Exelon Generation®

Order No. EA-12-051

RS-15-034
TMI-15-012

February 27, 2015

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

Three Mile Island Nuclear Station, Unit 1
Renewed Facility Operating License No. DPR-50
NRC Docket No. 50-289

Subject: Fourth Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-051)

References:

1. NRC Order Number EA-12-051, "Issuance of Order to Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation," dated March 12, 2012
2. NRC Interim Staff Guidance JLD-ISG-2012-03, "Compliance with Order EA-12-051, Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation," Revision 0, dated August 29, 2012
3. NEI 12-02, Industry Guidance for Compliance with NRC Order EA-12-051, "To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation," Revision 1, dated August 2012
4. Exelon Generation Company, LLC's Initial Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-051), dated October 25, 2012
5. Exelon Generation Company, LLC Overall Integrated Plan in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-051), dated February 28, 2013 (RS-13-036)
6. Exelon Generation Company, LLC First Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-051), dated August 28, 2013 (RS-13-130)
7. Exelon Generation Company, LLC Second Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-051), dated February 28, 2014 (RS-14-026)
8. Exelon Generation Company, LLC Third Six-Month Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-051), dated August 28, 2014 (RS-14-204)

9. NRC letter to Exelon Generation Company, LLC, Three Mile Island Nuclear Station, Unit 1 – Interim Staff Evaluation and Request for Additional Information Regarding the Overall Integrated Plan for Implementation of Order EA-12-051, Reliable Spent Fuel Pool Instrumentation (TAC No. MF0866), dated November 13, 2013

On March 12, 2012, the Nuclear Regulatory Commission ("NRC" or "Commission") issued an order (Reference 1) to Exelon Generation Company, LLC (EGC). Reference 1 was immediately effective and directs EGC to install reliable spent fuel pool level instrumentation. Specific requirements are outlined in Attachment 2 of Reference 1.

Reference 1 required submission of an initial status report 60 days following issuance of the final interim staff guidance (Reference 2) and an overall integrated plan pursuant to Section IV, Condition C. Reference 2 endorses industry guidance document NEI 12-02, Revision 1 (Reference 3) with clarifications and exceptions identified in Reference 2. Reference 4 provided the EGC initial status report regarding reliable spent fuel pool instrumentation. Reference 5 provided the Three Mile Island Nuclear Station, Unit 1 overall integrated plan.

Reference 1 requires submission of a status report at six-month intervals following submittal of the overall integrated plan. Reference 3 provides direction regarding the content of the status reports. References 6, 7, and 8 provided the first, second, and third six-month status reports, respectively, pursuant to Section IV, Condition C.2, of Reference 1 for Three Mile Island Nuclear Station, Unit 1. The purpose of this letter is to provide the fourth six-month status report pursuant to Section IV, Condition C.2, of Reference 1, that delineates progress made in implementing the requirements of Reference 1. The enclosed report provides an update of milestone accomplishments since the last status report, including any changes to the compliance method, schedule, or need for relief and the basis, if any. The enclosed report also addresses the NRC Interim Staff Evaluation Request for Additional Information Items contained in Reference 9.

This letter contains no new regulatory commitments. If you have any questions regarding this report, please contact David P. Helker at 610-765-5525.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 27th day of February 2015.

Respectfully submitted,

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

Enclosure:

1. Three Mile Island Nuclear Station, Unit 1 Fourth Six-Month Status Report for the Implementation of Order EA-12-051, Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation

cc: Director, Office of Nuclear Reactor Regulation
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# Enclosure

## Three Mile Island Nuclear Station, Unit 1

## Fourth Six-Month Status Report for the Implementation of Order EA-12-051, Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation

(31 pages)

**Three Mile Island Station Unit 1**

**Fourth Six-Month Status Report for the Implementation of Order EA-12-051, Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation**

## 1 Introduction

Three Mile Island Unit 1, developed an Overall Integrated Plan (Reference 1 in Section 8), documenting the requirements to install reliable Spent Fuel Pool Level Instrumentation (SFPLI), in response to NRC Order EA-12-051 (Reference 2). This enclosure provides an update of milestone accomplishments since submittal of the Third Six-Month status report including any changes to the compliance method, schedule, or need for relief/relaxation and the basis, if any.

## 2 Milestone Accomplishments

The following milestones have been completed since the development of the Third Six-Month status report (Reference 12), and are current as of January 27, 2015.

- Detailed Engineering approximately 90% complete

## 3 Milestone Schedule Status

The following provides an update to the milestone schedule to support the Overall Integrated Plan. This section provides the activity status of each item, and the expected completion date noting any change. The dates are planning dates subject to change as design and implementation details are developed.

The revised milestone target completion dates do not impact the order implementation date.

| Milestone | Target Completion Date | Activity Status | Revised Target Completion Date |
|---|---|---|---|
| Submit 60 Day Status Report | October 25, 2012 | Complete | |
| Submit Overall Integrated Plan | February 28, 2013 | Complete | |
| Submit Responses to RAIs | July 5, 2013 | Complete | |
| **Submit 6 Month Updates:** | | | |
| Update 1 | August 28, 2013 | Complete | |
| Update 2 | February 28, 2014 | Complete | |
| Update 3 | August 28, 2014 | Complete | |
| Update 4 | February 28, 2015 | Complete with this submittal | |

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| Provide Final Safety Evaluation (SE) Information | March 31, 2015 | Complete | |
| Update 5 | August 28, 2015 | Not Started | |
| **Modifications:** | | | |
| Conceptual Design | 3Q2012 | Complete | |
| Issue Exelon Fleet contract to procure SFPI Equipment | 2Q2013 | Complete | |
| Begin Detailed Design Engineering | 4Q2013 | Complete | |
| Complete and Issue SFPI Modification Package | 4Q2014 | Started | 1Q2015 |
| Begin Installation | 2Q2015 | Not Started | |
| Complete SFPI Installation and Put Into Service | 2Q2015 | Not Started | 4Q2015 |

## 4 Changes to Compliance Method

There are no changes to the compliance method as documented in the Overall Integrated Plan (Reference 1).

## 5 Need for Relief/Relaxation and Basis for the Relief/Relaxation

Three Mile Island Unit 1, expects to comply with the order implementation date and no relief/relaxation is required at this time.

## 6 Open Items from Overall Integrated Plan and Draft Safety Evaluation

The following tables provide a summary of the open items documented in the Overall Integrated Plan (Reference 1) or the Draft Safety Evaluation (SE) and the status of each item.

