Xcel Energy®

Monticello Nuclear Generating Plant
2807 W County Road 75
Monticello, MN 55362

July 28, 2015

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10 CFR 2.202
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U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Monticello Nuclear Generating Plant
Docket No. 50-263
Renewed Facility Operating License No. DPR-22

Monticello Nuclear Generating Plant Completion of Required Action by NRC Order EA-12-051 Reliable Spent Fuel Pool Instrumentation (TAC No. MF0924)

References:

1. NRC Order EA-12-051, "Issuance of Order to Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation," dated March 12, 2012 (ADAMS Accession No. ML12054A682).

On March 12, 2012, the Nuclear Regulatory Commission (NRC) issued Order EA-12-051, *"Issuance of Order to Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation,"* (Reference 1) to Northern States Power Company, a Minnesota corporation (NSPM), doing business as Xcel Energy. The Order was effective immediately and directed NSPM to install reliable spent fuel pool level instrumentation in the Monticello Nuclear Generating Plant (MNGP) as outlined in Attachment 2 of the Order. This letter, along with its enclosures, provides the notification required by § IV.C.3 of the Order that full compliance with the requirements described in Attachment 2 of the Order has been achieved for MNGP.

Enclosure 1 of this letter provides the Order Compliance Summary. Enclosure 2 of this letter provides Responses to the NRC Requests for Additional Information (RAIs) related to Order EA-12-051. Enclosure 3 provides a bridging document that provides a comparison between the Spent Fuel Pool Instrument vendor technical information and the MNGP site specific considerations.

Please contact John Fields at 763-271-6707, if additional information or clarification is required.

A001
NRR

Summary of Commitments

This letter makes no new commitments and no revisions to existing commitments.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on July 28, 2015.

Peter A. Gardner
Site Vice President, Monticello Nuclear Generating Plant
Northern States Power Company – Minnesota

Enclosures (3)

cc: Administrator, Region III, USNRC
Director of Nuclear Reactor Regulation (NRR), USNRC
Project Manager, Monticello Nuclear Generating Plant, USNRC
Resident Inspector, Monticello Nuclear Generating Plant, USNRC

ENCLOSURE 1

Monticello Nuclear Generating Plant
Completion of Required Action by NRC Order EA-12-051
Reliable Spent Fuel Pool Instrumentation

Compliance with NRC Order EA-12-051

1.0 Background

On March 12, 2012, the Nuclear Regulatory Commission (NRC) issued Order EA-12-051, *"Issuance of Order to Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation,"* (Reference 1) to Northern States Power Company, a Minnesota corporation (NSPM), doing business as Xcel Energy. The Order was effective immediately and directed NSPM to install reliable spent fuel pool level instrumentation in the Monticello Nuclear Generating Plant (MNGP) as outlined in Attachment 2 of the Order. The Order required compliance prior to plant startup from the second refueling outage following submittal of the Overall Integrated Plan (OIP), or by December 31, 2016, whichever comes first.

The NRC staff has requested that the compliance report be submitted within 60 days of commencing unit startup from the outage in which implementation of the strategies is required. NSPM is hereby reporting that full compliance with the order was achieved prior to commencing MNGP startup, on May 30, 2015, the second refueling outage following submittal of the OIP. The information provided herein documents full compliance for MNGP in response to the Order.

2.0 Compliance

NSPM has installed two MOHR Test and Measurement LLC (MOHR), independent, wide range level monitors in the MNGP Spent Fuel Pool (SFP) in response to Reference 1. The milestones identified in the OIP have been completed and no further action is required. MNGP is a single unit with one SFP.

NSPM submitted the MNGP OIP by letter dated February 28, 2013 (Reference 2). By letter dated October 28, 2013 (Reference 3), the NRC provided its interim staff evaluation and requested additional information necessary for completion of the review. The information requested by the NRC is included in Enclosure 2.

Compliance with Order EA-12-051 was achieved using the guidance in Nuclear Energy Institute (NEI) document NEI 12-02 (Reference 4) which has been endorsed by the NRC (Reference 5).

3.0 Order EA-12-051 Compliance Elements Summary

NSPM compliance with Order EA-12-051 for MNGP was achieved using the guidance in Nuclear Energy Institute (NEI) document NEI 12-02 (Reference 4) which has been endorsed by the NRC (Reference 5). The significant compliance elements were addressed as described below.

Identification of Levels of Required Monitoring - Complete

NSPM identified the three required levels for monitoring the MNGP SFP level in compliance with Order EA-12-051. As discussed in Enclosure 2 to this letter, Level 1 is 37' - 3" above the bottom of the SFP, Level 2, is 24' - 9" above the bottom of the SFP and Level 3 is 14 '- 9" above the bottom of the SFP. The three levels were incorporated into the SFP instrument design.

Instrument Design Features – Complete

The instruments installed at MNGP were designed to comply with the requirements specified in the order and described in NEI 12-02. The instruments were installed in accordance with the MNGP engineering change control process.

The instruments were arranged to provide reasonable protection against missiles in accordance with the NRC endorsed guidance. The instruments were mounted to retain design configuration during and following the maximum expected ground motion. The instruments will be reliable during expected environmental and radiological conditions when the SFP is at saturation for extended periods. The instruments are independent of each other and have separate and diverse power supplies. The instruments will maintain their designed accuracy following a power interruption and are designed to allow for routine testing and calibration.

The instrument displays are readily accessible during postulated events and allow for SFP level information to be promptly available to decision makers.

Program Features - Complete

Training was completed in accordance with the Systematic Approach to Training process. Procedures were developed in accordance with the site procedure control program. Site processes were established to ensure the instruments are maintained at their design accuracy.

The required actions for non-functioning channels are now specified in procedures, which implement the applicable NEI 12-02 requirements for compensatory actions if channels are unavailable (e.g., "use of alternate suitable equipment or supplemental personnel").

4.0 References

1. NRC Order EA-12-051, "Issuance of Order to Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation," dated March 12, 2012 (ADAMS Accession No. ML12054A682).

2. NSPM Letter to NRC, "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)," L-MT-13-016, dated February 28, 2013 (ADAMS Accession No. ML13060A447).

3. NRC Letter to NSPM, "Monticello Nuclear Generating Plant – 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. MF0924)," dated October 28, 2013 (ADAMS Accession No. ML13275A187).

4. 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 (ADAMS Accession No. ML12240A307).

5. NRC Interim Staff Guidance JLD-ISG-2012-03, "Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation," Revision 0, dated August 29, 2012 (ADAMS Accession No. ML 12221A339).

