR) Section 50.44(b)(2), "Combustible gas control," sub-item (i) requires that all Boiling Water Reactors (BWRs) with Mark I and Mark II type containments have an inerted atmosphere. The 10 CFR 50.44(b)(2) provision was retained in the 2003 risk-informed revision of the regulation (68 FR 54123) to maintain a low conditional probability of Mark I and Mark II containment failure by preventing hydrogen detonation in the very unlikely event that an accident could result in significant core damage (severe accident).

Although the 2003 revision of the regulation was risk-informed, the related standard technical specification (STS) retained its association with the design-basis loss of coolant accident to preventing hydrogen detonation following a severe accident. The NRC staff retained STS 3.6.3.2, "Primary Containment Oxygen Concentration," in the improved "Standard Technical Specifications – General Electric BWR/4 Plants," NUREG-1433, without modification from Revision 0 (1992) through the current Revision 4. The bases note that operational considerations justify inerting late in the startup process and early in the shutdown process to support containment entry without special breathing apparatus to conduct necessary inspections with the reactor coolant system pressurized. The applicability statements include a 24 hour period to complete inerting once reactor thermal power (RTP) exceeds 15 percent following startup and a 24 hour period to de-inert prior to going below 15 percent RTP in preparation for a scheduled shutdown. These infrequent transitory periods of reactor operation with the containment not inert are reasonably consistent with conditions considered in development of the risk-informed 10 CFR 50.44 regulation, where the staff assumed a high probability that the containment would be inerted during an event that progresses to a severe accident.

Contrary to the risk informed basis of the revised regulation in 10 CFR 50.44, the bases for STS 3.6.3.2 continues to be derived from design basis analyses, as evidenced by the discussion contained in the "Applicable Safety Analyses" section of the bases. Thus, the following statement included in the "Applicability" section of the bases applies to design-basis conditions following a loss of coolant accident: "As long as reactor power is < 15% RTP, the potential for an event that generates significant hydrogen is low and the primary containment need not be inert." A risk-informed evaluation of potential events initiated from <15 percent RTP indicates operation at low power may decrease the likelihood that events progress to conditions generating substantial amounts of hydrogen generation. However, the current 10 CFR 50.44(b)(2)(i) presumes core damage condition has been experienced and identifies the requirements to minimize the conditional primary containment failure probability.

In the current Nine Mile Point 1 TS 3.3.1 "Oxygen Concentration", the mode of applicability exceptions during reactor startup and prior to scheduled shutdown are thought sufficient to limit this to an infrequent transitory operating condition. TS 3.3.1, items a & b currently require the primary containment atmosphere to be reduced to less than 4 percent by volume oxygen concentration whenever the reactor coolant pressure is greater than 110 pounds per square inch gauge (psig) and the reactor is in power operating condition, with a 24 hour exception to this requirement during startup and shutdown. In addition, TS 3.3.1.c provides 24 hours to bring oxygen concentration to below 4 percent by volume if oxygen concentration were found to be greater than 4 percent by volume at any time during power operation (e.g. surveillances), except as allowed by the exceptions during startup and shutdown. TS 3.3.1.d states that failure to bring oxygen concentration to less than 4 percent oxygen concentration requires the reactor coolant pressure to be reduced to 110 psig or less within 10 hours (effectively a shutdown requirement).

Based on the current requirements in Nine Mile Point 1 TS 3.3.1, the containment would be inerted at all times during power operation, except as provided by the exceptions during startup and shutdown (i.e., an infrequent transitory operating condition). The possibility of an undefined duration of operation at ≤15 percent reactor thermal power (RTP) with containment de-inerted is not permitted under the current TS 3.3.1.

Exelon proposed to delete existing items a, b, c, and d in their entirety and replace them with new items TS 3.3.1.a.b.c, and d. Specifically,

- Proposed TS 3.3.1.a states, "The primary containment atmosphere shall be less than four percent by volume oxygen concentration during reactor power operation greater than 15 percent rated thermal power, except as specified in 'b' ".

- Proposed TS 3.3.1.b states, "Not required to be met until 24 hours after reactor power operation is greater than 15 percent rated thermal power. De-inerting may commence 24 hours prior to reducing reactor power operation to less than or equal to 15 percent rated thermal power."

- Proposed TS 3.3.1.c states, "If the containment oxygen concentration is greater than or equal to the four percent by volume limit, except as allowed in "b" above, restore the oxygen concentration to within the limit within 24 hours."

- Proposed TS 3.3.1.d states, "If Specifications 'a', 'b', or 'c' above are not met, the reactor power shall be reduced to less than or equal to 15 percent rated thermal power within 8 hours."