| **Overall Integrated Plan Open Items** | | |
|---|---|---|
| **OI#** | **Description** | **Status** |
| 1<br>(RAI-1a, Ref. 4) | **For Level 1, specify how the identified location represents the higher of the two points described in the NEI 12-02 guidance for this level.** | Started<br>NEI 12-02 section 2.3.1 identifies that Level 1 will be the HIGHER of two levels.<br>The first level is the suction loss due to |

| Overall Integrated Plan Open Items | | |
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| **OI#** | **Description** | **Status** |
| | | uncovering of the SF cooling suction pipe. This was identified by TMI in a letter dated 7/24/13 (Reference 4) as elevation 340' 4".<br><br>The second level is the loss of SF cooling pump NPSH under saturated conditions. This engineering analysis is in draft form. It will be completed with the SFPI design which is currently scheduled for completion 2/27/15. |
| 2 | Open Item:<br><br>**Continuous level indication will be provided by a guided wave radar system, submersible pressure transducer, or other appropriate level sensing technology that will be determined during the detailed engineering phase of the project.** | Complete.<br><br>(Addressed in Reference 6) |
| 3<br><br>(RAI-1b, Ref. 4) | RAI Question:<br><br>**A clearly labeled sketch depicting the elevation view of the proposed typical mounting arrangement for the portions of the instrument channel consisting of permanent measurement channel equipment (e.g., fixed level sensors and/or stilling wells, and mounting brackets). Indicate on this sketch the datum values representing Level 1, Level 2, and Level 3 as well as the top of the fuel. Indicate on this sketch the portion of the level sensor measurement range that is sensitive to measurement of the fuel pool level, with respect to the Level 1, Level 2, and Level 3 datum points.** | Started.<br><br>(Previously addressed in Reference 4)<br><br>Attachment 1 (attached) shows the TMI-1 SF Pool Elevation Sketch. This attachment has been revised to show Level 3 is moved 3" above the gate weir. The 3" allows for instrumentation accuracy and is the point below which instrumentation redundancy is lost.<br><br>Level 2 represents 10' above the SF racks.<br><br>Level 1 represents loss of SF cooling suction. This point will be finalized when item 1 above is resolved.<br><br>The exact level sensor measurement range will be finalized during the design phase which is currently scheduled for completion 2/27/15. |
| 4<br><br>(RAI-2, | RAI Question:<br><br>**Provide a clearly labeled sketch or marked-up plant drawing of the** | Started<br><br>The final locations and cable routings are not available at this time. A detailed design will |

| Overall Integrated Plan Open Items | | |
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| **OI#** | **Description** | **Status** |
| Ref. 4) | **plan view of the SFP area, depicting the SFP inside dimensions, the planned locations/placement of the primary and backup SFP level sensor, and the proposed routing of the cables that will extend from the sensors toward the location of the read-out/display device.** | include sensor locations and cable routing drawings from the Spent Fuel Pool to each channel indicator. The plan for the design of the SFPI system based on the current Exelon Nuclear program schedule for TMI-1 is design completion and acceptance of the design on 2/27/15. |
| 5<br><br>(RAI-3, Ref. 4) | RAI Question:<br><br>**Provide the following:**<br>**a) The design criteria that will be used to estimate the total loading on the mounting device(s), including static weight loads and dynamic loads. Describe the methodology that will be used to estimate the total loading, inclusive of design basis maximum seismic loads and the hydrodynamic loads that could result from pool sloshing or other effects that could accompany such seismic forces.**<br>**b) A description of the manner in which the level sensor (and stilling well, if appropriate) will be attached to the refueling floor and/or other support structures for each planned point of attachment of the probe assembly. Indicate in a schematic the portions of the level sensor that will serve as points of attachment for mechanical/mounting or electrical connections.**<br>**c) A description of the manner by which the mechanical connections will attach the level instrument to permanent SFP structures so as to support the level sensor assembly.** | Started<br><br>a) All SFPIS equipment will be designed in accordance with the TMI-1 Safe Shutdown Earthquake (SSE) design requirements.<br><br>The vendor, Westinghouse, has evaluated the structural integrity of the mounting brackets in calculation CN-PEUS-13-24 (Reference 20). The GTSTRUDL model, used by Westinghouse to calculate the stresses in the bracket assembly, considers load combinations for the dead load, live load and seismic load on the bracket. The reactionary forces calculated from these loads become the design inputs to design the mounting bracket anchorage to the refuel floor to withstand a Safe Shutdown Earthquake (SSE).<br><br>Seismic<br>The seismic loads are obtained from TMI-1's response spectra curves (Reference 8). The following methodology was used in determining the stresses on the bracket assembly:<br><br>• Frequency analysis, taking into account the dead weight and the hydrodynamic mass of the structure, is performed to obtain the natural frequencies of the structure in all three directions.<br>• SSE (Safe Shutdown Earthquake) response spectra analysis is performed to obtain member stresses and support |

| Overall Integrated Plan Open Items | | |
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| **OI#** | **Description** | **Status** |
| | | reactions.<br>• Modal responses are combined using the Ten Percent Method per U.S. NRC Regulatory Guide 1.92, Revision 1, "Combining Modal Responses and Spatial Components in Seismic Response Analysis".<br>• The seismic loads for each of the three directions are combined by the Square Root of the Sum of Squares (SRSS) Method.<br>• Sloshing analysis is performed to obtain liquid pressure and its impact on bracket design.<br>• The seismic results are combined with the dead load results and the hydrodynamic pressure results in absolute sum. These combined results are compared with the allowable stress values.<br><br><u>Sloshing</u><br><br>Sloshing forces were obtained by analysis. The TID-7024, Nuclear Reactors and Earthquakes, 1963 (Reference 21), by the US Atomic Energy Commission, approach has been used to estimate the wave height and natural frequency. Horizontal and vertical impact force on the bracket components was calculated using the wave height and natural frequency obtained using TID-7024 (Reference 21) approach. Using this methodology, sloshing forces have been calculated and added to the total reactionary forces that would be applicable for bracket anchorage design. The analysis also determined that the level probe can withstand a credible design basis seismic event. During the design basis event, the SFP water level is expected to rise and parts of the level sensor probe are assumed to |

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| **OI#** | **Description** | **Status** |
| | | become submerged in borated water. The load impact due to the rising water and submergence of the bracket components has also been considered for the overall sloshing impact. Reliable operation of the level measurement sensor with a submerged interconnecting cable has been demonstrated by analysis of previous Westinghouse testing of the cable, and the vendor's cable qualification. Boron build up on the probe has been analyzed to determine the potential effects on the sensor in WNA-TR-03149-GEN (Reference 19).<br><br>The following Westinghouse documents provide information with respect to the design criteria used, and a description of the methodology used to estimate the total loading on the device.<br><br>a. To be provided by WEC during detailed design – Pool-side Bracket Seismic Analysis<br><br>b. LTR-SEE-II-13-47, WNA-TR-03149-GEN (Reference 19) – Sloshing Analysis<br><br>c. EQ-QR-269 (Reference 17), WNA-TR-03149-GEN (Reference 19), EQ-TP-353 (Reference 25) – Seismic Qualification of other components of SFPI<br><br>TMI-1's specific calculations will be developed to address the seismic qualification of the readout display in the Control Building Patio 322' elevation. The design criteria in this calculation will meet the requirements to withstand a SSE. The methods that will be used in the calculation follow IEEE Standard 344-2004 and IEEE Standard 323-2003 for seismic qualification of the instrument.<br><br>b) The level sensor, which is one long probe, will be suspended from the launch plate via a coupler/connector assembly. The launch |