ENCLOSURE 2

Monticello Nuclear Generating Plant
Completion of Required Action by NRC Order EA-12-051
Reliable Spent Fuel Pool Instrumentation

Responses to Requests for Additional Information

On June 7, 2013, the NRC Staff provided requests for additional information (RAI) in Reference 1 regarding the Spent Fuel Pool Instrumentation (SFPI) overall integrated plan. Reference 2 provided the Northern States Power Company, a Minnesota corporation (NSPM), doing business as Xcel Energy responses to NRC RAIs regarding the Overall Integrated Plan (OIP) for the Monticello Nuclear Generating Plant (MNGP). These responses are superseded by the responses provided herein.

On October 28, 2013, the NRC issued an Interim Staff Evaluation (ISE) of MNGP's SFPI OIP (Reference 3). The ISE documented the NRC Staff's review and provided feedback on NSPM's OIP. The ISE also included RAIs, to which the NRC Staff needed a response to complete their review. The RAIs issued by the NRC in the ISE superseded the RAIs reported in the Reference 1 email.

The responses to the RAIs in Reference 3 were initially provided to the NRC via the online reference portal during the installation of the SFPI channels. Most of the RAI responses are unchanged except for small editorial changes and replacement of future tense statements with past tense statements as necessary to reflect the completed status of the associated actions. However, RAI Responses 1, 5, 6, 11 and 14 have been modified more significantly to provide updated information. A brief synopsis of the changes is provided below:

RAI-1 – This response provides more detail with regard to specific SFP levels to provide a more complete answer to the NRC questions raised during the onsite audit.

RAI-5 – The response has been revised to provide additional information that the NRC requested during the onsite audit. Specifically, the NRC requested identification that the mounting brackets for the Spent Fuel Pool Level Probe Assembly meet seismic class I requirements.

RAI-6 – The response has been revised to include the results of a room heat-up study for the Alternate Shutdown System (ASDS) panel area to provide information regarding temperature conditions of this area during post beyond design bases event conditions.

RAI-11 – The response has been revised to indicate that the final maintenance procedure for the Spent Fuel Pool Level Instrument was provided to the NRC via the online reference portal.

RAI-14 – The response has been revised to indicate that when a single SFPI channel or both SFPI channels are out of service, the requirements for compensatory actions are located in a NSPM fleet procedure. During the onsite audit performed by the NRC, it was discussed that these requirements were planned to reside in the MNGP Technical Requirements Manual (TRM). Subsequently, this direction was revised so that a common fleet approach could be used for these required actions.

All documents referenced were previously provided to the NRC in the online reference portal or during the FLEX/SFPI audit performed in November 2014.

References:

1. Email from T Beltz (NRC) to R. Loeffler (NSPM), "Monticello Nuclear Generating Plant - Requests for Additional Information Regarding Overall Integrated Plan for Reliable Spent Fuel Pool Instrumentation (TAC No. MF0924)," dated June 7, 2013 (ADAMS Accession No. ML13176A331).

2. Letter from M A Schimmel (NSPM) to Document Control Desk (NRC), "Responses to Requests for Additional Information Regarding Monticello Nuclear Generating Plant's Overall Integrated Plan Submitted 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) (TAC No. MF0924)," L-MT-13-058, dated July 12, 2013 (ADAMS Accession No. ML13193A324).

3. NRC Letter to NSPM, "Monticello Nuclear Generating Plant – 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. MF0924)," dated October 28, 2013 (ADAMS Accession No. ML13275A187).

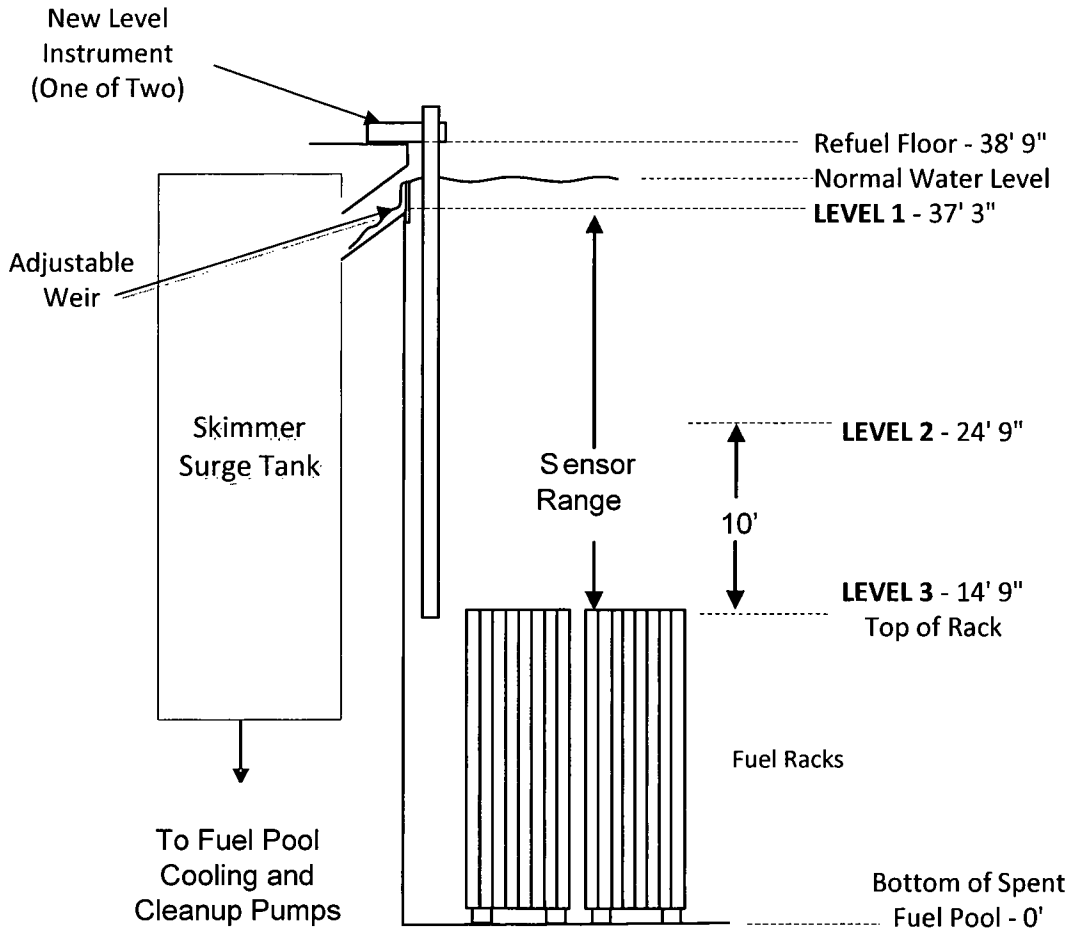
NRC RAI #1

Given the potential for varied dose rates from hardware stored in the SFP, please provide a description of how the elevation identified as Level 2 might be affected.

