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JAFP-15-0027
February 27, 2015

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

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)

James A. FitzPatrick Nuclear Power Plant
Docket No. 50-333
License No. DPR-059

Reference:

1. NRC Order Number, EA-12-051, Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation, ML12056A044, dated March 12, 2012
2. NRC Interim Staff Guidance, Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation, JLD-ISG-2012-03, date August 29, 2012
3. Industry Guidance for Compliance with NRC Order EA-12-051, To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation, NEI 12-02, dated August 24, 2012
4. Entergy to NRC, 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), JAFP-12-0125, dated October 29, 2012
5. Entergy to NRC, James A. FitzPatrick Overall Integrated Plan in Response to March 12, 2012 Commission Order Modifying License with Regard to Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-051), JAFP-13-0023, dated February 28, 2013

Dear Sir or Madam:

On March 12, 2012, the Nuclear Regulatory Commission (“NRC” or “Commission”) issued an order [Reference 1] to James A. FitzPatrick Nuclear Power Plant (JAF). Reference 1 was immediately effective and directed JAF 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.2. Reference 2 endorsed industry guidance document NEI 12-02, Revision 1 [Reference 3] with clarifications and exceptions identified in Reference 2. Reference 4 provided the JAF initial status report regarding spent fuel pool instrumentation. Reference 5 provided the JAF 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. 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 attached report provides an update of milestone accomplishments since the last status report, including any changes to the compliance method, schedule, or need for relief/relaxation and the basis, if any.

This letter contains no new regulatory commitments. If you have any questions regarding this report, please contact Chris M. Adner, Regulatory Assurance Manager, at 315-349-6766.

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

Sincerely,

Brian R. Sullivan
Site Vice President

BRS/CMA/mh

Attachment: James A. FitzPatrick Nuclear Power Plant's (JAF's) Fourth Six-Month Status Report for the Implementation of Order EA-12-051, Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation

cc: Director, Office of Nuclear Reactor Regulation
NRC Regional Administrator
NRC Resident Inspector
Ms. Jessica A. Kratchman, NRR/JLD/PMB, NRC
Mr. Doug Pickett, Senior Project Manager
Ms. Bridget Frymire, NYSPSC
Mr. John B. Rhodes., President NYSERDA

JAFP-15-0027

Attachment

James A. FitzPatrick Nuclear Power Plant's (JAF's) Fourth Six-Month Status Report for the Implementation of Order EA-12-051, Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation

(25 Pages)

James A. FitzPatrick Nuclear Power Plant's (JAF's) Fourth Six-Month Status Report for the Implementation of Order EA-12-051, Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation

1. Introduction

James A. FitzPatrick Nuclear Power Plant (JAF) developed an Overall Integrated Plan (Reference 1 in Section 8), documenting the requirements to install reliable spend fuel pool level instrumentation (SFPI), in response to Reference 2. This attachment provides an update of milestone accomplishments since the last 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 milestone(s) have been completed since July 31, 2014, and are current as of January 31, 2015: None

3. Milestone Schedule Status

The following provides an update to 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.

Milestone	Target Completion Date	Activity Status	Revised Target Completion Date
Submit 60 Day Status Report	October 2012	Complete	
Submit Overall Integrated Plan	February 2013	Complete	
Submit 6 Month Updates:			
Update 1	August 2013	Complete	
Update 2	February 2014	Complete	
Update 3	August 2014	Complete	
Update 4	February 2015	Complete	
Update 5	August 2015	Not Started	
Update 6	February 2016	Not Started	
Update 7	August 2016	Not Started	
Modifications:			
Modifications Evaluation	April 2015	In Progress	
Design Engineering	April 2015	In Progress	

James A. FitzPatrick Nuclear Power Plant's (JAF's) Fourth Six-Month Status Report for the Implementation of Order EA-12-051, Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation

Milestone	Target Completion Date	Activity Status	Revised Target Completion Date
Implementation Outage	2016	Not Started	
Procedures:			
Create Procedures	2016	In Progress	
Training:			
Develop Training Plan	2016	Not Started	
Training Complete	2016	Not Started	
SFP LI Implementation	2016	Not Started	
Full Site SFPI Implementation	Fall of 2016	Not Started	
Submit Completion Report	2016	Not Started	
Respond to ISE RAIs received December 12, 2013 (Reference 3)	March 31, 2016	In Progress	
Respond to RAIs received August 29, 2013	October 3, 2013	Complete	

*Target Completion Date is the last submitted date from either the overall integrated plan or previous six-month update

4. Changes to Compliance Method

There are no additional changes to the compliance method.

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

JAF expects to comply with the order implementation date and no relief/relaxation is required at this time.

James A. FitzPatrick Nuclear Power Plant's (JAF's) Fourth Six-Month Status Report for the Implementation of Order EA-12-051, Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation

6. Open Items from Overall Integrated Plan and Interim Staff Evaluation

FitzPatrick has received an Interim Staff Evaluation that includes 18 RAIs. Responses to the RAIs are due by March 31, 2016, and are provided in Section 9 of this six-month status report. The following table provides a status of the RAIs.