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| | | plate is a subcomponent of the bracket assembly, which will be mounted to the Fuel Handling Building 348" floor via anchors at the South end and attached to the North wall with anchors at the North end of the SF pool . A sketch of the portions of the level sensor that will serve as points of attachment for mechanical/mounting or electrical connections will be provided later.<br><br>c) The bracket assembly that supports the sensor probe and launch plate will be mechanically connected to the Fuel Handling Building structure. One type of mechanical connection that may be used consists of four concrete expansion anchors that will bolt the bracket assembly to the SFP structure via the base plate. Another type of mechanical connection is a welded connection between the base plate and existing embedded plates on the SFP structure. The concrete expansion anchors and welds will be designed to withstand SSE and will meet the TMI-1 safety related installation requirements. The qualification details of the bracket will be provided in a Pool-side bracket Seismic Analysis and the qualification of the anchorage to the floor/wall will be provided in a TMI-1 specific calculation – Evaluation of SFPI Sensor Mounting Detail Anchorage and Mounting.<br><br>This item is expected to be completed by 2/27/15. |
| 6<br><br>(RAI-4, Ref. 4) | RAI Question:<br><br>**Provide the following:**<br>**a) A description of the specific method or combination of methods that will be applied to demonstrate the reliability of the permanently installed equipment** | Started<br><br>a) Beyond Design Basis Environment – Westinghouse qualified the components (probe, connector, cable) of the SFPIS located in the SFP area to the beyond design basis environment conditions as defined in the Exelon specification which is |

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| | **under beyond-design basis ambient temperature, humidity, shock, vibration, and radiation conditions.**<br>**b) A description of the testing and/or analyses that will be conducted to provide assurance that the equipment will perform reliably under the worst-case credible design basis loading at the location where the equipment will be mounted. Include a discussion of this seismic reliability demonstration as it applies to a) the level sensor mounted in the SFP area, and b) any control boxes, electronics, or read-out and re-transmitting devices that will be employed to convey the level information from the level sensor to the plant operators or emergency responders.**<br>**c) A description of the specific method or combination of methods that will be used to confirm the reliability of the permanently installed equipment such that following a seismic event the instrument will maintain its required accuracy.** | based on guidance in NEI-12-02 section 3.4. Components of the system were subjected to beyond design basis conditions of heat and humidity, thermal and radiation aging mechanisms. This testing confirmed functionality of these system components under these beyond design basis environmental conditions. Westinghouse performed testing to ensure aging of the components in the SFP area will not have a significant effect on the ability of the equipment to perform following a plant design basis earthquake. Exelon has reviewed the documents and found them acceptable. Reference Westinghouse documents EQ-TP-351 (Reference 22), WNA-TR-03149-GEN (Reference 19), and EQ-TP-354 (Reference 18) for description of specific qualification methods.<br><br>Mild Environment – Westinghouse qualified the system components (display panel, sensor) that reside in the mild environment conditions to determine that the components can satisfactorily perform to those conditions. Westinghouse has determined that aging does not have a significant effect on the ability of the equipment to perform following a plant design basis earthquake. Exelon has reviewed the documents and found them acceptable. Reference Westinghouse documents EQ-QR-269 (Reference 17), WNA-TR-03149-GEN (Reference 19) for description of specific methods.<br><br>Display – The methods to be used by the vendor to qualify the readout display follow IEEE Standard 344-2004 and IEEE Standard 323-2003 for seismic qualification of the instrument. For temperature and humidity qualification of the displays IEEE 344-2004, IEEE 323-2003, NRC Regulatory Guides 1.100, Revision 3; 1.209, March 2007; and |

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| | | EPRI TR-107330 guidance will be followed. The readout display will be located in the Control Building Patio 322' elevation and is not expected to be subject to harsh environmental or radiological conditions seen in the Fuel Handling Building.<br><br>Shock and Vibration – SFPIS pool side brackets will be analyzed for Safe Shutdown Earthquake design requirements per NRC Order EA-12-051 and NEI 12-02 guidance. As provided by the NRC Order EA-12-051, the NEI 12-02 guidance and as clarified by the NRC interim staff guidance, the probe, coaxial cable, and the mounting brackets are "inherently resistant to shock and vibration loadings." As a result, no additional shock and vibration testing is required for these components. SFPIS pool side brackets for both the primary and backup Westinghouse SFP measurement channels will be permanently installed and fixed to rigid refuel floors or walls, which are Seismic Category 1 structures. The SFPI system components, such as level sensor and its bracket, display enclosure and its bracket, will be subjected to seismic testing, including shock and vibration test requirements. The level sensor electronics are enclosed in a NEMA-4X housing. The display electronics panel utilizes a NEMA-4X rated stainless steel housing as well. These housings will be mounted to a seismically qualified wall and will contain the active electronics, and aid in protecting the internal components from vibration induced damage.<br><br>b) The seismic adequacy of the SFPIS (all components) will be demonstrated by vendor testing and analysis in accordance with below listed standards: |

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| | | • IEEE 344-2004, IEEE Recommended Practice for Seismic Qualification of Class 1E Electrical Equipment for Nuclear Power Generating Stations<br>• IEEE-323-1974, Standard for Qualifying Class 1E Equipment for Nuclear Power Generating Stations<br>• USNRC Regulatory Guide 1.100, Rev. 3<br>• USNRC Regulatory Guide 1.92, Rev. 1<br>• TMI-1 Calculation - Seismic Qualification of the SFPIS Indicator<br>Seismic adequacy of the level sensor probe supporting bracket within the SFP area will be demonstrated by analysis as discussed in the response to RAI-3 (Ref 4) above.<br>c) Westinghouse will seismically qualify the SFPI instrument and its components. With the instrument to be seismically qualified and installed as described in section b) above response, including the readout display in the Control Building Patio 322' elevation, the instrument is assured to maintain reliable and accurate indication when required.<br>This item is expected to be completed by 2/27/15. |
| 7<br>(RAI-5, Ref. 4) | RAI Question:<br>**Provide the following:**<br>**a) A description of how the two channels of the proposed level measurement system meet this requirement so that the potential for a common cause event to adversely affect both channels is minimized to the extent practicable.**<br>**b) Further information on how each level measurement system, consisting of level sensor electronics, cabling, and readout** | Started<br>The two channels of the proposed level measurement system will be installed such that:<br>a) Primary level probe will be mounted on the North wall of the "A" SFP and the backup probe will be mounted on the South wall of the "B" SFP and will be separated by a distance greater than the span of the shortest side of the pool. This meets the NEI 12-02 Revision 1 (Reference 26) guidance for channel separation. |

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| | **devices will be designed and installed to address independence through the application and selection of independent power sources, the use of physical and spatial separation, independence of signals sent to the location(s) of the readout devices, and the independence of the displays.** | The level sensor enclosure and the electronics/ UPS enclosure for the primary instrument channel and backup instrument channel will be installed in the Control Building Patio of TMI1. The exact locations have not been finalized; therefore, spatial separation of the level sensors and electronics/UPS enclosures for primary and backup instrument channels and routing of the associated instrument channel cables have not been completed. It will be completed with the SFPI design which is currently scheduled for completion by 2/27/15.<br>b) The 120 VAC power to the primary and backup instruments will be provided from separate TMI 1 non-1E power panels. The 120VAC distribution panels for the primary and backup instruments are powered by different 480V buses. Therefore, the loss of any one bus will not result in the loss of ac power to both instrument channels.<br>This item is expected to be completed by 2/27/15. |
| 8<br>(RAI-6, Ref. 4) | RAI Question:<br>**Provide the following:**<br>**a) A description of the electrical ac power sources and capabilities for the primary and backup channels.**<br>**b) Please provide the results of the calculation depicting the battery backup duty cycle requirements demonstrating that its capacity is sufficient to maintain the level indication function until offsite resource availability assured.** | Started<br>a) The primary and backup SFPLI instrument channels will be normally powered from separate non-1E 120 VAC breaker panels. These are powered from separate 480V buses which are ultimately powered from separate Auxiliary transformers, which maintain power source independence. Upon loss of normal AC power, individual batteries installed in each channel's electronics/ UPS enclosure will automatically maintain continuous channel operation for at least three (3) days. The power cable routings are not yet defined. It will be completed with the SFPI design |