NSPM Response

For the MNGP Spent Fuel Pool, pool levels are defined in Figure 1 - 1 provided below:

Figure 1 - 1 – Spent Fuel Pool Levels



The level requirements come from NEI 12-02, which require the following levels of required monitoring:

- **Level 1** - Level that is adequate to support operation of the normal fuel pool cooling system.
- **Level 2** - Level that is adequate to provide substantial radiation shielding for a person standing on the spent fuel pool operating deck. NEI 12-02 indicates that selection of 10 feet between level 2 and level 3 assures a range of water level where any necessary operations in the vicinity of the spent fuel pool can be completed without significant dose consequences from direct gamma radiation from the stored spent fuel.
- **Level 3** – Level where fuel remains covered and actions to implement make-up water addition should no longer be deferred.

NSPM performed a calculation of the dose rates in the spent fuel pool at various levels in accordance with NEI 12-02. The results of the calculation indicated that the total integrated dose for the dielectric material is 9.79E+08 rad. The instrument material is qualified for a total dose of 10 Grad, or 1.0E+10 rad. Therefore, the qualified radiation dose for the material is greater than the calculated results and is acceptable.

NRC RAI #2

Please provide a clearly labeled sketch or marked-up plant drawing of the plan view of the SFP area, depicting the SFP inside dimensions, the planned locations/placement of the primary and back-up SFP level sensor, and the proposed routing of the cables that will extend from these sensors toward the location of the read-out/display device.

NSPM Response

The MNGP SFP is approximately 26' X 40'. The SFP probes are located in the Northeast and Southeast corners of the SFP. This arrangement provides separation by a distance equal to the longest length of a side of the pool and uses inherent protection provided by the pool walls.

The primary SFP Level Instrument probe is located at Northeast corner of the SFP and the backup Instrument probe is located at the Southeast corner. The primary channel display is in the Control Room (CR) and the backup instrument display is located near the ASDS panel in the Emergency Filtration Train (EFT) building.

Cables were routed from the sensors (probes) to the read-out/display device location to ensure independence and redundancy of the channels.

Documents and drawings to support the SFP instrument system design and layout were provided to the NRC in the online reference portal.

NRC RAI #3

Please provide the following:

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.*

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.*

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.*

d) *Address how other hardware stored in the SFP will not create adverse interaction with the fixed instrument location(s).*

NSPM Response

a) NSPM performed a calculation of the total loading on the bracket including design basis seismic loads and hydrodynamic loads.

The Methodology section of the calculation states:

"The structural members of the brackets are designed using a static equivalent force (that bounds actual forces in all directions due to seismically induced forces acting on the bracket). The vertical static equivalent force is then superimposed with Fz and other forces and moments which are provided by MOHR … "

Hydrodynamic loads on the level probes were modeled by including the effects of water sloshing in the SFP.

The calculation concludes:

> *The probe supports, as designed, and the existing supporting structure are structurally adequate to support the vendor (MOHR) provided probes. The bracket design meets Class I requirements in accordance with NEI 12-02 ... and includes use of an additional conservation factor of 50% greater than the site design basis seismic in-structure response spectra.*

b) Detailed drawings were developed as part of the modification that show how the SFP level instrument probes are installed and supported within the MNGP SFP. One probe is located in the Northeast corner (primary) and one probe is located at the Southeast corner (backup) of the MNGP SFP. The drawings also provide details showing how each probe is attached to the support structure interface. Documents and drawings to support the SFP instrument system design and layout were provided to the NRC in the online reference portal.

c) The probe support structures are connected to the existing JIB Crane Sockets as depicted in the drawings provide response to part b) above.

d) A site specific evaluation was performed that demonstrated that the probes will not deflect enough to interact with the pool liner or any nearby equipment lugs.

The calculation states:

> *The probe displacement calculations, and the impact testing show that no damage to the probe or to the pool liner is expected during the postulated seismic event. The probe displacement calculations also show that the probe located 12 in. from the wall is not expected to impact a set of lugs located 4.25 in. from the probe.*

In addition, introduction of any new materials that could impact the instrument probes is strictly controlled by the SFP inventory plant procedure. Any new item proposed to be stored in the SFP is evaluated for acceptability. Special Nuclear Material stored in the SFP is monitored and inventoried annually by plant procedures.

NRC RAI #4

For RAI 3(a) above, please 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.

NSPM Response

The analyses used to verify the design criteria and methodology for seismic testing of the SFP instrumentation and the electronics units, including the design basis maximum seismic loads and the hydrodynamic loads that could result from pool sloshing or other effects that could accompany such seismic forces, are described in response to RAI #3 and were provided to the NRC during the onsite audit of the Spent Fuel Pool Order EA-12-051 in November 2014. .

NRC RAI #5

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.

NSPM Response

The SFP Level Probe Mounting Brackets are attached to existing JIB sockets located at the northeast and southeast corners of the MNGP SFP and are designed consistent with Seismic Class I mounting practices.

Design inputs included the weight of the probes and forces determined by analyses including seismic and pool sloshing effects on the probe.

The methodology used to qualify the structural integrity of the affected structures/equipment, is consistent with the MNGP USAR Section 12.2.1.9, Seismic Loads. Thereby, assuring that the installation of the bracket meets the Seismic Class I requirements of NEI 12-02.

NRC RAI #6

Please provide the following:

a) A description of the specific method or combination of methods you intend to apply to demonstrate the reliability of the permanently installed equipment under beyond-design-basis ambient temperature, humidity, shock, vibration, and radiation conditions.

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 retransmitting devices that will be employed to convey the level information from the level sensor to the plant operators or emergency responders.

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.

NSPM Response

a.) *Temperature and Humidity:* The SFPI system equipment is certified to function properly during and after exposure to temperatures from -10 to +55^{o}C, and humidity from 5 to 95 %.

Shock and Vibration: The electronics of the SFPI system equipment and associated batteries were tested to demonstrate general robustness including shock resistance for handling and transport and vibration resistance appropriate for equipment in large power plants.

Radiation: The SFPI system equipment located in the spent fuel pool area has been qualified to withstand postulated accident conditions with an expected life of 40 years.

b.) & c.) The SFPI system electronics and batteries are seismically tested and qualified using Institute of Electrical and Electronics Engineers (IEEE)-344:2004 methodology.

With respect to the probe assembly, combined seismic and hydrodynamic analyses were used to demonstrate that the probe waveguide's geometric dimensions do not change significantly as a result of the seismic conditions. In

the absence of alteration to the geometric configuration of the probe waveguide, there is no mechanism for seismic excitation of the probe assembly to alter system accuracy.

The accuracy of system electronics is demonstrated following seismic excitation as part of the seismic testing protocol.

The post- beyond design basis external event (BDBEE) environment of the control boxes, electronics, or read-out and retransmitting devices available to the operators was assessed with respect to temperature, humidity and radiation. Instrument displays are mounted in MNGP CR and the EFT building. For the CR, temperature will not exceed 120°F within 48 hours of the event. NSPM evaluated the EFT building where the SFP backup level indication is present (near ASDS Panel) and provided temporary ventilation when battery charging is being performed in a BDBEE event. Temporary ventilation is provided during a BDBEE as part of the FLEX strategies.