Information Request

1. Proposed TS 3.3.1.a and 3.3.1.b lack controls or limitations, such as a linkage to startup and scheduled shutdowns, that appear necessary to ensure operation up to 15 percent RTP while de-inerted would be infrequent and transitory, consistent with the risk-informed basis of 10 CFR 50.44(b)(2). Propose additional controls or limitations for these TSs to ensure operation at power while de-inerted would be infrequent and transitory, consistent with the applicability statement of STS 3.6.3.2.

2. Proposed TS 3.3.1.d permits continued operation with the containment oxygen concentration greater than 4 percent if the oxygen concentration could not be restored to less than the 4 percent limit within 24 hours. Provide justification that the proposed end state and completion time (i.e., indefinite operation at up to 15 percent RTP within 8 hours of the inability to restore oxygen concentration within limits) is consistent with the risk-informed basis of 10 CFR 50.44(b)(2) or propose an alternative end state and completion time with an appropriate justification. Justification for indefinite operation at low power should include supporting analyses demonstrating that, during reactor power operation at 15 percent RTP or less, the potential for hydrogen generation for all accident conditions (i.e., design-basis accidents and beyond design-basis accidents, including severe accidents) would be low enough that it would not cause an uncontrolled hydrogen and oxygen combination in the containment that could result in containment failure.

**Exelon Response to RAI (1)**

The original proposal to replace Limiting Condition for Operation (LCO) 3.3.1, Specifications a through d, are revised by this response. To address the NRC comments in the RAI, the approach is to retain most of the existing LCO 3.3.1 content in the Nine Mile Point Unit 1 (NMP!) Technical Specification (TS) and modified to align with the Standard Technical Specifications (STS) in NUREG-1433 (STS 3.6.3.2). Nine Mile Point Unit 2 (NMP2) TS 3.6.3.2, Primary Containment Oxygen Concentration, was also used as a model to ensure an overall consistent approach for both units is used for this LCO.

To address Information Request 1, the additional controls or limitations to ensure operation at power while de-inerted would be infrequent and transitory are retained in the original LCO 3.3.1 content. The specifics are described below.

To address Information Request 2, the changes that allowed indefinite operation are removed.

Additionally, to align with STS 3.6.3.2, the following changes are proposed as shown in the markups provided in Attachment 2. These TS markups supersede in their entirety the TS markups provided in the June 26, 2018, submittal.

- LCO 3.3.1, Specification a: The reactor pressure requirement is removed and the applicability of being greater than 15% rated thermal power is added. This aligns with the applicability statement in STS 3.6.3.2.

- LCO 3.3.1, Specification b: The 15% power applicability is added prior to startup and shutdown. This section also has the phrase, "major refueling outage or other," deleted to more align with the STS 3.6.3.2 requirements.

- LCO 3.3.1, Specification c: This Specification is unchanged.

- LCO 3.3.1, Specification d: The reactor pressure requirement is removed. To align with the current STS LCO 3.6.3.2, Action B, the statement, "reduce thermal power to less than or equal to 15 percent rated thermal power within 8 hours," is added. To ensure this action statement is transitory or infrequent, the additional action to exit the power operating condition within 12 hours is added. This 12-hour completion time is a typical allowance in the STS to transition from Mode 1 to a lower mode.

The TS Bases have also been revised, along with a revised Insert A, to align with these changes and are submitted for information only. These TS Bases markups supersede in their entirety the TS Bases markups provided in the June 26, 2018, submittal.

**ATTACHMENT 2**

Nine Mile Point Nuclear Station, Unit 1
Renewed Facility Operating License No. DPR-63
NRC Docket No. 50-220

Response to Request for Additional Information
Revised Markup Pages

TS Marked-up Pages

124
125

TS Bases Marked-up Pages
(for information only)

126

| LIMITING CONDITION FOR OPERATION | SURVEILLANCE REQUIREMENT |
|---|---|
| 3.3.1 OXYGEN CONCENTRATION<br><br>Applicability:<br><br>Applies to the limit on oxygen concentration within the primary containment system.<br><br>Objective:<br><br>To assure that in the event of a loss-of-coolant accident any hydrogen generation will not result in a combustible mixture within the primary containment system.<br><br>Specification:<br><br>a. The primary containment atmosphere shall be reduced to less than four percent by volume oxygen concentration with nitrogen gas whenever ~~the reactor coolant pressure is greater than 110 psig and~~ the reactor is in the power operating condition, except as specified in "b" and "c" below. | 4.3.1 OXYGEN CONCENTRATION<br><br>Applicability:<br><br>Applies to the periodic testing requirement for the primary containment system oxygen concentration.<br><br>Objective:<br><br>To assure that the oxygen concentration within the primary containment system is within required limits.<br><br>Specification:<br><br>In accordance with the Surveillance Frequency Control Program, oxygen concentration shall be determined. |