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| | | which is currently scheduled for completion by 2/27/15.<br><br>Additionally, a receptacle and a selector switch are installed in each channel electronics/ UPS enclosure to directly connect emergency power to the SFPLI. During an ELAP (Extended Loss of AC Power) and before the batteries are discharged, the cabinets will be connected via the above receptacle and selector switch to power provided by the FLEX diesel generators.<br>b) The Westinghouse Report, WNA-CN-00300-GEN (Reference 23), provides the results of the calculation depicting the battery backup duty cycle. This calculation demonstrates that battery capacity is 4.22 days to maintain the level indicating function to the display location, located in the Patio Area at Control Building at TMI. Therefore, the TMI-1 Station readout display of level indication will be available for greater than 72 hours of operation. The results of the calculation meet the NEI 12-02 Revision 1 (Reference 26) requirements. |
| 9<br><br>(RAI-7, Ref. 4) | RAI Question:<br><br>**Provide the following:**<br>**a) An estimate of the expected instrument channel accuracy performance under both (a) normal SFP level conditions (approximately Level1 or higher) and (b) at the beyond design-basis conditions (i.e., radiation, temperature, humidity, post-seismic and post-shock conditions) that would be present if the SFP level were at the Level2 and Level3 datum points.** | Started<br><br>a) The Westinghouse documents WNA-CN-00301 (Reference 9) and WNA-DS-02957-GEN (Reference 10) describe the channel accuracy under both (a) normal SFP level conditions and (b) at the Beyond Design Basis (BDB) conditions that would be present if SFP level were at Level 2 and Level 3 datum points. Each instrument channel will be accurate to within ±3"during normal spent fuel pool level conditions. The instrument channels will retain this accuracy after BDB conditions, in |

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| | **b) A description of the methodology that will be used for determining the maximum allowed deviation from the instrument channel design accuracy that will be employed under normal operating conditions as an acceptance criterion for a calibration procedure to flag to operators and to technicians that the channel requires adjustment to within the normal condition design accuracy.** | accordance with the above Westinghouse documents.<br>b) The Westinghouse document WNA-TP-04709-GEN (Reference 11) describes the methodology for routine testing/calibration verification and calibration methodology. This document also specifies the required accuracy criteria under normal operating conditions. TMI calibration and channel verification procedures will follow the guidance and criteria provided in this document.<br><br>Instrument channel calibration will be performed if the level indication reflects a value that is outside the acceptance band established in the TMI calibration and channel verification procedures.<br><br>Calibration will be performed once per refueling cycle for TMI. Per Westinghouse document WNA-TP-04709-GEN (Reference 11) calibration on a SFP level channel is to be completed within 60 days of a planned refueling outage considering normal testing scheduling allowances (e.g., 25%). This is in compliance with the NEI 12-02 Revision 1 (Reference 26) guidance for Spent Fuel Pool Instrumentation.<br>These items will be completed by 3/31/15. |
| 10<br>(RAI-8, Ref. 4) | RAI Question:<br>**Provide the following:**<br>**a) A description of the capability and provisions the proposed level sensing equipment will have to enable periodic testing and calibration, including how this capability enables the equipment to be tested in-situ.**<br>**b) A description of how such testing and calibration will enable the conduct of regular channel** | Started.<br>a) During the detailed design phase, Westinghouse will provide the calibration procedure and functional test procedure describing the capabilities and provisions of SFPI periodic testing and calibration, including in-situ testing. TMI-1 will review the procedures to ensure the instrument can be calibrated/functionally tested/in-situ testing can be performed per the Order requirements. This item will be completed by 3/31/15. |

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| | **checks of each independent channel against the other, and against any other permanently-installed SFP level instrumentation.**<br>**c) A description of how functional checks will be performed, and the frequency at which they will be conducted. Describe how calibration tests will be performed, and the frequency at which they will be conducted.**<br>**d) A discussion as to how these surveillances will be incorporated into the plant surveillance program.**<br>**e) A description of the preventive maintenance tasks required to be performed during normal operation, and the planned maximum surveillance interval that is necessary to assure that the channels are fully conditioned to accurately and reliably perform their functions when needed.** | b) The level displayed by the channels will be verified per the TMI-1 administrative and operating procedures. If the level is not within the required accuracy per Westinghouse recommended tolerances, channel calibration will be performed.<br><br>c) Functional checks will be performed per a future Westinghouse functionality test procedure at the Westinghouse recommended frequency. Calibration tests will be performed per a future Westinghouse calibration procedure at the Westinghouse recommended frequency. In accordance with TMI-1 maintenance and operating programs, TMI-1 will develop calibration, functional test, and channel verification procedures per future Westinghouse recommendations to ensure reliable, accurate and continuous SFPI functionality. This item will be completed by 11/30/15.<br><br>d) TMI-1 will develop preventive maintenance tasks for the SFPI per future Westinghouse recommendations to assure that the channels are fully conditioned to accurately and reliably perform their functions when needed. This item will be completed by 11/30/15. |
| 11<br><br>(RAI-9, Ref. 4) | RAI Question:<br><br>**Please provide the following:**<br>**a) The specific location for each of the primary and backup instrument channel displays.**<br>**b) If the primary and backup display location is other than the main control room, provide justification for prompt accessibility to displays including primary and alternate route evaluation, habitability at** | Started<br><br>a) TMI's primary and backup instrument channel displays are planned to be located on the second floor of the control building. Precise location within the second floor of the control building will be finalized during the detailed design process.<br><br>b) As stated above, TMI's primary and backup instrument channel displays are planned to be located on the second floor of the control building. Precise location within the second floor of the control building will be |

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| **OI#** | **Description** | **Status** |
| | **display location(s), continual resource availability for personnel responsible to promptly read displays, and provisions for communications with decision makers for the various SFP drain down scenarios and external events.**<br>**c) The reasons justifying why the locations selected enable the information from these instruments to be considered "promptly accessible" to various drain-down scenarios and external events.** | finalized during the detailed design process. This location was selected due to the fact that this area will be manned during any BDBEE where the FLEX RCS makeup pump is located as well. Also, the area is in close proximity to the main control room, and alternate shutdown panel. The display can be accessed from the main control room on demand if the FLEX RCS makeup station is not being manned as well. It will take up to 3 minutes to reach the display location, for both the primary and backup channels, when an operator is dispatched from the control room (down 2 floors).<br><br>Radiological habitability at this location has been evaluated against TMI UFSAR Table 11.A-2 and Figure 11.A-5. The peak radiation post LOCA is 480mRem/hr in this location. Also the estimated dose rates from SFP drain-down conditions to Level 3, (calculation BYR13-187 (Reference 24)) were evaluated. Therefore the exposure to personnel monitoring SFP levels due to radiation in the display location for both channels would remain less than emergency exposure limits allowable for emergency responders to perform this action. Heat and humidity from SFP boil-down conditions have been evaluated for this location. The location is in a different building physically separated by concrete walls, closed air lock/fire doors from the SFP such that heat and humidity from a boiling SFP would not compromise habitability at this location.<br><br>Spent Fuel Pool Level monitoring will be the responsibility of Operations personnel who will monitor the display periodically once dispatched from the Control Room. As stated above, travel time from the Control Room to the primary and secondary displays is approximately 3 minutes based on walkdown by Engineering. Radiological |