The system has been tested to the temperature, humidity and radiation conditions expected following a BDBEE. Testing found that the system performed acceptably and demonstrated with reasonable assurance that the SFPI system would be available following a BDBEE.

NRC RAI #7

For RAI #6 above, please provide the results for the selected methods, tests and analyses used to demonstrate the qualification and reliability of the installed equipment in accordance with the Order requirements.

NSPM Response

The results are included in the following reports from MOHR Test and Measurement LLC:

- MOHR 1-0410-1, Rev. 1, "MOHR EFP-IL SFPI System Temperature and Humidity Test Report"
- MOHR 1-0410-2, Rev. 2, "MOHR SFP-1 Level Probe Assembly Materials Qualification Report"
- MOHR 1-0410-3, Rev. 0, "MOHR EFP-IL System Proof of Concept Report"
- MOHR 1-0410-4, Rev. 2, "MOHR EFP-IL SFPI System EMC Test Report"
- MOHR 1-0410-4-S1, Rev. 0, "MOHR EFP-IL SFPI System Supplemental EMC Information"

- MOHR 1-0410-5, Rev. 0, "MOHR EFP-IL SFPI System Shock and Vibration Test Report"
- MOHR 1-0410-6, Rev. 1, "MOHR EFP-IL SFPI System Seismic Test Report"
- MOHR 1-0410-7, Rev. 2, "MOHR EFP-IL SFPI System Battery Life Report"
- MOHR 1-0410-8, Rev. 2, "MOHR EFP-IL SFPI System Boric Acid Deposition Report"
- MOHR 1-0410-9, Rev. 2, "MOHR SFP-1 Level Probe Assembly Seismic Analysis Report"
- MOHR 1-0410-9.10, Rev. 0, "MOHR SFP-1 Site-Specific Seismic Analysis Report Xcel Energy Monticello Nuclear Generating Plant (MONTICELLO)"
- MOHR 1-0410-10, Rev. 1, "MOHR EFP-IL SFPI System Power Interruption Report"
- NAI-1725-004, Rev. 3, "Seismic Induced Hydraulic Response in the CGS Spent Fuel Pool"

The documents listed above were provided to the NRC when the NRC staff audited MOHR's SFP instrumentation design at the MOHR facility during the May 2014 with the exception of the site specific documents, 1-0410-9.10 and NAI-1725-004. As described in the NRC audit report (Reference 7-1), the NRC found the MOHR SFP Instrumentation and documentation package acceptable for reference by licensees.

The site specific documents 1-0410-9.10 and NAI-1725-004 were provided to the NRC in the online reference portal.

References

7-1 NRC letter, "Donald C. Cook Nuclear Plant, Units 1 and 2 - Report for the Onsite Audit of MOHR Regarding Implementation of Reliable Spent Fuel Pool Instrumentation Related to Order EA-12-051 (TAC Nos. MF0761 and MF0762)," dated August 27, 2014 (ADAMS Accession No. ML14216A362).

NRC RAI #8

Please provide the following:

a) A description of how the two channels of the proposed level measurement system meet this (channel independence) requirement so that the potential for a common cause event to adversely affect both channels is minimized to the extent practicable.

b) Further information on how each level measurement system, consisting of level sensor electronics, cabling, and readout 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 location(s) of the readout devices, and the independence of the displays.

NSPM Response

a) The SFPI system design includes two separate and independent channels; a primary instrument channel and a backup instrument channel. Each channel consists of a SPF-1 signal probe, signal processor, monitor, and Uninterruptable Power Supply (UPS) Battery. The normal power supply to the instruments is provided by different sources such that a loss of a distribution panel will not result in the loss of both channels. During a BDBEE each channel has independent battery systems which will supply the channels with power for seven (7) days in minimum power mode. One indicator is located in the CR and the backup indicator is located near the ASDS panel in the EFT building. Cables for each channel are routed in separate conduits and cable trays.

b) The SFPI probes are located in the Northeast and Southeast corners of the SFP. The indicators are located in the CR and near the ASDS panel in the EFT building. Cables for each channel are routed in separate conduits and cable trays to provide additional redundancy.

The design provides two identical, non-safety related wide-range level instruments which feed two independent trains of non-safety cable and indicators to provide a highly reliable remote display of SFP water level. Physical separation of the two channels is accomplished by diversity of SFP locations and by separately routing cable and conduit.

NRC RAI #9

Please provide the following:

a) A description of the electrical AC power sources and capabilities for the primary and backup channels.

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.

NSPM Response

a) The level indicating channels are installed as an independent and redundant system. Each channel is powered by an independent 120VAC source. Each channel is provided with a battery back-up power supply capable of powering the channel for seven days.

- Primary power for the level indicating channels and the display is installed in the CR.
- Each channel is powered from a different 480V bus. Therefore, loss of any one 480V bus does not result in loss of normal 120VAC power for both instrument channels.
- On loss of normal 120VAC power, each channel's UPS automatically transfers to a dedicated backup battery. If normal power is restored, the channel will automatically transfer back to the normal AC power.
- Each backup battery is maintained in a charged state by a UPS. The batteries are sized to be capable of supporting for seven days of monitoring.

Instrument accuracy and performance are not affected by restoration of power or restarting the processor.

b) Permanent installed battery capacity for seven days on-demand operation is designed consistent with NEI 12-02 duration without reliance on or crediting of potentially more rapid flexible strategies (FLEX) program power restoration. The sample rate estimates in the minimum power mode have been developed by the vendor using conservative instrument power requirements and measured battery capacity with draw-downs during and following exposure of the batteries to their maximum operating temperature for up to seven days. The instrument configuration was established for an automated sample rate when under battery

power consistent with seven days on-demand operation in the minimum power mode.

NRC RAI #10

Please provide the following:

a) *An estimate of the expected instrument channel accuracy performance under both (a)-normal SFP level conditions (approximately Level 1 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 Level 2 and Level 3 datum points.*

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.*

NSPM Response

a) *Accuracy:* The absolute system accuracy is better than ± 3 inches for all expected conditions. The instrument channel accuracy performance is approximately ±1% of span based on the sensitive range of the detector. This is conservative, bounding instrument channel accuracy with the vendor estimating expected instrument channel accuracy to be better than the above bounding accuracy. This accuracy is applicable for normal conditions and also the temperature, humidity, chemistry, and radiation levels expected for beyond-design-basis event conditions. Accuracy was validated by Factory Acceptance Testing.

Trending: The display trends and retains data when powered from either normal or backup power. This has been verified by vendor testing.