greater than 15 percent rated thermal power,

| LIMITING CONDITION FOR OPERATION | SURVEILLANCE REQUIREMENT |
|---|---|
| b. ~~Within the 24-hour period subsequent to the reactor being placed in the run mode for the power operating condition,~~ the containment atmosphere oxygen concentration shall be reduced to less than four percent by volume, and maintained in this condition. Deinerting may commence 24 hours prior to a ~~major refueling outage or other~~ scheduled shutdown. | 24 hours after the reactor is greater than 15% rated thermal power |
| c. If the containment oxygen concentration is greater than or equal to the four percent by volume limit, except as allowed during startup and shutdown in "b" above, restore the oxygen concentration to within the limit within 24 hours. | being less than or equal to 15% rated thermal power, for |
| d. If Specifications "a," "b," or "c" above are not met, ~~the reactor coolant pressure shall be reduced to 110 psig or less within ten hours~~. | reduce thermal power to less than or equal to 15 percent rated thermal power within 8 hours, followed by exiting the power operating condition within 12 hours. |

AMENDMENT NO. ~~142~~, 185

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## BASES FOR 3.3.1 AND 4.3.1 OXYGEN CONCENTRATION

The four percent by volume oxygen concentration eliminates the possibility of hydrogen combustion following a loss-of-coolant accident (Section VII-G.2.0 and Appendix E-II.5.2)*. The only way that significant quantities of hydrogen could be generated by metal-water reaction would be if the core spray system failed to sufficiently cool the core. As discussed in Section VII-A.2.0*, each core spray system will deliver, as a minimum, core spray sparger flow as shown on Figure VII-2*. In addition to hydrogen generated by metal-water reaction, significant quantities can be generated by radiolysis. (Technical Supplement to Petition for Conversion from Provisional Operating License to Full Term Operating License).

Inerting the primary containment is an operational problem because it prevents containment access without an appropriate breathing apparatus. Therefore, the primary containment is inerted as late as possible in the plant startup and deinerted as soon as possible in the plant shutdown. The probability of an event that generates hydrogen occurring within the first 24 hours of a startup, or within the last 24 hours before a shutdown, is low enough that these "windows," when the primary containment is not inerted, are also justified. The 24 hour time period is a reasonable amount of time to allow plant personnel to perform inerting or deinerting.

If oxygen concentration is greater than or equal to four percent by volume at any time while in the power operating condition, with the exception of the relaxations allowed during startup and shutdown, oxygen concentration must be restored to less than four percent by volume within 24 hours. The 24 hour completion time is allowed when oxygen concentration is greater than or equal to four percent by volume because of the low probability and long duration of an event that would generate significant amounts of hydrogen occurring during this period.

~~If oxygen concentration cannot be restored to within limits within the required completion time, reactor coolant pressure must be reduced to less than or equal to 110 psig within 10 hours.~~

~~At reactor pressures of 110 psig or less, the reactor will have been shutdown for more than an hour and the decay heat will be at sufficiently low values so that fuel rods will be completely wetted by core spray. The fuel clad temperatures would not exceed the core spray water saturation temperature of about 344°F.~~

INSERT A

The primary containment is normally slightly pressurized during periods of reactor operation. Nitrogen used for inerting could leak out of the containment but air could not leak in to increase the oxygen concentration. Once the containment is filled with nitrogen to the required concentration, no monitoring of oxygen concentration is necessary. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

*FSAR

## RAI Response

## INSERT A

All nuclear reactors must be designed to withstand events that generate hydrogen either due to the zirconium metal water reaction in the core or due to radiolysis. The primary method to control hydrogen is to inert the primary containment. With the primary containment inert, that is, oxygen concentration less than 4.0 percent by volume, a combustible mixture cannot be present in the primary containment for any hydrogen concentration. An event that rapidly generates hydrogen from zirconium metal water reaction will result in excessive hydrogen in primary containment, but oxygen concentration will remain less than 4.0 percent by volume and no combustion can occur. The primary containment must be inert when reactor power is greater than or equal to 15% rated thermal power, since this is the condition with the highest probability of an event that could produce hydrogen. Specification 3.3.1.b allows for primary containment be inerted up to 24 hours after exceeding 15 percent rated thermal power and allows deinerting to commence 24 hours prior to reaching 15% rated thermal power.

Inerting the primary containment is an operational problem because it prevents containment access without an appropriate breathing apparatus. As long as power is less than 15% rated thermal power, the potential for an event that generates significant hydrogen is low and the primary containment need not be inert. Furthermore, the probability of an event that generates hydrogen occurring within 24 hours of greater than 15% rated thermal power is low enough when the primary containment is not inerted, is also justified. The 24-hour time period is a reasonable amount of time to allow plant personnel to perform inerting or de-inerting.