| Overall Integrated Plan Open Items | | |
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| **OI#** | **Description** | **Status** |
| | | habitability for the transit routes to both displays has been evaluated against TMI Station UFSAR Table 11.A-2 and Figure 11.A-5 in the Control Building for post LOCA scenario conditions as well as estimated dose rates from SFP drain-down conditions to Level 3, (calculation BYR13-187 (Reference 24)) and exposure to personnel monitoring SFP levels would remain less than emergency exposure limits allowable for emergency responders to perform this action. Heat and humidity from SFP boil-down conditions have been evaluated for access to this location, and the access routes are located in a different building physically separated by closed air lock/fire doors from the SFP such that heat and humidity from a boiling SFP would not compromise habitability concerns with accessing these displays. The walkthrough to access the display locations is within the robust seismic category I structures, from the control room to the display locations, located near the TMI-1 remote shutdown room.<br><br>Operators will be able to use the sound powered phone system to communicate to the control room with the display information immediately. Being able to provide the indicated SFP level within approximately 10 minutes is not considered an unreasonable delay.<br><br>Final verification of the readout locations will be verified by 2/27/15. |
| 12<br><br>(RAI-10, Ref. 4) | RAI Question:<br><br>**Please provide the following:**<br><br>a) **A list of the operating (both normal and abnormal response) procedures, calibration/test procedures, maintenance procedures, and inspection** | Started<br><br>Appropriate quality measures will be selected for the SFPIS required by Order EA-12-051, consistent with Appendix A of NEI 12-02. Site procedures will be developed for system inspection, calibration and test, maintenance, repair, operation and normal and abnormal |

| Overall Integrated Plan Open Items | | |
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| **OI#** | **Description** | **Status** |
| | **procedures that will be developed for use of the SFP instrumentation in a manner that addresses the order requirements.**<br><br>b) **A brief description of the specific technical objectives to be achieved within each procedure. If your plan incorporates the use of portable spent fuel level monitoring components, please include a description of the objectives to be achieved with regard to the storage location and provisions for installation of the portable components when needed.** | responses, in accordance with Exelon's procedure control process. Technical objectives to be achieved in each of the respective procedures are described below:<br><br>Procedure Objectives to be achieved<br><br>1. System Inspection: To verify that system components are in place, complete, and in the correct configuration, and that the sensor probe is free of significant deposits.<br>2. Calibration and Test: To verify that the system is within the specified accuracy, is functioning as designed, and is appropriately indicating SFP water level.<br>3. Maintenance: To establish and define scheduled and preventive maintenance requirements and activities necessary to minimize the possibility of system interruption.<br>4. Repair: To specify troubleshooting steps and component repair and replacement activities in the event of system malfunction.<br>5. Operation: to provide sufficient instructions for operation and use of the system by plant operation staff.<br>6. Responses: To define the actions to be taken upon observation of system level indications, including actions to be taken at the levels defined in NEI 12-02 Revision 1 (Reference 26).<br><br>All procedures will be in place before the system is considered operable – 11/30/15 |
| 13<br><br>(RAI-11, Ref. 4) | RAI Question:<br><br>**Provide the following:**<br>**a) Further information describing the maintenance and testing program the licensee will establish and implement to ensure that regular testing and calibration is performed and verified by inspection and audit to demonstrate conformance with design and system** | Started<br><br>Response for a:<br><br>Performance tests (functional checks) and Operator performance checks will be described in detail in the vendor operator's manual, and the applicable information is planned to be contained in plant operating procedures.<br><br>Operator performance tests are planned to be |

| Overall Integrated Plan Open Items | | |
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| **OI#** | **Description** | **Status** |
| | **readiness requirements. Include a description of your plans for ensuring that necessary channel checks, functional tests, periodic calibration, and maintenance will be conducted for the level measurement system and its supporting equipment.**<br>**b) A description of how the guidance in NEI 12-02 section 4.3 regarding compensatory actions for one or both non-functioning channels will be addressed.**<br>**c) A description of what compensatory actions are planned in the event that one of the instrument channels cannot be restored to functional status within 90 days.** | performed periodically as recommended by the equipment vendor.<br><br>Channel functional tests per operations procedures with limits established in consideration of vendor equipment specifications are planned to be performed at appropriate frequencies established equivalent to or more frequently than existing SFPI.<br><br>Manual calibration and operator performance checks are planned to be performed in a periodic scheduled fashion with additional maintenance on an as-needed basis when flagged by the system's automated diagnostic testing features.<br><br>Channel calibration tests per maintenance procedures with limits established in consideration of vendor equipment specifications are planned to be performed at frequencies established in consideration of vendor recommendations.<br><br>SFPI channel/equipment maintenance / preventative maintenance and testing program requirements to ensure design and system readiness are planned to be established in accordance with Exelon's processes and procedures and in consideration of vendor recommendations to ensure that appropriate regular testing, channel checks, functional tests, periodic calibration, and maintenance is performed (and available for inspection and audit).<br><br>Subject maintenance and testing program requirements are planned to be developed during the SFPI modification design process. These program requirements are expected to be completed by 3/31/15.<br><br><u>Response for b, c</u>: |

<table>
<tr><th colspan="3">Overall Integrated Plan Open Items</th></tr>
<tr><th>OI#</th><th>Description</th><th>Status</th></tr>
<tr><td></td><td></td><td>Both primary and backup SFPI channels will incorporate permanent installation (with no reliance on portable, post-event installation) of relatively simple and robust augmented quality equipment. Permanent installation coupled with stocking of adequate spare parts reasonably diminishes the likelihood that a single channel (and greatly diminishes the likelihood that both channels) is (are) out-of-service for an extended period of time. Planned compensatory actions for unlikely extended out-of-service events are summarized as follows:
<table>
<tr><th># Channel(s) Out-of-Service</th><th>Required Restoration Action</th><th>Compensatory Action if Required Restoration Action not completed within Specified Time</th></tr>
<tr><td>1</td><td>Restore channel to functional status within 90 days (or if channel restoration not expected within 90 days, then proceed to Compensatory Action)</td><td>Immediately initiate action in accordance with Note below</td></tr>
<tr><td>2</td><td>Initiate action within 24 hours to restore one</td><td>Immediately initiate action in accordance with Note</td></tr>
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| Overall Integrated Plan Open Items | | |
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| **OI#** | **Description** | **Status** |
| | | <table><tr><td></td><td>channel to functional status and restore one channel to functional status within 72 hours</td><td>below</td></tr></table><br>Note: Initiate an Issue Report to enter the condition into the Corrective Action Program. Identify the equipment out of service time is greater than the specified allowed out of service time, develop and implement an alternate method of monitoring, determine the cause of the non-functionality, and the plans and schedule for restoring the instrumentation channel(s) to functional status. |

| Draft Safety Evaluation Open Items | | |
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| **OI#** | **Description** | **Status** |
| 1<br><br>(RAI-2 Ref. 5) | RAI Question:<br>**Please describe the impact of the installation of the gate on the reliability of the SFP level instrumentation for each SFP, and what compensatory measures would be taken to ensure reliable level indication in each SFP when the gate is installed.** | Complete<br>Complete redundant monitoring of the pools will not be available when the gate is installed. The gate is not normally installed. There is an existing procedure 1507-2, Fuel Handling Building Crane Operations, which installs and removes the gate. To address the concern when the gate may be installed the procedure 1507-2 will be revised to establish administrative guidance/controls to follow the NEI 12-02 Rev. 1 (Reference 26) section 4.3 guidance for the 90-day out of service criterion. Action will be tracked by AR evaluation A2322479-08. The elevation for the bottom of the gate opening for TMI is 321ft. Level 3 for TMI is revised to elevation 321ft. 3 in., which is slightly above the bottom of the gate opening, rather than, the top of the Fuel rack elevation 319ft. 1 in. This will provide assurance that both the primary and backup SFP level instrument channels can measure the same Level 3 elevation in both SFPs. See revised Attachment 1. |