Restoration after Loss of Power: The system automatically swaps to available power (backup battery power or external power source) when normal power is lost. Neither the source of power nor system restoration impact the accuracy. Previously collected data is retained. This has been verified by vendor testing.

Diagnostics: The system performs and displays the results of real-time information related to the integrity of the cable, probe, and instrument channel.

b) The methodology that was used for determining the maximum allowed deviation from the instrument channel design accuracy employed under normal operating conditions as an acceptance criterion was developed under MOHR document 1-0410-15. "MOHR EFP-IL SFPI System Uncertainty Analysis" concludes:

> "*This report documents water level measurement uncertainty of the EFP-IL SFPI system derived from customer-witnessed Factory Acceptance Testing of the first 19 channels of EFP-IL SFPI system hardware. These instruments exceed MOHR's published minimum accuracy specification of +/- 3 in. across the range of measurement as measured through the 1000 ft. maximum length of transmission cable. ....*
>
> *Based on objective evidence presented in this report and supporting documentation, the MOHR EFP-IL SFPI system exceeds the NEI 12-02 water level measurement accuracy requirement of +/- 1 foot."*

Maintenance Procedures used this value of +/- 3 in. for the AS FOUND Level verification checks.

NRC RAI #11

Please provide the following:

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.*

b) *A description of how such testing and calibration will enable the conduct of regular channel checks of each independent channel against the other, and against any other permanently-installed SFP level instrumentation.*

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. Provide a discussion as to how these surveillances will be incorporated into the plant surveillance program.*

d) *A description of what preventive maintenance tasks are required to be performed during normal operation, and the planned maximum surveillance interval that is necessary to ensure that the channels are fully conditioned to accurately and reliably perform their functions when needed.*

NSPM Response

a) Periodic testing and Calibration of the SFP level instrumentation was established in conjunction with the requirements of the vendor (MOHR) technical manuals.

Each instrument electronically logs a record of measurement values over time. The channel level measurements can be compared to each other to demonstrate constancy.

MOHR's documentation provides a description of the capability and provisions the level sensing equipment has to enable periodic testing and calibration, including how this capability enables the equipment to be tested in-situ.

The NRC staff audited MOHR's SFP instrumentation design at the MOHR facility during the week of May 26, 2014 and issued its audit report (See response to RAI #7). Section 4 of the NRC audit report addresses, in part, calibration and testing, and determined the following:

- MOHR reports provide the testing and calibration procedures for the SFPI. MOHR's SFPI design can be calibrated in-situ without removal from its installed location.
- The MOHR reports provide recommended calibration intervals to be followed by users of this technology.
- The NRC staff found the instructions and recommendations for calibration of the SFPI to be *"thorough and user-friendly."*

b) Each instrument electronically logs a record of measurement values over time in nonvolatile memory that can be compared to demonstrate constancy, including any changes in pool level, such as that associated with the normal evaporative loss/refilling cycle. The channel level measurements are directly compared to each other (i.e., regular cross-channel comparisons). Any other measurements of SFP level may be used for diagnostic purposes if cross-channel comparisons are anomalous.

c) Functional checks are automated and/or semi-automated (requiring limited operator or technician interaction) and are performed through the instrument menu software and initiated by the operator or technician. There are other internal system tests that are performed by system software on an essentially continuous basis without user intervention but can also be performed on an on-demand basis with diagnostic output to the display for the operator or technician

to review. Other tests such as menu button tests, level alarm tests, and alarm relay tests are only initiated manually by the operator or technician. At a minimum, functional checks are performed at a frequency, commensurate with vendor requirements. SFPI levels are verified daily at both instrument displays.

Calibration checks are described in detail in the Vendor Operator's Manual. The applicable information is provided in plant procedures or preventive maintenance tasks. At a minimum, calibration checks are performed at a frequency, commensurate with vendor requirements.

d) Formal calibration checks are recommended by the vendor on a two-year interval to demonstrate calibration to external National Institute of Standards and Technology traceable standards. Formal calibration check surveillance interval and timing are established in procedures consistent with vendor requirements. The SFPI preventive maintenance performance is controlled through tasks in the MNGP Preventive Maintenance program.

In addition, the NRC requested a final copy of the MNGP calibration procedure for the spent fuel pool level instruments. In response, NPSM provided procedures 7182-01, Rev. 0, "Spent Fuel Pool Level Channel A Instrumentation Maintenance," and 7182-02, Rev. 0, Spent Fuel Pool Level Channel B Instrumentation Maintenance."

The referenced documents were provided to the NRC in the online reference portal.

NRC RAI #12

Please provide the following:

a) *The specific location for the backup instrument channel display.*

b) *Please describe the evaluation used to validate that the display location can be accessed without unreasonable delay following a BDB 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 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 BDB event. Describe whether personnel are continuously stationed at the display or monitor the display periodically.*

NSPM Response

a) The backup SFPI display is located near the ASDS panel on the third floor of the EFT building.

b) The EFT building is independent from the reactor and turbine buildings. The ASDS panel room is one level from where the CR is located. The EFT building provides a safe enclosure and protection for the main components of the CR air conditioning system (including the emergency filtration train units for the CR air conditioning system) and for other safety-related equipment as necessary, in addition to the ASDS panel. The EFT area has a mild environment and is independent from the secondary containment, the turbine building, and the radioactive waste building.

   The backup SFPI display, just like the ASDS panel, is easily accessible from the CR. Operators walk out of the CR to the 951' corridor to the EFT building, up the stairway to 959' elevation, and into the ASDS panel room in less than 10 minutes. The entire operator walking path is environmentally and radiologically mild. Personnel may remain, if necessary, at the ASDS panel during the ELAP event. However, sufficient ventilation is provided to the CR during an ELAP event that relocating to the ASDS panel should not be required.

NRC RAI #13

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 spent SFP instrumentation. Please provide a brief description of the specific technical objectives to be achieved within each procedure.

NSPM Response

The following procedures were revised or generated to incorporate the SFPI design change:

- Abnormal Operating Procedure C.4-B.09.07.E, "Loss of Power to LC-107 or MCC-114" - This procedure provides direction for a loss of power to 480V LC-107, Panel P-16/PNL, or MCC-114. This procedure was updated to show installation of Spent Fuel Pool Level Instrumentation per NRC order EA-12-051.

SFP level instrument channel A is normally powered by Panel L-48 which is fed from MCC-114.