RAI #	Response Status
1	See Section 9
2	In Progress
3	In Progress
4	In Progress
5	See Section 9
6	See Section 9
7	See Section 9
8	See Section 9
9	See Section 9
10	In Progress
11	See Section 9
12	See Section 9
13	See Section 9
14	See Section 9
15	See Section 9
16	See Section 9
17	See Section 9
18	See Section 9

7. Potential Interim Staff Evaluation Impacts

The Nexus Documents stipulate that the level probes be installed in the northeast and southeast corners of the SFP. During the development of the modification, there were obstructions encountered from the support brackets for the Auxiliary Decay Heat Removal (ADHR) piping in the pool. This would have required drilling the support plate to allow the probe to be installed and would have required a complete evaluation of the piping support and potential changes to the ADHR pipe. It would also have exposed the level probe to a turbulence as a result of the intake and discharge flow to and from the SFP which would have required additional testing to demonstrate that the probe was adequate for the intended installation.

In keeping with the guidance of the NEI document to locate the probes in the corners of the pool, the probes were relocated to the opposite side of the pool from the initially proposed location. The west side of the pool is essentially unobstructed. This affords a more suitable

installation of the probes. The level instruments are installed so that the primary and backup probes, Loops A and B respectively, will be mounted in the southwest and the northwest corners of the Spent Fuel Pool.

8. References

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

1. James A. FitzPatrick Overall Integrated Plan in Response to March 12, 2012 Commission Order Modifying License with Regard to Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-051), JAFP-13-0023, dated February 28, 2013.
2. NRC Order Number EA-12-051, "Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation," dated March 12, 2012.
3. James A. FitzPatrick Nuclear Power 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. MF1076), Dated December 12, 2013 (ML13338A645).
4. November 26, 2013, Public Meeting Summary for the Discussion Between the NRC Staff and Industry Concerning Responses to Staff Interim Evaluations for Spent Fuel Pool Instrumentation, dated December 26, 2013 (ML13347B030).
5. James A. FitzPatrick Nuclear Power Plant - Request for Additional Information Regarding Overall Integrated Plan for Reliable Spent Fuel Pool Instrumentation (Order EA-12-051) (TAC No. MF1076), dated August 29, 2013 (ML13226A534).
6. Response to Request for Additional Information for the Overall Integrated Plan for the Commission Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation, dated October 3, 2013 (JAFP-13-0132).

James A. FitzPatrick Nuclear Power Plant's (JAF's) Fourth Six-Month Status Report for the Implementation of Order EA-12-051, Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation

9. Responses to the Interim Staff Evaluation Requests for Additional Information

RAI #1

Please provide information regarding specific procedures controlling irradiated hardware stored in the SFP. Include details of any analysis performed to determine the projected dose rate impact and the appropriate Level 2 elevation as a result of dose from irradiated material stored in the SPF.

Interim Staff Guidance JLD-ISG-2012-03 'Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation' states "The NRC staff considers that the methodologies and guidance in conformance with the guidelines provided in NEI 12-02, Revision 1, subject to the clarifications and exceptions in Attachment 1 to this ISG, are an acceptable means of meeting the requirements of Order EA-12-051."

NEI 12-02 R1 section 2.3.2, 'Level 2- level that is adequate to provide substantial radiation shielding for a person standing on the spent fuel pool operating deck' defines Level 2.

Level 2 represents the 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 2 is based on either of the following:

- 10 feet (+/- 1 foot) above the highest point of any fuel rack seated in the spent fuel pools, or
- a designated level that provides adequate radiation shielding to maintain personnel radiological dose levels within acceptable limits while performing local operations in the vicinity of the pool. This level shall be based on either plant-specific or appropriate generic shielding calculations, considering the emergency conditions that may apply at the time and the scope of necessary local operations, including installation of portable SFP instrument channel components. Additional guidance can be found in EPA-400, USNRC Regulatory Guide 1.13 and ANSI/ANS-57.2-1983.

Entergy has selected the 10 foot option which has been determined by the NRC to meet the requirements of the order with no further evaluation or review required.

The immediately following was updated from the 3rd Six-Month Status Report.

Irradiated equipment and materials are permanently stored in the SFP and hung on the SFP walls. Specific procedures control irradiated equipment and materials stored in the SFP. These procedures are as follows:

- Radiological Controls for Highly Radioactive Objects - EN-RP-123
- Spent Fuel Pool Material Control - AP-17.03
- Transfer of Control Blades in the Spent Fuel Pool Using Control Blade Hangers - MP-004.25
- LPRM Removal and Installation - MP-004.18
- IRM/SRM Instrument Dry Tube Removal and Installation - MP-004.20

Because JAF has chosen Level 2 as 10 feet (+/- 1 foot) above the highest point of any fuel rack seated in the spent fuel pool, no additional analysis is required. Additionally, the JAF FLEX strategy ensures that all activities in the proximity of the SFP are completed prior to the calculated time to boil and thus prior to reduction of spent fuel pool level; therefore, this strategy

ensures that necessary operations in the vicinity of the spent fuel pool can be completed without significant dose consequences.

