FENOC
First Energy Nuclear Operating Company

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Peter P. Sena III
President and Chief Nuclear Officer

February 27, 2013
L-13-057

10 CFR 2.202

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

SUBJECT:
Beaver Valley Power Station, Unit Nos. 1 and 2
Docket No. 50-334, License No. DPR-66
Docket No. 50-412, License No. NPF-73
Davis-Besse Nuclear Power Station
Docket No. 50-346, License No. NPF-3
Perry Nuclear Power Plant
Docket No. 50-440, License No. NPF-58
FirstEnergy Nuclear Operating Company's (FENOC's) Overall Integrated Plan in Response to March 12, 2012 Commission Order Issuance of Order to Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-051)

References:

1. Nuclear Regulatory Commission (NRC) Order Number EA-12-051, Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation
2. 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
3. NEI 12-02, Industry Guidance for Compliance with NRC Order EA-12-051, "To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation", Revision 1, dated August 24, 2012
4. FENOC Initial Status Report in Response to March 12, 2012, Commission Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-051), dated October 26, 2012

On March 12, 2012, the NRC issued an order (Reference 1) to FENOC. Reference 1 was immediately effective and imposes additional requirements to increase the capability of FENOC to mitigate beyond-design-basis external events. Specific requirements are outlined in Attachment 2 of Reference 1.

Reference 1 requires submission of an overall integrated plan by February 28, 2013. The NRC Interim Staff Guidance (ISG) (Reference 2) was issued August 29, 2012 and endorses industry guidance document NEI 12-02, Revision 1 (Reference 3) with clarifications and exceptions identified in Reference 2. Reference 3 provides direction regarding the content of the overall integrated plan.

Reference 4 provided the FENOC initial status report regarding requirements for reliable spent fuel pool instrumentation, as required by Reference 1.

The purpose of this letter is to provide the overall integrated plans pursuant to Section IV, Condition C.1, of Reference 1. This letter confirms FENOC has received Reference 2 and has Overall Integrated Plans developed in accordance with the guidance for providing reliable spent fuel pool instrumentation that will enhance the ability to cope with conditions resulting from beyond-design-basis external events.

The information in the enclosures provides FENOC's overall integrated plans for reliable spent fuel pool instrumentation pursuant to Reference 3. The enclosed overall integrated plans are based on conceptual design information. Progress made, proposed changes in compliance methods, updates to the schedule and, if needed, requests for relief and the bases will be provided in the 6-month Integrated Plan updates required by Reference 1.

There are no new regulatory commitments contained in this letter. If there are any questions or if additional information is required, please contact Mr. Thomas A. Lentz, Manager – Fleet Licensing, at 330-315-6810.

I declare under penalty of perjury that the foregoing is true and correct. Executed on February 27, 2013.

Respectfully,

Peter P. Sena, III

Enclosures:
1 Beaver Valley Power Station Reliable Spent Fuel Pool Level Instrumentation Overall Integrated Plan
2 Davis-Besse Nuclear Power Station Reliable Spent Fuel Pool Level Instrumentation Overall Integrated Plan
3 Perry Nuclear Power Plant Reliable Spent Fuel Pool Level Instrumentation Overall Integrated Plan

cc: Director, Office of Nuclear Reactor Regulation (NRR)
NRC Region I Administrator
NRC Region III Administrator
NRC Resident Inspector (BVPS)
NRC Resident Inspector (DBNPS)
NRC Resident Inspector (PNPP)
NRR Project Manager (BVPS)
NRR Project Manager (DBNPS)
NRR Project Manager (PNPP)
Director BRP/DEP
Site BRP/DEP Representative
Utility Radiological Safety Board

Beaver Valley Power Station
Reliable Spent Fuel Pool Level Instrumentation
Overall Integrated Plan

In response to NRC Order EA-12-051
Based on NEI-12-02, Revision 1 and NRC Interim Staff Guidance JLD-ISG-2012-03

February 2013

Prepared by: R Schlett for B.J. Murtagh 2-25-13
Brian J. Murtagh Date

Reviewed by: R Schlett for A. Oduho 2/25/13
Albert Oduho Date

Approved by: Carmen Mancuso 2-25-13
Carmen Mancuso Date

FirstEnergy Nuclear Operating Company (FENOC)

Beaver Valley Power Station Reliable Spent Fuel Pool Instrumentation Overall Integrated Plan

1. Introduction

On March 12, 2012, the Nuclear Regulatory Commission (NRC) issued Order EA-12-051, *Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation.* Order EA12-051 requires licensees to "have a reliable indication of the water level in associated spent fuel storage pools capable of supporting identification of the following pool water level conditions by trained personnel: 1) level that is adequate to support operation of the normal fuel pool cooling system, 2) level that is adequate to provide substantial radiation shielding for a person standing on the spent fuel pool operating deck, and 3) level where fuel remains covered and actions to implement make-up water addition should be no longer deferred." Order EA-12-051 also requires all holders of operating licenses issued under 10 CFR Part 50 to submit to the Commission for review an overall integrated plan, including a description of how compliance with Order EA-12-051 requirements will be achieved, by February 28, 2013.