- Abnormal Operating Procedure C.4-B.09.07.D, "Loss of Power to LC-104 or its MCCs" - This procedure provides direction for a loss of power to 480V LC-104, and various MCCs including MCC 144. This procedure was updated to show installation of Spent Fuel Pool Level Instrumentation per NRC order EA-12-051. SFP level instrument channel B is normally powered by MCC-144 via LC-104.
- Operations Procedure (OP) 2030, "Control Room Log" - The purpose of this log is to implement the requirements of OWI-02.03, "Operator Rounds" for the CR. This procedure was changed to provide a daily check for the Spent Fuel Pool Level Instrumentation system Channel A. As the system does not alarm, it is necessary to check the indicator to review any level or system faults and alarms. The system uses a two blink led protocol that indicates level status on the first blink and system status on the second.
- OP 2194, "EFT Daily Log Sheet and Admin Bldg Checks" - The purpose of this log is to implement the requirements of OWI-02.03, "Operator Rounds" for the EFT and Administration Buildings. This Procedure provides a daily check for the Spent Fuel Pool Level Instrumentation System Channel B. As the system does not alarm, it is necessary to check the indicator to review any level or system faults and alarms. The system uses a two blink LED protocol that indicates level status on the first and system status on the second.
- OP B.02.01-01, "Fuel Pool Cooling - Function and General Description of System" - Fuel Pool Cooling and Cleanup System handle the spent fuel cooling load and to maintain pool water purity and clarity. The system has been designed to provide sufficient filtering capacity to filter the entire spent fuel pool water volume every 12 hours. The procedure was updated to indicate that wide-range spent fuel pool level indication is available in the CR and the EFT Building.
- OP B.02.01-03, "Fuel Pool Cooling - Instrumentation and Controls" – The procedure was updated to indicate the installation of the spent fuel pool level instrumentation. Operations manual was updated to include new instruments.
- OP B.02.01-04, "Fuel Pool Cooling – References" - The procedure was updated to indicate the installation of the spent fuel pool level instrumentation. Operations manual was updated to include the plant modification number.
- OP B.02.01-05, "Fuel Pool Cooling - System Operation" - The procedure was updated to indicate the installation of the spent fuel pool level instrumentation. This manual provides details for normal operation (battery and system checks). The procedure includes discussion of battery maintenance and battery life limitations which prevents taking readings of level more than 30 samples per hour to meet the 7 day power requirement.
- I&C Maintenance Procedure 7182-01, "Spent Fuel Pool Level Channel A Instrumentation Maintenance" and 7182-02, "Spent Fuel Pool Level Channel B

Instrumentation Maintenance" – These procedures incorporate vendor manual calibration, test, maintenance, and inspection requirements for the Spent Fuel Pool level instrumentation channels.

- Fleet Procedure FP-BDB-EQP-01, "Equipment Important to BDB Compliance," – This procedure provides the compensatory measures that must be implemented and the limitations associated with removing Beyond Design Bases equipment (including the SFPIs) from service.

The referenced documents were provided to the NRC in the online reference portal. Procedure numbers and titles are subject to change.

NRC RAI #14

Please provide the following:

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 readiness requirements. Please 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.

b) A description of how the guidance in NEI12-02 section 4.3 regarding compensatory actions for one or both non-functioning channels will be addressed.

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.

NSPM Response

a) Maintenance and testing of the SFP Instrumentation system is described in response to RAI #11.

b) & c)
The primary or back-up instrument channel can be out of service for testing, maintenance, and/or calibration for up to 90 days provided the other channel is functional. Additionally, compensatory actions must be taken if the

instrumentation channel is not expected to be restored or is not restored within 90 days.

For a single channel that is not expected to be restored, or is not restored within 90 days, the compensatory actions include the steps necessary to ensure availability of normal alarms and proper function of the remaining indication channel validated by direct visual monitoring.

If both channels become non-functioning, then actions are initiated within 24 hours to restore one of the channels of instrumentation and to implement compensatory actions within 72 hours. Compensatory actions include the steps necessary to ensure availability of normal alarms and increased direct visual monitoring of spent fuel pool level.

The SFPI allowed out of service times and compensatory actions discussed above are described in procedure FP-BDB-EQP-01.

NRC SE-1

Please provide information describing how the final arrangement of the SFP instrumentation and routing of the cabling between the level instruments, the electronics and the displays, meets the Order requirement to arrange the SFP level instrument channels in a manner that provides reasonable protection of the level indication function against missiles that may result from damage to the structure over the SFP.

NSPM Response

See the response to RAI #2.

NRC SE-2

Please provide an assessment of potential susceptibilities of EMI/RFI [Electromagnetic Interference/Radio Frequency Interference] *in the areas where the SFP instrument located and how to mitigate those susceptibilities.*

NSPM Response

The MOHR SFPI level indicators were successfully evaluated and tested to the requirements of EPRI TR-102323 for Non-Safety Related equipment. The MOHR SFPI level probes were successfully tested in situ for EMI susceptibility by keying a radio transceiver near each level probe and verifying the level indication did not deviate by more than one inch.

Other components of the SFPI system did not require EMI/RFI testing for the reasons described below.

- The primary SFPI level indicator is mounted in the CR which does not allow the use of transmitters.
- The backup SFPI level indicator is located in the EFT building. The EFT/ASDS room is a low traffic area and radio use is not permitted when the panel is open.

NRC SE-3

Please provide the following:

a) *A description of the 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.*

b) *Information describing compensatory actions when both channels are out-of-order, and the implementation procedures.*

c) *Additional information describing expedited and compensatory actions in the maintenance procedure to address when one of the instrument channels cannot be restored to functional status within 90 days*

NSPM Response

See the response to RAI #14.

Enclosure 3

Bridging Document Between Vendor Technical Information and Monticello Nuclear Generation Plant Site Specific Considerations

Referenced documents are identified below the table.