RAI #2

Please provide the results of 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.

This response will be provided in a future update.

RAI #3

For each of the mounting attachments required to fasten 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.

This response will be provided in a future update**.**

RAI #4

Please provide further information to describe how other material stored in the SFP will not create adverse interaction with the fixed instrument location(s).

This response will be provided in a future update.

RAI #5

Please provide analysis of the maximum expected radiological conditions (dose rate and total integrated dose) to which the sensor electronics (including power boxes, signal processors, and display panels) will be exposed. Also, provide documentation indicating the maximum total integrated dose the sensor electronics can withstand and how it was determined. Discuss the time period over which the analyzed total integrated dose was applied.

See bridging document Topic #3 (Section 10).

RAI #6

Please provide information indicating (a) the maximum expected ambient temperature in the room in which the sensor electronics will be located under BDB conditions, with no ac power available to run Heating Ventilation and Air Conditioning (HVAC) systems; and, (b) whether the sensor electronics are capable of continuously performing required functions under this expected temperature condition.

See bridging document Topic #3 (Section 10).

James A. FitzPatrick Nuclear Power Plant's (JAF's) Fourth Six-Month Status Report for the Implementation of Order EA-12-051, Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation

RAI #7

Please provide information indicating (a) the maximum expected relative humidity in the room in which the sensor electronics will be located under BDB conditions, with no ac power available to run HVAC systems; and, (b) whether the sensor electronics are capable of continuously performing required functions under this expected humidity condition.

See bridging document Topic #3 (Section 10).

RAI #8

Please provide a description of the specific method or combination of methods you intend to apply to demonstrate the reliability of the permanently installed equipment under BDB shock and vibration conditions.

The immediately following was updated from the 3rd Six-Month Status Report to include changes based on issuance of the NRC Audit Report for the SFPI vendor (MOHR).

See bridging document Topic #14 (Section 10).

RAI #9

For RAI #8 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.

The immediately following was updated from the 3rd Six-Month Status Report to include changes based on issuance of the NRC Audit Report for the SFPI vendor (MOHR).

See bridging document Topic #14 (Section 10).

RAI #10

Please provide the vendor analysis and seismic testing results and show the SFP level instrument performance reliability, following exposure to simulated seismic conditions representative of the environment anticipated for the SFP structures at JAF, has been adequately demonstrated.

This response will be provided in a future update.

RAI #11

Please provide the NRC staff with the final configuration of the power supply source for each channel so the staff may conclude the two channels are independent from a power supply assignment perspective.

Each instrument loop is normally powered from a 120VAC 60 Hz plant distribution panel to support continuous monitoring of SFP level. The distribution panel for the primary Loop A receives power from a different 600V bus than the distribution panel for the backup Loop B. Therefore, loss of any one 600V bus does not result in loss of normal 120VAC power for both instrument loops.

The distribution panels selected to provide 120VAC to the level instrumentation are non-safety related panels.

Loop A 120V Power is from Distribution Panel 71RRACA8 on the east wall of the Relay Room, elevation 284'- 8".

Loop B 120V Power is from Distribution Panel 71AC10 on the north wall of the Relay Room, elevation 284'- 8".

RAI #12

Please provide the results of the calculation depicting the battery backup duty cycle requirements demonstrating battery capacity is sufficient to maintain the level indication function until offsite resource availability is reasonably assured.

The immediately following was updated from the 3rd Six-Month Status Report to include changes based on issuance of the NRC Audit Report for the SFPI vendor (MOHR).

See bridging document Topic #18 (Section 10).

RAI #13

Please provide an analysis verifying the proposed instrument performance is consistent with these estimated normal and BDB accuracy values. Demonstrate that the channels will retain these accuracy performance values following a loss of power and subsequent restoration of power.

The immediately following was updated from the 3rd Six-Month Status Report to include changes based on issuance of the NRC Audit Report for the SFPI vendor (MOHR).

See bridging document Topics #16, 17 and 18 (Section 10).

RAI #14

Please provide a description of the methodology to be used for determining the maximum allowed deviation from the instrument channel design accuracy under normal operating conditions. Staff understands this allowed deviation will serve as an acceptance criterion for a calibration procedure to alert operators and technicians that the channel requires adjustment to within normal design accuracy.

The immediately following was updated from the 3rd Six-Month Status Report to include changes based on issuance of the NRC Audit Report for the SFPI vendor (MOHR).

In general relative to normal operating conditions, any applicable calibration procedure tolerances (or acceptance criterion) will be established based on the vendor manuals stated/recommended reference accuracy (or design accuracy). The methodology used will be based on the vendor manuals and captured in plant procedures and/or programs. See bridging document Topic #20 (Section 10).

RAI #15

Please provide a description of the in-situ calibration process at the SFP location that will result in the channel calibration being maintained at its design accuracy.

The immediately following was updated from the 3rd Six-Month Status Report to include changes based on issuance of the NRC Audit Report for the SFPI vendor (MOHR).