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| 2<br>(RAI 5, Ref. 5) | RAI Question:<br>**For RAI 4(a) above, provide the analyses used to verify the design criteria and methodology for seismic testing of the SFP instrumentation and the electronics units, including design basis maximum seismic loads and the hydrodynamic loads that could result from pool sloshing or other effects that could accompany such seismic forces.** | Started<br>The following Westinghouse documents will provide the analyses used to verify the design criteria and describe the methodology for seismic testing of the SFP instrumentation and electronics units, inclusive of design basis maximum seismic loads and hydrodynamic loads that could result from pool sloshing and other effects that could accompany such seismic forces:<br>a. To be provided by WEC during detailed design phase - Pool-side Bracket Seismic Analysis<br>b. LTR-SEE-II-13-47, WNA-TR-03149-GEN (Reference 19) - Sloshing Analysis<br>c. EQ-QR-269 (Reference 17), WNA-TR-03149-GEN (Reference 19), EQ-TP-353 (Reference 25) - Seismic Qualification of other components of SFPI<br>TMI-1 specific calculations will address the seismic qualification of the Control Building 322' Patio indicators. The design criteria that will be used in this calculation will satisfy the requirements to withstand a SSE and will meet the TMI-1 safety related installation requirements for mounting the readout displays in the Control Building 322' elevation.<br>This information will be available when the design work is complete on 2/27/15. |
| 3<br>(RAI-6, Ref. 5) | RAI Question:<br>**For each of the mounting attachments required to attach SFP level equipment to plant structures, please describe the design inputs, and the methodology that was used to qualify the structural integrity of the affected structures/equipment.** | Started<br>The structural integrity and mounting of SFP level equipment will be based on formal calculations, plant drawings, and approved work plans per Exelon procedures and processes.<br>Design Inputs will include, but not limited to, the following:<br>1. Component weights and dimensions, core hole locations and support details.<br>2. The capability of concrete expansion anchors.<br>3. The loads (dynamic and static) for the probe mounting bracket.<br>4. Concrete properties<br>5. Seismic accelerations requirements for electrical equipment<br>6. Allowable stresses for structural bolts.<br>Methodology to qualify the safety related structural integrity will include, but not limited to, the following:<br>1. Structural Weldments – Qualifying the weld design entails the selection of a weld's physical attributes, such as type, configuration and size, which will make it suitable for transferring |

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| | | the prescribed loads within appropriate limits. This process involves determining the maximum unit forces on the weld and comparing them with the weld capacity. The methodology determines weld design forces by assuming nominal linear stress/strain distribution. For each design, the engineer must confirm that the distribution of stiffness within the joint is consistent with this assumption. In some cases more refined techniques may be required to predict appropriate distribution of weld forces.<br><br>2. Concrete Expansions - The design methodology of concrete expansion anchor assemblies involves 1) application of component attachment loads to the plate, 2) analysis of the assembly to determine the resultant tension and shear forces on individual anchors, 3) evaluation of the anchor forces relative to anchor allowables and 4) computation and evaluation of bending stresses in the CEA plate. Reactions for the attached component (applied to the plate at the centroid of the attachment weld) shall be resolved into moments, shears and axial loads (about the major axes of the expansion anchor plate).<br><br>3. Local Stress Effects – The member local stresses for open sections are computed according to specific procedures for flange attachments, web attachments, attachments to flanges of beams supporting concrete, and attachments to webs of beams supporting concrete.<br><br>4. Existing Embedment Plate Evaluation - Embedment plates for mechanical/electrical component support attachments (i.e., pipe supports, conduit supports, HVAC supports, etc.) are evaluated as follows:<br><br>• Determine embedment plate detail based on the component support design drawing and appropriate structural drawings.<br>• Determine an allowable load for the embedment plate detail per plant design tables.<br>• Ensure that the attachment location satisfies the location tolerances used in determining the embedment plate allowables.<br>• Calculate reactions at face of embedment plate.<br>• Determine if the embedment plate can be qualified per criteria.<br><br>5. Conduit and Conduit Supports - Structural adequacy of rigid conduit is evaluated by determining the critical span condition, loads, checking conduit stresses and verifying structural adequacy of conduit clamps. Structural adequacy of Conduit, |

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| | | Junction Boxes and Junction Box supports is evaluated by determining loads, calculating member forces and joint reactions, checking member stresses, checking connections, checking expansion anchor assemblies, checking attachments to structure and resolving overstresses.<br><br>6. Cable Tray Loading Violations (CTLVs) – If cable trays are used then the structural evaluation of cable tray supports for potential increase in design basis loading will be performed by identifying the hangers affected by the routing point. For each affected hanger controlling routing point will be determined. Then actual load associated with the routing point will be computed. Then the actual load will be compared to the load used in the hanger design. An evaluation of cable tray hanger for any increased load will be performed.<br><br>7. Category I Partition Walls - When qualifying a wall for a new/revised attachment, the following method is utilized:<br><br>• If the loads on the existing critical design strip are larger in magnitude than the loads on the design strip containing the new attachment, then the wall can be qualified by this comparison.<br>• If the wall cannot be qualified by comparison of loading, moment and shear due to the attachment shall be calculated and their effects added to the critical design strip. New stresses or moment and shear will be compared to the allowable stresses/capacities. If this results in an unacceptable overstress condition, detailed evaluation of the design strip containing the attachment is required. All existing attachments and core holes in the strip will be accounted for in this evaluation.<br><br>Final verification of these methods will be available 2/27/15. |
| 4<br><br>(RAI-8, Ref. 5) | <u>RAI Question</u>:<br><br>**For (RAI-6, Ref.5) above, provide the results from the selected methods, tests and analyses used to demonstrate the qualification and reliability of the installed equipment in accordance with the Order requirements.** | <u>Started</u><br><br>Below is a summary of the test conditions used by Westinghouse to qualify the SFPIS. These test conditions are also documented in References 13 to 16. Environmental Conditions for SFPIS Components installed in the Spent Fuel Pool Area at TMI are bounded by below test conditions, except for radiation TID 12" above top of fuel rack for beyond design basis conditions (BDB). The BDB radiation TID, 12" above top of fuel rack for Byron Station is 4.E07 R γ, per calculation BYR13-051 – NEI 12-02 Spent Fuel Pool Doses. (Calculation BYR13-187, "Radiation Doses in the vicinity of the Spent Fuel Pool at Reduced Water Level" (Reference 24) proves that calculation BYR 13-051 bounds the Exelon Fleet for these values.) The BDB radiation value to which the Westinghouse equipment is qualified to is 1.E07 R γ, per Section 5.1.1 of WNA-TR-03149-GEN (Reference 19). The radiation value of 4.E07 R γ is higher than 1.E07 R γ to which Westinghouse qualified the |

instrument to. However, this value of 4.E07 R γ is applicable only when the water is at Level 3. At Level 2 the TID reduces to 2.E07 R γ and it further reduces to 8.E06 at Level 1 and above. With SFP water level at Level 3 the only components of SFPI that are exposed to high radiation are the stainless steel probe and the stainless steel anchor. The materials with which the probe and the anchor are manufactured are resistant to radiation effects. The stainless steel anchor and stainless steel probe can withstand 40 year dose. Westinghouse updated the design specification (WNA-DS-02957-GEN (reference 10)) and LTR-SFPIS-13-35, Revision 1 documentation to include the above technical justification.