#	Topic	Parameter Summary	Reference Document #	Additional Comments	Test or Analysis Results	Licensee Evaluation
1	Design Specification	Spent Fuel Pool (SFP) instrument requirements derived from References 1, 2 & 3	References 4 - 14, 18 & 30		N/A	Evaluation of the vendor information was completed under Engineering Change 23419 in accordance with Xcel Energy's Design Change Process.
2	Test Strategy	Per requirements in References 1, 2 & 3	References 4, 6, 7, 8 & 9		N/A	The equipment testing performed for the SFP instrument has been found to be acceptable based on the current design requirements.
3	Environmental Qualification for Electronics Enclosure with Display	–Control Room < 104°F EFT: < 107°F	Reference 4		14 - 131°F	Vendor testing analysis bounds licensee parameters defined in the references provided in the parameter summary column. From (Reference 26) Calculation 90-38 "Control Room Space Temperature Evaluation during Station Blackout" the maximum Control Room (CR) temperature under accident conditions is less than 120°F. Calculation 96-074 "Station Blackout (SBO) Heat-up of the EFT Building" (Reference 37) has concluded that the maximum steady-state temperature is between 117°F to 117.2°F (for the ASDS area).
		relative humidity (RH) non-condensing	Reference 4		5% - 95% RH	Normal relative humidity (RH) conditions are assumed to be 20-90%. (Reference 36)
		Radiation effects			N/A	Vendor test analysis bounds licensee parameters; the CR and the EFT (for the ASDS area) are considered a mild environment with minimal expected radiation.
4	Environmental Testing for Level Sensor components in SFP area - Submerged Portion of Probe Body	85 - 212°F (References 1, 2 & 40)	Reference 5 & 16	The Total Integrated Dose (TID) is the total 16 year dose plus the seven day worst case accident dose at the lowest spacer location on the probe body	480°F long-term for poly-ether-ether-ketone (PEEK) insulators	The SFP is expected to remain at or above the minimum ambient temperature of the Reactor Building (85°F) as called out in calculation 05-133 (Reference 40). An accident condition assumes that the SFP is in a boiling condition, thus the boiling temperature of water at atmospheric pressure (212°F) is indicated. The limiting critical components of the probes are the PEEK spacers. Based on this evaluation the PEEK spacers are acceptable for the application.
		Submerged component (References 1 & 2)	Reference 5		PEEK insulators capable of long term submergence	
		6.5 x 10^8 rads TID (References 1, 2 & 15)	Reference 5 & 15		PEEK: 1 x 10^{10} rads	Calculation 14-098 (Reference 15) defines a worst-case dose rate of approximately 7.526 x 10^8 rads. The PEEK spacers are qualified to 1 x 10^{10} rads. As such, the PEEK spacers are suitable for the application.
5	Environmental Testing for Level Sensor Electronics Housing-Probe Head located Above the SFP	85 - 212°F (References 1, 2 & 40)	Reference 5 & 16	Rad TID is the total 16 year dose plus the seven day worst-case accident dose at the location of the probe head	PEEK: 480°F long-term, EPDM: 12 days @ 311°F	The SFP area is expected to remain at or above the minimum ambient temperature of the Reactor Building (85°F) as called out in calculation 05-133 (Reference 40). Maximum accident condition temperature and humidity directly above the SFP will likely be in a condensing steam environment which conservatively will be no greater than 212°F, the temperature of boiling water at atmospheric pressure. Based on the vendor analysis results the sensitive materials in the probe head will not be challenged under the expected conditions described in References 1, 2 & 40 and are acceptable.
		0% - 100% RH Condensing	Reference 5		0% - 100% RH for PEEK	100% non-condensing RH is a conservative humidity range for normal operating conditions. Based on the vendor analysis results, the sensitive materials in the probe head will not be challenged under the expected conditions of References 1 & 2 and are acceptable.

#	Topic	Parameter Summary	Reference Document #	Additional Comments	Test or Analysis Results	Licensee Evaluation
		7.814 x 10^6 rads TID (Reference 15)	Reference 5		PEEK: 1 x 10^{10} rads	Calculation 14-098 (Reference 15) defines a worst-case dose rate of approximately 7.526 x 10^8 rads. Based on the vendor analysis results, the sensitive materials in the probe head will not be challenged under the expected conditions of References 1, 2 & 15 and are acceptable.
6	Thermal & Radiation Aging - Organic Components in SFP area	See Items 4 & 5 above	Reference 5		See Items 4 & 5 above	Vendor test analysis bounds licensee parameters. See discussion in Items 4 and 5 above.
7	Basis for Dose Requirement	References 1 & 2	N/A		Reference 15	Calculation 14-098 (Reference 15) is based on the requirements of EA-12-051 (Reference 1) and NEI 12-02 (Reference 2). The calculation determines the dose rates for various locations and SFP water levels for both a seven day accident scenario and 16 year TID.
8	Seismic Qualification	Seismic Class I (References 1, 2 & 16)	References 11, 12, 18, 32 & 41		Seismic Class I	Seismic Report 1-0410-9.10 (Reference 12) and Calculation 14-060 (Reference 32) demonstrate the seismic adequacy of the probe support bracket and anchorage. The bracket is designed to Seismic Class I requirements and is a non-safety related structure anchored to the concrete SFP wall with Nuclear Safety Related expansion anchors. The MOHR-EFP level indicator and battery enclosure were seismically tested by the vendor. The results are documented in MOHR test report 1-0410-6 (Reference 8). Seismic installation of the level probes in the SFP and the battery enclosures in the CR and the EFT Building are documented in EC 23419 (Reference 41).
9	Sloshing	Water induced motion from seismic event does not cause equipment structural failure	References 27, 28 & 29	See Item 8		Seismic Report 1-0410-9.10 (Reference 12) documents the loading produced by a seismic event on the bracket, including the sloshing effects..
10	SFP Instrumentation System Functionality Test Procedure	System must allow for routine in-situ functionality testing (Reference 2)	Reference 28			The system features on board electrical diagnostics. Full channel functional testing utilized comparison of actual pool level to that which is indicated, as well as additional tests using references. The level indication is calibrated in-situ. (References 38 and 39)
11	Pool-side Bracket Seismic Analysis (References 1, 2, & 16, Sec 2.9.2)	Seismic Class I (References 1, 2 & 16)	References 11 & 12	See Item 8	Seismic Class I	See Item 8
12	Additional Brackets (Sensor Electronics and Electronics Enclosure)	Seismic Class I (References 1, 2 & 16)	Reference 8	See Item 8	Seismic Class I	See Item 8
13	Shock & Vibration	References 20 & 21	Reference 7		References 20 & 21	The vendor testing adequately addresses the requirements for general robustness of the enclosures. The probes were evaluated to be adequately designed for resilience against shock and vibration expected in the area of use, given that there are no missile impact requirements imposed by References 1 & 2. Per NEI 12-02 (Reference 2), Section 3.4, "Shock and Vibration", the requirements for shock and vibration do not apply to the mounting of components in the SFP. However, the new probe mounting components and fasteners are seismically qualified and designed as rigid components inherently resistant to vibration effects. The probes are affixed to the bracket using a machine screw connection designed with proper thread engagement and lock washers. The indicator and battery enclosures are mounted in the CR and the ASDS. The equipment is not affixed or adjacent to any rotating machinery that would cause vibration effects in the area of installation. The new instrument mounting components and fasteners are seismically qualified and designed as rigid components inherently resistant to vibration effects. Similarly, the effects of shock on the supporting fixtures for the CR instruments is not a credible threat; equipment in the CR and the ASDS area is qualified seismically such that there are no expected impacts from adjacent objects during the design basis earthquake requirements imposed by NEI 12-02.