The process will be captured in Entergy procedures established based on manufacturer's recommendations and Entergy processes and procedures. The instrument automatically

monitors the integrity of its level measurement system using in-situ capability. Deviation of measured test parameters from manufactured or as-installed configuration beyond a configurable threshold prompts operator intervention. See bridging document Topic #20 (Section 10).

RAI #16

For the SFP level instrumentation displays located outside the main control room, please describe the evaluation used to validate 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 walkthroughs) that it will take for personnel to access the display. 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.

The primary and backup SFPI displays will be located in the Relay Room. The panels are deemed promptly accessible since the Relay Room is directly below the Control Room and is within the Control Room boundary. The stairway down to the Relay Room is accessed via an interior fire door from the Control Room. The Control Room personnel can access this area in a minimal amount of time.

The Relay and Control Rooms are considered mild environments. Since they are within the same boundary, the environments are essentially the same. See bridging document Topic #3 (Section 10) for Relay Room environmental conditions. Personnel will not be continuously stationed at the display, it will be monitored periodically.

RAI #17

Please provide a list of the procedures addressing operation (both normal and abnormal response), calibration, test, maintenance, and inspection that will be developed for use of the SFP instrumentation. Include a brief description of the specific technical objectives to be achieved within each procedure.

The immediately following was updated from the 3rd Six-Month Status Report to include changes based on issuance of the NRC Audit Report for the SFPI vendor (MOHR).

The calibration and test procedure developed by MOHR are provided in the technical manuals developed by MOHR. See bridging document Topics #10, 19, and 20 (Section 10). The objectives are to measure system performance, to determine if there is a deviation from normal tolerances, and to return the system to normal tolerances.

Diagnostic procedures developed by MOHR are provided as automated and semi-automated routines in system software alerting the operator to abnormal deviation in selected system parameters such as battery voltage, 4-20 mA loop continuity, and TDR waveform of the transmission cable. The technical objective of the diagnostic procedures is to identify system conditions that require operator attention to ensure continued reliable liquid level measurement. Manual diagnostic procedures are also provided in the event that further workup is determined to be necessary.

Maintenance procedures developed by MOHR are provided in the technical manual. These allow a technician trained in EFP-IL system maintenance to ensure that system functionality is maintained.

An operation procedure will provide sufficient instructions for operation and use of the system.

Entergy procedures will be developed in accordance with the vendor manuals provided by MOHR and Entergy procedures and processes.

FLEX Support Guidelines will provide sufficient instructions for use of the SFPI during a beyond design basis external event.

RAI #18

Please provide further information describing the maintenance and testing program to be established and implemented to ensure that regular testing and calibration is performed and verified by inspection and audit to demonstrate conformance with design and system readiness requirements. Include a description of plans to ensure necessary channel checks, functional tests, periodic calibration, and maintenance will be conducted for the level measurement system and its supporting equipment.

The immediately following was updated from the 3rd Six-Month Status Report to include changes based on issuance of the NRC Audit Report for the SFPI vendor (MOHR).

SFPI channel/equipment maintenance/preventative maintenance and testing program requirements to ensure design and system readiness will be established in accordance with Entergy's processes and procedures and in consideration of vendor recommendations to ensure that appropriate regular testing, channel checks, functional tests, periodic calibration, and maintenance are performed (and available for inspection and audit). See bridging document Topics #10 and 20 (Section 10).

James A. FitzPatrick Nuclear Power Plant's (JAF's) Fourth Six-Month Status Report for the Implementation of Order EA-12-051, Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation

10. JAF Bridging Document Between Vendor Technical Information and Licensee Use Based on NRC Staff Requests for Additional Information (RAIs) and NRC Vendor Audit

#	Topic	Parameter Summary	Vendor Reference Document #	Additional Comment	Test or Analysis Results	Licensee Evaluation
1	Design Specification	SFPI Requirements derived from References 1, 2, and 3	References 4-12, 25, 27, 28, 29, and 30			Evaluation of vendor information is within the scope of EC 52728 (Reference 33).
2	Test Strategy	Per Requirements in References 1, 2, and 3	References 4, 6-12, 25, 28, 29, 27, and 30			The equipment testing performed for the SFPI has been found to be acceptable based on the current design requirements.
3	Environmental Qualification for electronics enclosure with Display	75-112.5°F (References 13 & 36)	Reference 4		14-131°F	The display/processors will be located in the Relay Room, within the Control Room Boundary. Calculation JAF-CALC-MISC-04509 (Reference 36) determines that the maximum temperature in the Relay Room, for a configuration in which no ventilation is provided and the equipment inside is powered, will be 110°F after 93 hours and 112.5°F after 144 hours. The normal operating temperature of the Relay Room is 75°F (Reference 13, Table 9.9-1). The SFPI vendor, MOHR, has successfully tested its system electronics to a nominal temperature range of 14°F to 131°F. The sensor electronics is capable of continuously performing its required function

James A. FitzPatrick Nuclear Power Plant's (JAF's) Fourth Six-Month Status Report for the Implementation of Order EA-12-051, Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation

#	Topic	Parameter Summary	Vendor Reference Document #	Additional Comment	Test or Analysis Results	Licensee Evaluation
						under the expected temperature conditions. Results of the vendor testing are available in proprietary MOHR Report 1-0410-1 Rev. 0 (Reference 4), MOHR EFP-IL SFPI System Temperature and Humidity Report.
		5-95% RH	Reference 4		5-95% RH	The SFPI vendor, MOHR, has successfully tested its system electronics to operate in a humidity range of 5% to 95% relative humidity. Results of the vendor testing are available in proprietary MOHR Report 1-0410-1 Rev. 0, MOHR EFP-IL SFPI System Temperature and Humidity Report (Reference 4). Humidity in the Relay Room is normally regulated by the Relay Room Ventilation and Cooling (RRHV) system at 40-50% (Reference 34). During an extended loss of AC power, the HVAC system is no longer available. Assuming the Relay Room is isolated from outside air, the temperature is expected to increase and the relative humidity is expected to decrease because the heat loads are dominated by the sensible heat of electrical equipment. Therefore, the maximum temperature of 112.5°F and humidity of 50% is still bounded by the 47 °C (116.6 °F) and 71 percent RH test case presented in MOHR Report 1-0410-1 (Reference 4) which was endorsed by the

James A. FitzPatrick Nuclear Power Plant's (JAF's) Fourth Six-Month Status Report for the Implementation of Order EA-12-051, Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation

#	Topic	Parameter Summary	Vendor Reference Document #	Additional Comment	Test or Analysis Results	Licensee Evaluation
						NRC Audit Report for MOHR (Reference 32). In the event outside air is introduced to the Relay Room, due to open doors or HVAC system connections to other rooms, ASHRAE (Reference 35, Chapter 14 Appendix: Design Conditions for Selected Locations) defines the 0.4% dehumidification condition to be 80.5 °F db, 72.4 °F dew point, and ~67% RH for Syracuse, New York (Reference 35). Similarly, 84.8 °F db, 75.4 °F wb, and ~65% RH is defined for a 0.4% evaporation conditions. These conditions are bounded by the 32°C (89.6°F) and 96 percent RH test case presented in MOHR Report # 1-0410-1 (Reference 4). Hence, the operational humidity range of 5–95 percent RH encompasses all expected conditions for the Relay Room and the sensor electronics are capable of continuously performing their required function under the expected humidity conditions.
		No radiation effects			N/A	Acceptable, the JAF Relay Room is within the Control Room boundary and considered a mild environment. No additional testing is required per NRC Audit Report for MOHR (Reference 32).

James A. FitzPatrick Nuclear Power Plant's (JAF's) Fourth Six-Month Status Report for the Implementation of Order EA-12-051, Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation

#	Topic	Parameter Summary	Vendor Reference Document #	Additional Comment	Test or Analysis Results	Licensee Evaluation
4	Environmental Testing for Level Sensor components in SFP area-Submerged Portion of Probe Body	40-212°F (References 1, 2, and 13)	Reference 5	RAD TID is the total 40 yr dose plus the 7 day worst case accident dose at the lowest spacer location on the Probe body	480°F long-term for PEEK Insulators	The NRC Audit Report for MOHR (Reference 32) concludes that the SFP-1 probe is suitable for operation in the SFP environment. The SFP is expected to remain at or above the minimum ambient temperature of the Reactor Building (40°F) as called out in the UFSAR (Reference 13). Maximum accident condition of the spent fuel pool is taken to be 212°F boiling water/steam at atmospheric pressure. Based on the vendor analysis results, the sensitive materials in the probe body will not be challenged under the required conditions of References 1, 2, and 13, and are acceptable.
		Submerged Component (References 1 and 2)	Reference 5		PEEK Insulators capable of long term submergence	
		Evaluation in Progress	Reference 5		10 Grad for PEEK Insulators	Calculation will be developed to define the worst case dose rate to the SFPI.
5	Environmental Testing for Level Sensor Electronics Housing-Probe Head located Above the SFP	40-212°F (References 1, 2, and 13)	Reference 5	Rad TID is the total 40 yr dose plus the 7 day worst case accident dose at the location	PEEK: 480°F EPDM: 194°F long-term, 12 day @ 311°F Sylgard 170: 392°F long-term	The NRC Audit Report for MOHR (Reference 32) concludes that the SFP-1 probe is suitable for operation in the SFP environment. The SFP area is expected to remain at or above the minimum ambient temperature of the Reactor Building (40°F) as called out in the UFSAR (Reference 13). Maximum accident condition temperature and humidity directly above the spent fuel pool is taken to

James A. FitzPatrick Nuclear Power Plant's (JAF's) Fourth Six-Month Status Report for the Implementation of Order EA-12-051, Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation

#	Topic	Parameter Summary	Vendor Reference Document #	Additional Comment	Test or Analysis Results	Licensee Evaluation
						be 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 required conditions of References 1, 2, and 13, and are acceptable. For coaxial transmission cable beyond the Probe Head, MOHR uses Class 1E Nuclear Safety Related RSCC Wire & Cable RSS-6-110A/LE which meets the requirements of Institute of Electrical and Electronic Engineers (IEEE) 383-1974, "IEEE Standard for Type Test of Class 1 E Electric Cables, Field Splices, and Connections for Nuclear Power Generating Stations" and is acceptable (Reference 32).
		0-100% RH Condensing (References 1 and 2)	Reference 5		0-100% RH for PEEK, EPDM and Sylgard 170	The NRC Audit Report for MOHR (Reference 32) concludes that the SFP-1 probe is suitable for operation in the SFP environment. 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 required conditions of References 1 and 2,