Environmental Conditions for SFPIS Components in the Spent Fuel Pool Area

Level sensor probe, coax coupler and connector assembly, launch plate and pool side bracket assembly, and coax cable are designed and qualified to operate reliably in the below specified environmental conditions.

| Parameter | Normal for Exelon Plants | BDB |
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| Temperature | 50-140°F | 212°F |
| Pressure | Atmospheric | Atmospheric |
| Humidity | 0-95% RH | 100% (saturated steam) |
| Radiation TID γ (above pool) | 1E03 Rads | 1E07 Rads |
| Radiation TID γ (12" above top of fuel rack) | 1E09 Rads (probe and weight only) | 1E07 Rads |

Environmental Conditions Outside of the Spent Fuel Pool Area

The level sensor transmitter and bracket, electronics display enclosure and bracket are designed and qualified to operate reliably in the below specified environmental conditions.

| Parameter | Normal | BDB | BDB (Level Sensor |
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| | | | | | Electronics Only) |
| | | | Temperature | 50-120°F | 140°F | 140°F |
| | | | Pressure | Atmos-pheric | Atmos-pheric | Atmospheric |
| | | | Humidity | 0-95% RH | 0-95% (non-condensing) | 0-95% (non-condensing) |
| | | | Duration | 3 days | 3 days | 3 days |
| | | | Radiation TID γ | ≤ 1E03 R γ | ≤ 1E03 R γ | ≤ 1E03 R γ |

Thermal and Radiation Aging – organic components in SFP area

Westinghouse documents EQ-QR-269, EQ-TP-354, WNA-TR-03149-GEN (References 17, 18 & 19) provide thermal and radiation aging program details for the SFPI components. Westinghouse completed their thermal and radiation aging testing programs to qualify the SFPI components to 1.25 years. Exelon has reviewed the documents and found them acceptable.

Additionally, Westinghouse is continuing their aging tests to age the system components to 10 years. These tests were completed in Summer 2014. Final test reports were provided to Exelon. TMI will complete the test report reviews by 2/27/15.

Seismic Category I Testing

Seismic qualification testing will be performed by Westinghouse along with the technical evaluations during detailed design.

Vibration Justification

Components of the system (i.e., bracket, transmitter, display enclosure) will be permanently installed to meet the requirements to withstand a SSE and will meet TMI's seismic installation

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| | | requirements. Westinghouse will analyze the pool side bracket to withstand design basis SSE. Other components of the SFPIS will be subjected to shock and vibration during the seismic testing.<br><br>Sloshing Justification<br><br>A sloshing calculation will be performed by Westinghouse during detailed design. Sloshing forces will be taken into consideration for the anchorage design of the pool side bracket to ensure the bracket is rigidly mounted to include sloshing affects. |
| 5<br><br>(RAI-10, Ref. 5) | RAI Question:<br><br>**Please provide the following:**<br><br>a) **A description of the electrical ac power sources and capabilities for the primary and backup channels.**<br><br>b) **Please provide the results of the calculation depicting the battery backup duty cycle requirements demonstrating that its capacity is sufficient to maintain the level indication function until offsite resource availability is reasonably assured.** | Started<br><br>a) The primary and backup SFPLI instrument channels will be normally powered from separate non-1E 120 VAC breaker panels. These are powered from separate 480V buses which are ultimately powered from separate Auxiliary transformers, which maintain power source independence. Upon loss of normal AC power, individual batteries installed in each channel's electronics/ UPS enclosure will automatically maintain continuous channel operation for at least three (3) days. The power cable routings are not yet defined. It will be completed with the SFPI design which is currently scheduled for completion by 2/27/15.<br><br>Additionally, a receptacle and a selector switch are installed in each channel electronics/ UPS enclosure to directly connect emergency power to the SFPLI. During an ELAP (Extended Loss of AC Power) and before the batteries are discharged, the cabinets will be connected via the above receptacle and selector switch to power provided by the FLEX diesel generators.<br><br>b) The Westinghouse Report, WNA-CN-00300-GEN (Reference 23), provides the results of the calculation depicting the battery backup duty cycle. This calculation demonstrates that battery capacity is 4.22 days to maintain the level indicating function to the display location, located in the Patio Area at Control Building at TMI. Therefore, the TMI-1 Station readout display of level indication will be available for greater than 72 hours of operation. The results of the calculation meet the NEI 12-02 |

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| | | requirements. |
| 6<br><br>(RAI-13, Ref. 5) | RAI Question:<br><br>**Please provide the following:**<br>**a) The specific location for each of the primary and backup instrument channel displays.**<br><br>b) **For any SFP level instrumentation displays located outside the main control room, please describe the evaluation used to validate that the display location can be accessed without unreasonable delay following a BOB event. Include the time available for personnel to access the display as credited in the evaluation, as well as the actual time (e.g., based on walk-throughs) that it will take for personnel to access the display. Additionally, please include a description of the radiological and environmental** | Started<br><br>a) TMI's primary and backup instrument channel displays are planned to be located on the second floor of the Control Building. Precise location within the second floor of the control building will be finalized during the detailed design process. This will be completed by 2/27/15.<br><br>b) As stated above, TMI's primary and backup instrument channel displays are planned to be located on the second floor of the Control Building. Precise location within the second floor of the control building will be finalized during the detailed design process. This location was selected due to the fact that this area will be manned during any BDBEE where the FLEX RCS makeup pump is located as well. Also, the area is in close proximity to the main control room, and alternate shutdown panel. The display can be accessed from the main control room on demand if the FLEX RCS makeup station is not being manned as well. It will take up to 3 minutes to reach the display location, for both the primary and backup channels, when an operator is dispatched from the control room (down 2 floors).<br><br>Radiological habitability at this location has been evaluated against TMI UFSAR Table 11.A-2 and Figure 11.A-5. The peak radiation post LOCA is 480mRem/hr in this location. Also the estimated dose rates from SFP drain-down conditions to level 3, (calculation BYR13-187 (Reference 24)) was evaluated. Therefore the exposure to personnel monitoring SFP levels due to radiation in the display location for both channels would remain less than emergency exposure limits allowable for emergency responders to perform this action. Heat and humidity from SFP boil-down conditions have been evaluated for this location. The location is in a different building physically separated by concrete walls, closed air lock/fire doors from the SFP such that heat and humidity from a boiling SFP would not compromise habitability at this location.<br><br>Spent Fuel Pool Level monitoring will be the responsibility of Operations personnel who will monitor the display periodically once dispatched from the Control Room. As stated above, travel time from the Control Room to the primary and secondary displays is approximately 3 minutes based on walkdown by Engineering. Radiological habitability for the transit routes to both displays has been evaluated against TMI Station UFSAR |