#	Topic	Parameter Summary	Reference Document #	Additional Comments	Test or Analysis Results	Licensee Evaluation
14	Requirement Traceability Matrix	Software Traceability Matrix Required for Software Evaluation of Equipment	References 30 & 35		Reference 35	The instrument software Verification and Validation has been completed.
15	Factory Acceptance Testing	Must demonstrate functionality of full EFP-IL and SFP-1	MOHR Factory Acceptance Test Procedure		References 33 & 34	Acceptable channel factory acceptance tests have been completed successfully.
16	Channel Accuracy	± 1 foot (Reference 2)	Reference 27			The system possesses an absolute maximum accuracy of +/- 3.0", below the 12" required by NEI 12-02 (Reference 2).
17	Power Consumption	120 VAC, 60 Hertz (Reference 16)	References 9 & 13		85 - 264 VAC, 47 - 63 Hertz	The power requirements for the instruments are met by the CR power panels that will provide normal AC power to the units.
		Seven day battery life required	Reference 9		Seven day battery life at 15 samples per hour rate	Acceptable, the instrument testing demonstrates the battery capacity is sufficient for the maximum duration required by References 1 & 2.
18	Technical Manual	N/A	References 28 and 29			The manuals have been provided by the vendor.
19	Calibration	Must allow for in-situ calibration	References 27, 28 and 29			The manuals have been provided by the vendor. The level indication is calibrated in-situ.
20	Failure Modes and Effects Analysis (FMEA)	System provides reliable indication of fuel pool level, consistent with the requirements of References 1 & 2.	Reference 14		SFP instrument system will meet requirements of References 1 & 2	The FMEA adequately addresses failure modes and effects for the full instrument channel with credit taken for the use of two redundant channels provided the installation meets all requirements stipulated in References 1 & 2.
21	Emissions Testing	Electric Power Research Institute (EPRI) TR-102323, Revision 3 (Reference 23)	References 6 & 31		EPRI TR-102323, Revision 3 (Reference 23)	The NRC has endorsed the EPRI "Guidelines for Electromagnetic Interference Testing of Power Plants" (EPRI TR-102323-Rev. 3) as guidance for acceptable industry test standards and limits. The EFP-IL SFPI system exceeds EPRI TR-102323-R3 EMC requirements. It addresses the applicable testing for Non Safety equipment. (Reference 6) Electro Static Discharge (IEC 61000-4-2:2008), Electrical Fast Transient (IEC 61000-4-4:2004) and Surge (IEC 61000-4-5:2005) immunity, which are optional tests for non-safety equipment per Rev 3 of EPRI TR-102323, are addressed by similitude with the MOHR CT-100. The MOHR CT-100 electronic hardware has been incorporated as the level measurement system in the EFP-IL SFP instrument system without modification, and the EFP-IL includes a metal enclosure compared to the plastic enclosure of the CT-100, which provides superior shielding properties. The CT-100 TOR demonstrates no anomalies from 80-1000 MegaHertz and from 1400-2700 MegaHertz at test levels up to 3 Volts/meter. Radiated immunity testing was performed in accordance with IEC 61000-4-3:2008. This provides reasonable assurance that radiofrequency interference from radio handsets or other commonly encountered commercial or industrial sources of interference will not impact system performance (Reference 31).

References:

1) Nuclear Regulatory Commission Order EA-12-051, "Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation," March 12, 2012. (ADAMS Accession No. ML12056A044)
2) 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," August, 2012. (ADAMS Accession No. ML12240A307)
3) JLD-ISG-2012-03, Revision 0, "Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation," August 29, 2012, (ADAMS Accession No. ML12221A339)
4) 1-0410-1, Revision 1, "MOHR EFP-IL SFPI System Temperature and Humidity Test Report"
5) 1-0410-2, Revision 2, "MOHR SFP-1 Level Probe Assembly Materials Qualification Report"
6) 1-0410-4, Revision 2, "MOHR EFP-IL SFPI System EMC Test Report"
7) 1-0410-5, Revision 0, "MOHR EFP-IL SFPI System Shock and Vibration Test Report"
8) 1-0410-6, Revision 1, "MOHR EFP-IL SFPI System Seismic Test Report"
9) 1-0410-7, Revision 2, "MOHR EFP-IL SFPI System Battery Life Report"
10) 1-0410-8, Revision 2, "MOHR EFP-IL SFPI System Boric Acid Deposition Report"
11) 1-0410-9, Revision 2, "MOHR SFP-1 Level Probe Assembly Seismic Analysis Report"
12) 1-0410-9.10, Revision 0, "MOHR SFP-1 Site-Specific Seismic Analysis Report Xcel Energy Monticello Nuclear Generating Plant (MONTICELLO)"
13) 1-0410-10, Revision 1, "MOHR EFP-IL SFPI System Power Interruption Report"
14) EVAL-194-4812-01,Revision 2, "MOHR EFP-IL Liquid Level Measurement System Failure Modes and Effects Analysis (FMEA)"
15) NSPM Calculation 14-098, Revision 0, "Dose at SFP Level Instrument"
16) USAR, Revision 27, "Monticello Updated Safety Analysis Report" – Section 10.2.2
17) Not Used
18) NAI-1725-004, Revision 3, "Seismic Induced Hydraulic Response in the CGS Spent Fuel Pool"
19) Not Used
20) IEC 60068-2-27, (2008-02) Environmental Testing - Part 2-27
21) IEC 60068-2-6, (2007-12) Environmental Testing – Part 2-6
22) Not Used
23) EPRI TR-102323, Revision 3, "Guidelines for Electromagnetic Interference of Power Plant Equipment"
24) Not Used
25) Not Used
26) NSPM Calculation 90-38, Revision 4, "Control Room Space Temperature Evaluation during Station Blackout"
27) 1-0410-12, Revision 0, "EFP-IL Signal Processor Operator's Manual"
28) 1-0410-13, Revision 0, "EFP-IL Signal Processor Technical Manual"
29) 1-0410-14, Revision 0, "SFP-1 Level Probe Assembly Technical Manual"
30) 1-0410-11, Revision 2, "MOHR EFP-IL SFPI System Software V&V Report"
31) 1-0410-4-SI, Revision 0, "MOHR EFP-IL SFPI System Supplemental EMC Information"

32) NSPM Calculation 14-060, Revision 0, “Evaluation of the Mounting Brackets for the Spent Fuel Pool Level Probe Assembly”
33) EFP-IL00034, “Factory Acceptance Test Liquid Level Sensing System, for Monticello”
34) EFP-IL00035, “Factory Acceptance Test Liquid Level Sensing System, for Monticello”
35) 1-0451-4, Revision 0, “MOHR EFP-IL SFPI System Software Traceability Matrix”
36) EQ-PART-B, “EQ Central File Part B Environmental Specifications”
37) NSPM Calculation 96-074, Revision 2, "Station Blackout (SBO) Heat-up of the EFT Building"
38) Procedure 7182-01, Revision 0, “Spent Fuel Pool Level Channel A Instrumentation Maintenance”
39) Procedure 7182-02, Revision 0, “Spent Fuel Pool Level Channel B Instrumentation Maintenance”
40) NSPM Calculation 05-133, “Validation of Normal Temperature for the EQ Program”
41) NSPM EC 23419, “Fukushima Response Spent Fuel Pool Instrumentation”