James A. FitzPatrick Nuclear Power Plant's (JAF's) Fourth Six-Month Status Report for the Implementation of Order EA-12-051, Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation

#	Topic	Parameter Summary	Vendor Reference Document #	Additional Comment	Test or Analysis Results	Licensee Evaluation
						and are acceptable.
		Evaluation in Progress	Reference 5		PEEK: 10 Grad EPDM: 2 Grad Sylgard 170:200 Mrad	The NRC Audit Report for MOHR (Reference 32) concludes that the SFP-1 probe is suitable for operation in the SFP environment. Calculation will be developed to define the worst case dose rate to the SFPI.
6	Thermal & Radiation Aging-organic components in SFP area	See Topics #4 and 5 above	Reference 5		See above Topics #4 and 5	Acceptable, vendor test/analysis bound licensee parameters, see discussion above in Topics #4 and 5.
7	Basis for Dose Requirement	References 1 and 2	N/A			Entergy Calculation Procedure EN-DC-126 (Reference 14) is being used to develop a calculation based on the requirements of NEI 12-02 (Reference 2) and EA-12-051 (Reference 1). The calculation (will) determine(s) the dose rates for various locations and SFP water levels for both a 7 day accident scenario and 40 year TID.
8	Seismic Qualification	Evaluation in Progress	References 8 and 11		Seismic Class 1	Evaluation of the SFPI seismic qualification is still in progress.
9	Sloshing	Evaluation in Progress	References 8 and 11	See Topic #8		Evaluation of sloshing effect on the SFPI is still in progress.

James A. FitzPatrick Nuclear Power Plant's (JAF's) Fourth Six-Month Status Report for the Implementation of Order EA-12-051, Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation

#	Topic	Parameter Summary	Vendor Reference Document #	Additional Comment	Test or Analysis Results	Licensee Evaluation
10	Spent Fuel Pool Instrumentation System Functionality	System must allow for routine, in situ functionality	References 20, 21, and 22			The system features on board electrical diagnostics. SFPI channel/equipment maintenance/preventative maintenance and testing program requirements to ensure design and system readiness will be established in accordance with Entergy's processes and procedures and in consideration of vendor recommendations to ensure that appropriate regular testing, channel checks, functional tests, periodic calibration, and maintenance are performed (and available for inspection and audit). The instrument automatically monitors the integrity of its level measurement system using in-situ capability. Revision 0 of the manuals have been provided by the vendor (References 20, 21, and 22) for use, although it is possible these could be amended by the vendor in the future based on installation experience.
11	Boron Build-Up	Buildup cannot produce error greater than 1' including all other error source terms (References 1 and 2)	Reference 10		Boron buildup can produce a maximum error of 2.5 inches	Acceptable, MOHR Report 1-0410-8 (Reference 10) concludes that the presence of borated water and/or boric acid deposits will not significantly impair the ability of the MOHR EFP-IL SFPI system to accurately measure water level in the SFP environment. Previous Topic #10 already discusses maintenance / preventative maintenance requirements being established in

James A. FitzPatrick Nuclear Power Plant's (JAF's) Fourth Six-Month Status Report for the Implementation of Order EA-12-051, Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation

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						consideration of vendor recommendations (which includes and bounds those associated with boron build-up). Similarly, Topic #20 below discusses overall calibration or channel functional testing methodology expected to be based on vendor stated accuracy along with comparison of SFPI channels to actual pool level (which would also bound boron build-up effects specified in Reference 32). Visual inspection and/or wash down of the probe assembly could be initiated by accuracy requirements or routine inspection. The probe head assembly includes a connection mechanism for flushing water to remove boron build-up as may be necessary. Alternatively, the SFP water level can be raised until it covers and dissolves the boric acid deposit (Reference 22).
12	Pool-side Bracket Seismic Analysis (References 1, 2, and 13)	Seismic Class I (References 1, 2, and 13)	Reference 11	See Topic #8	Seismic Class I	A calculation will be prepared to ensure the SFPI Probe Mounting Bracket is seismically qualified.
13	Additional Brackets (Sensor Electronics and Electronics Enclosure)	Seismic Class I (References 1, 2, 3, and 13)	Reference 8	See Topic #8	Seismic Class I	Calculations will be prepared as needed to ensure additional brackets are seismically qualified.
14	Shock & Vibration	(References 1, 2, 3)	References 7, 11, and		IEC 60068-2-27 (2008-	The NRC Audit Report for MOHR (Reference 32) concludes that the shock and vibration

James A. FitzPatrick Nuclear Power Plant's (JAF's) Fourth Six-Month Status Report for the Implementation of Order EA-12-051, Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation

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		MIL-STD-167-1 for vibration and MIL-STD-901D (Reference 19) for shock	30		02) (Reference 15) IEC 60068-2-6 (2007-12) (Reference 16)	test results were satisfactory. The report also acknowledges that the testing performed in MOHR Report 1-0410-16 (Reference 30) is sufficient to close the open item identified during the MOHR audit. Acceptable, the vendor testing provided adequately addresses the requirements for general robustness of the enclosures. The probe and repairable head are essentially a coax cable system that is considered inherently resistant to shock and vibration. The probes and repairable head are evaluated to be adequately designed for resilience against shock and vibration (Reference 30). The new probe mounting components and fasteners are seismically qualified and designed as rigid components inherently resistant to vibration effects. The probes will be affixed to the bracket using a machine screw connection designed with proper thread engagement and lock washers. The indicator and battery enclosures will be mounted in the Relay Room (Reference 33), which is within the Control Room Boundary. The equipment is not affixed or adjacent to any rotating machinery that would cause vibration effects in the area of installation.

James A. FitzPatrick Nuclear Power Plant's (JAF's) Fourth Six-Month Status Report for the Implementation of Order EA-12-051, Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation

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						The new instrument mounting components and fasteners are seismically qualified and designed as rigid components inherently resistant to vibration effects. There are no expected impacts from adjacent objects during the BDBEE or design basis earthquake requirements imposed by NEI 12-02.
15	Requirements Traceability Matrix	Software Traceability Matrix Required for Software Evaluation of Equipment	Reference 23			The instrument software Verification and Validation was performed by MOHR per Revision 2 of MOHR Report 1-0410-11 (Reference 23).
16	Factory Acceptance Test	Must demonstrate functionality of full EFP-IL and SFP-1	MOHR FAT Procedure			Acceptable channel factory acceptance tests have been completed successfully.
17	Channel Accuracy	+/- 1 foot (Reference 2)	References 20 & 27		3.0 in max, not including boric acid deposition or boiling effects	Appendix A of Reference 20 states that the absolute accuracy is 76.2 mm or 3.0 in, not including boric acid deposition effects. This error complies with the limit of ±1 foot set by NEI 12-02 (Reference 2). See topic # 11 for boric acid deposition effects. Additionally, the probe is designed to produce accurate level indication in boiling

James A. FitzPatrick Nuclear Power Plant's (JAF's) Fourth Six-Month Status Report for the Implementation of Order EA-12-051, Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation

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						and frothing (multiphase) environments (Reference 27).
18	Power Consumption	120 VAC, 60 Hz (References 13 and 26)	References 9, 12, and 26		85-264 VAC 47-63 HZ Maximum 18.83 W, average 11.48 W	The NRC Audit Report for MOHR (Reference 32) concludes that no deficits were identified with respect to function reliability, accuracy, or calibration as a result of power interruption. Acceptable, the power requirements for the instrument are met by the power supply that will provide normal AC power to the units. MOHR Report 1-0410-10 (Reference 12) concludes that the accuracy is not affected by an interruption in power.
		7 day battery life required	Reference 9		7 day battery life @ 15 samples per hour rate	The NRC Audit Report for MOHR (Reference 32) concludes that battery life capacity is satisfactory. Acceptable, the instrument testing demonstrates the battery capacity is sufficient for the maximum duration required by References 1 and 2.
19	Technical Manual	N/A	References 21 and 22			Revision 0 of the manuals have been provided by the vendor (References 21 and 22) for use, although it is possible these could be amended by the vendor in the future based on installation experience.
20	Calibration	Must allow for	References	System is		Revision 0 of the manuals have been

James A. FitzPatrick Nuclear Power Plant's (JAF's) Fourth Six-Month Status Report for the Implementation of Order EA-12-051, Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation

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		in-situ calibration	20, 21, and 22	calibrated using CT-100 device and processing of scan files by vendor. Dry scan from original installation must be maintained		provided by the vendor (References 20, 21, and 22) for use, although it is possible these could be amended by the vendor in the future based on installation experience. Previous Topic #10 already discusses maintenance / preventative maintenance requirements being established in consideration of vendor recommendations. Overall calibration or channel functional testing methodology is expected to be based on vendor stated accuracy and to incorporate a comparison of SFPI channels to actual pool level as well as a SFPI cross channel comparison.
21	Failure Modes and Effects Analysis (FMEA)	System provides reliable indication of fuel pool level, consistent with the requirements of References 1 & 2.	Reference 31		SFPI system will meet requirements of References 1 and 2 when installed as required	Acceptable, the FMEA provided 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.
22	Emissions Testing	EPRI TR-102323, Rev. 3 (Reference 17)	References 6 and 25		EPRI TR-102323, Rev. 3 (Reference	Acceptable, MOHR reports 1-0410-4 (Reference 6) and 1-0410-4-S1 (Reference 25) demonstrate the new SFPI satisfies the EMI/RFI compliance guidelines of Revision 3

James A. FitzPatrick Nuclear Power Plant's (JAF's) Fourth Six-Month Status Report for the Implementation of Order EA-12-051, Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation

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					17)	of EPRI TR-102323 (Reference 17) in accordance with Entergy Engineering Standard EN-IC-S-004-MULTI (Reference 24). As demonstrated in the MOHR System EMC Test Report and Supplemental Information (References 6 and 25), the SFPI system passed the High Frequency Radiated and Conducted Emissions testing. FLEX Support Guidelines (FSG) governing the use of the SFPI will include a cautionary statement to preclude radio usage within close proximity to the displays.