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| | **conditions on the paths personnel might take. Describe whether the display location remains habitable for radiological, heat and humidity, and other environmental conditions following a BOB event. Describe whether personnel are continuously stationed at the display or monitor the display periodically.** | Table 11.A-2 and Figure 11.A-5 in the Control Building for post LOCA scenario conditions as well as estimated dose rates from SFP drain-down conditions to Level 3, (calculation BYR13-187 (Reference 24)) and exposure to personnel monitoring SFP levels would remain less than emergency exposure limits allowable for emergency responders to perform this action. Heat and humidity from SFP boil-down conditions have been evaluated for access to this location, and the access routes are located in a different building physically separated by closed air lock/fire doors from the SFP such that heat and humidity from a boiling SFP would not compromise habitability concerns with accessing these displays. The walkthrough to access the display locations is within the robust seismic category I structures, from the control room to the display locations, located near the TMI-1 remote shutdown room.<br><br>Operators will be able to use the sound powered phone system to communicate to the control room with the display information immediately. Being able to provide the indicated SFP level within approximately 10 minutes is not considered an unreasonable delay. |
| 7<br><br>(RAI-14, Ref. 5) | RAI Question<br><br>**Please provide a list of the procedures addressing operation (both normal and abnormal response), calibration, test, maintenance, and inspection procedures that will be developed for use of the SFP instrumentation. The licensee is requested to include a brief description of the specific technical objectives to be achieved within each procedure.** | Started<br><br>Appropriate quality measures will be selected for the SFPIS required by Order EA-12-051, consistent with Appendix A of NEI 12-02 Revision 1 (Reference 26). Site procedures will be developed for system inspection, calibration and test, maintenance, repair, operation and normal and abnormal responses, in accordance with Exelon's procedure control process. Technical objectives to be achieved in each of the respective procedures are described below:<br><br>Procedure Objectives to be achieved<br><br>1. System Inspection: To verify that system components are in place, complete, and in the correct configuration, and that the sensor probe is free of significant deposits.<br>2. Calibration and Test: To verify that the system is within the specified accuracy, is functioning as designed, and is appropriately indicating SFP water level.<br>3. Maintenance: To establish and define scheduled and preventive maintenance requirements and activities necessary to minimize the possibility of system interruption.<br>4. Repair: To specify troubleshooting steps and component repair and replacement activities in the event of system malfunction.<br>5. Operation: to provide sufficient instructions for operation and use of the system by plant operation staff.<br>6. Responses: To define the actions to be taken upon observation of system level indications, including actions to be taken at the |

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| | | levels defined in NEI 12-02.<br>All procedures will be in place before the system is considered operable – 11/30/15 |

## 7 Potential Draft Safety Evaluation Impacts

There are no potential impacts to the Draft Safety Evaluation identified at this time.

## 8 References

The following references support the updates to the Overall Integrated Plan described in this enclosure.

1. Exelon Generation Company, LLC, letter to USNRC, "Overall Integrated Plan in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-051)," dated February 28, 2013 (RS-13- 036).
2. NRC Order Number EA-12-051, "Issuance of Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation," dated March 12, 2012.
3. USNRC letter to Exelon Generation Company, LLC, Request for Additional Information Regarding Overall Integrated Plan for Reliable Spent Fuel Pool Instrumentation, dated June 26, 2013.
4. Exelon Generation Company, LLC, letter to USNRC, "Response to Request for Additional Information – Overall Integrated Plan in Response to Commission Order Modifying License Requirements for Reliable Spent Fuel Pool Instrumentation (Order No. EA-12-051)", dated July 24, 2013 (RS-13-095).
5. USNRC letter to Exelon Generation Company, LLC, "Interim Staff Evaluation and Request for Additional Information Regarding the Overall Integrated Plan for Implementation of Order EA-12-051, Reliable Spent Fuel Pool Instrumentation", dated November 13, 2013.
6. First Six-Month Status Report for the Implementation of Order EA-12-051, Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation, dated August 28, 2013 (RS-13-130).
7. Second Six-Month Status Report for the Implementation of Order EA-12-051, Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation, dated February 28, 2014 (RS-14-026).
8. 42105-R-001, Summary of Conservative, Design In-Structure Response Spectra for Resolution of Unresolved Safety Issue A-46 for Three Mile Island Nuclear Generation Station, Unit 1.
9. Westinghouse Document, WNA-CN-00301-GEN, "Spent Fuel Pool Instrumentation System Channel Accuracy Analysis," Revision 1.

10. Westinghouse Document, WNA-DS-02957-GEN, "Spent Fuel Pool Instrumentation System (SFPIS) Standard Product System Design Specification," Revision 4.
11. Westinghouse Document, WNA-TP-04709-GEN, "Spent Fuel Pool Instrumentation System Calibration Procedure," Revision 4.
12. Third Six-Month Status Report for the Implementation of Order EA-12-051, Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation, dated August 28, 2014 (RS-14-204).
13. VSDS Web Report viewer for TMI-1 Survey Maps – 348' FHB on 6/8/14.
14. ES-010T, TMI-1 Environmental Parameters.
15. TMI-1 UFSAR section 9.4.1 – SF Cooling System.
16. BYR13-051NEI 12-02 Spent Fuel Pool Doses.
17. Westinghouse Document, EQ-QR-269, "Design Verification Testing Summary Report for the Spent Fuel Pool Instrumentation," Revision 1.
18. Westinghouse Proprietary Document, EQ-TP-354, "Mechanical Preconditioning, Thermal Aging, and Radiation Aging Procedure for the Spent Fuel Pool Instrumentation System Coaxial Cables and Couplers," Revision 0.
19. Westinghouse Document, WNA-TR-03149-GEN, "SFPIS Standard Product Final Summary Design Verification Report," Revision 1.
20. Westinghouse Calculation CN-PEUS-13-24 - Seismic Analysis of the SFP Mounting Bracket at Byron and Braidwood Nuclear Stations (Similar analysis will be done for TMI or this analysis will be verified to be applicable).
21. TID-7024, Nuclear Reactors and Earthquakes, 1963, by the US Atomic Energy Commission (Appendix F – Dynamic Analysis of Fluids in Containers Subjected to Acceleration).
22. Westinghouse Proprietary Document, EQ-TP-351, "Environmental Qualification Test Procedure for the Spent Fuel Pool Instrumentation System Coaxial Cable and Connectors Inside the Spent Fuel Pool Area," Revision 0.
23. Westinghouse Document, WNA-CN-00300-GEN, "Spent Fuel Pool Instrumentation System Power Consumption Calculation," Revision 1.
24. BYR13-187 - Radiological Does in the Vicinity of the Spent Fuel Pool at Reduced Water Level.
25. Westinghouse Proprietary Document, EQ-TP-353, Revision 0, "Static Pull Test Procedure for Spent Fuel Pool Instrumentation System Connector," December 2013.
26. NEI 12-02 Revision 1 – Industry Guidance for Compliance with NRC Order EA-12-051, "To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation".

# ATTACHMENT 1 - TMI-1 SPENT FUEL POOL ELEVATION SKETCH