James A. FitzPatrick Nuclear Power Plant's (JAF's) Fourth Six-Month Status Report for the Implementation of Order EA-12-051, Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation

Spent Fuel Pool Instrumentation Order (EA-12-051)
Bridging Document Between Vendor Technical Information and Licensee Use
Based on NRC Staff Requests for Additional Information (RAIs) and NRC Vendor Audit

References for Section 10:

1. ML12054A679, NRC Order EA-12-051, "ORDER MODIFYING LICENSES WITH REGARD TO RELIABLE SPENT FUEL POOL INSTRUMENTATION", Nuclear Regulatory Commission, March 12, 2012
2. ML12240A307, NEI 12-02 Rev. 1, "Industry Guidance for compliance with NRC Order EA-12-051, "To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation" August, 2012.
3. ML12221A339, Rev. 0, JLD-ISG-2012-03, "Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation", August 29, 2012, Nuclear Regulatory Commission Japan Lessons-Learned Project Directorate.
4. 1-0410-1 "MOHR EFP-IL SFPI System Temperature and Humidity Test Report"
5. 1-0410-2 "MOHR SFP-1 Level Probe Assembly Materials Qualification Report"
6. 1-0410-4 "MOHR EFP-IL SFPI System EMC Test Report"
7. 1-0410-5 "MOHR EFP-IL SFPI System Shock and Vibration Test Report"
8. 1-0410-6 "MOHR EFP-IL SFPI System Seismic Test Report"
9. 1-0410-7 "MOHR EFP-IL SFPI System Battery Life Report"
10. 1-0410-8 "MOHR EFP-IL SFPI System Boric Acid Deposition Report"
11. 1-0410-9 "MOHR SFP-1 Level Probe Assembly Seismic Analysis Report"
12. 1-0410-10 "MOHR EFP-IL SFPI System Power Interruption Report"
13. UFSAR , Rev. 4, "James A. FitzPatrick Updated Safety Analysis Report"
14. EN-DC-126, Rev 5, "Engineering Calculation Process"
15. IEC 60068-2-27 (2008-02) "Environmental Testing-Part 2-27: Tests-Test Ea and Guidance: Shock"
16. IEC 60068-2-6 (2007-12) "Environmental Testing-Part 2-6: Tests-Test Fc: Vibration (sinusoidal)"
17. EPRI TR-102323, Rev. 3, "Guidelines for Electromagnetic Interference of Power Plant Equipment"
18. MIL-STD-167-1 "Mechanical Vibrations of Shipboard Equipment (Type 1-Environmentally and Type II-Internally Excited)"
19. MIL-S-901D "Shock Tests H.I.(High Impact) shipboard Machinery, Equipment, and Systems, Requirements for"
20. 1-0410-12 "EFP-IL Signal Processor Operator's Manual"
21. 1-0410-13 "EFP-IL Signal Processor Technical Manual"
22. 1-0410-14 "SFP-1 Level Probe Assembly Technical Manual"
23. 1-0410-11 "MOHR EFP-IL SFPI System Software Verification and Validation"

James A. FitzPatrick Nuclear Power Plant's (JAF's) Fourth Six-Month Status Report for the Implementation of Order EA-12-051, Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation

24. EN-IC-S-004-MULTI, Rev. 001, "EMI/RFI Design Considerations"
25. 1-0410-4-S1 "MOHR EFP-IL SFPI Supplemental EMC Information"
26. MOHR Drawing 1-0430-20 "EFP-IL System Electrical Diagram"
27. 1-0410-15 "MOHR EFP-IL SFPI System Uncertainty Analysis"
28. NAI-1725-003, Rev. 0 "GOTHIC Verification and Sensitivity Studies for Predicting Hydrodynamic Response to Acceleration in Rectangular Shaped Pools"
29. NAI-1725-004, Rev. 3 "Seismic Induced Hydraulic Response in the CGS Spent Fuel Pool"
30. 1-0410-16, "MOHR SFP-1 Level Probe Assembly Shock and Vibration Test Report
31. EVAL-194-4812-01 "MOHR EFP-IL Liquid Level Measurement System Failure Modes and Effects Analysis (FMEA)"
32. 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)
33. EC52728, Rev 0, "FUKUSHIMA - SPENT FUEL POOL LEVEL INSTRUMENTATION"
34. DBD-070, Rev. 14, "Entergy Nuclear Northeast James. A. FitzPatrick Nuclear Power Plant Design Basis Document for the Control Room Relay Room Ventilation and Cooling Systems"
35. 2009 ASHRAE Handbook Fundamentals, I-P Edition
36. JAF-CALC-MISC-04509, Rev. 0, "Main Control Room Heat-Up During Extended Loss of Offsite Power"