The NRC issued Japan Lessons-Learned Project Directorate, JLD-ISG-2012-03, *Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation,* Revision 0, dated August 29, 2012, that endorses with exceptions and clarifications, the methodologies described in Nuclear Energy Institute (NEI) 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 24, 2012.

This integrated plan for the Beaver Valley Power Station (BVPS), Unit Nos. 1 and 2 provides the approach for complying with Order EA-12-051 using the methods described in NRC JLD-ISG-2012-03. The BVPS integrated plan is based on evaluations performed during development of a preliminary design that will be further developed in a detailed design engineering package. Any values provided will be confirmed during the final design process. Consistent with the requirements of Order EA-12-051 and the guidance of NEI 12-02 Rev. 1, six-month reports will delineate progress made, any proposed changes in compliance methods, updates to the schedule and, if needed, requests for relief and the bases.

2. Schedule

Installation of reliable spent fuel pool (SFP) level instrumentation for the SFP for Unit 1 of BVPS is scheduled for completion prior to startup from refueling outage 1R23 (spring 2015) based on the end of the second refueling outage following the submittal of this integrated plan. The following milestones are planned dates subject to change as design and implementation details are developed.

- Commence SFP Instrumentation Design — 4Q12 (complete)
- Commence SFP Instrumentation Procurement — 2Q13
- Complete SFP Instrumentation Design — 4Q13
- SFP Instrumentation Delivery — 2Q14
- Begin SFP Instrumentation Installation — 3Q14
- Commissioning of SFP Instrumentation — 2Q15

- NRC Order Implementation Date (based on the scheduled end of the second refueling outage after Implementation Plan submittal) — Spring 2015

Installation of reliable SFP level instrumentation for the SFP for Unit 2 of BVPS is scheduled for completion prior to the end of the fourth quarter of 2015 based on the end of the second refueling outage following the submittal of this integrated plan. The following milestones are planned dates subject to change as design and implementation details are developed.

- Commence SFP Instrumentation Design — 4Q12 (complete)
- Commence SFP Instrumentation Procurement — 2Q13
- Complete SFP Instrumentation Design — 4Q13
- SFP Instrumentation Delivery — 3Q14
- Begin SFP Instrumentation Installation — 4Q14
- Commissioning of SFP Instrumentation — 4Q15
- NRC Order Implementation Date (based on the scheduled end of the second refueling outage after implementation plan submittal) — Fall 2015

3. Identification of Spent Fuel Pool Water Levels

BVPS discharges irradiated fuel to a single spent fuel storage pool for each unit. With the exception of limited time periods for maintenance or non-refueling operations, administrative controls maintain gates in the open position between the following pools: spent fuel pool, fuel transfer canal and cask loading pit. Thus, these pools are normally inter-connected and at the same water level when the water level in the spent fuel pool is greater than 1 foot above the top of stored fuel seated in the storage racks.

The water levels for the SFP for the Beaver Valley Station will be determined based on the existing design attributes, commitments, and licensing basis of the station. This is also consistent with the NRC and NEI requirements. Levels that are to be determined will be established as part of the final design and by the Complete SFP Instrumentation Design milestone in Section 2, Schedule. The proposed design for BVPS will be based on the following key spent fuel pool water levels:

Level 1 - Level adequate to support operation of the normal fuel pool cooling system

Indicated level on either the primary or backup instrument channel for Unit 1 of greater than a to-be-determined elevation plus the accuracy of the SFP level instrument channel, which is to be determined.

Indicated level on either the primary or backup instrument channel for Unit 2 of greater than a to-be-determined elevation plus the accuracy of the SFP level instrument channel, which is to be determined.

Once the water level in the Unit 1 pool drops below a to-be-determined elevation, water will no longer be extracted from the pool to be sent to Unit 1 SFP cooling equipment to provide heat removal from the Unit 1 SFP.

Once the water level in the Unit 2 pool drops below a to-be-determined elevation, water will no longer be extracted from the pool to be sent to Unit 2 SFP cooling equipment to provide heat removal from the Unit 2 SFP.

Level 2 - Level adequate to provide substantial radiation shielding for a person standing on the spent fuel pool operating deck

Indicated level on either primary or backup instrument channel of Unit 1 greater than 752'-0" plus the accuracy of the SFP level instrument channel, which is to be determined. This monitoring level ensures there is an adequate water level to provide substantial radiation shielding for a person standing on the SFP operating deck.

Indicated level on either primary or backup instrument channel of Unit 2 greater than 752'-0" plus the accuracy of the SFP level instrument channel, which is to be determined. This monitoring level ensures there is an adequate water level to provide substantial radiation shielding for a person standing on the SFP operating deck.

This level was selected based on the NEI 12-02 Rev. 1 guidance for selecting the plant specific elevation for Level 2 given as 10 feet (+/- 1 foot) above the highest point of any fuel rack seated in the spent fuel pool.

Level 3 - Level where fuel remains covered and actions to implement make-up water addition should no longer be deferred

Indicated level on either the primary or backup instrument channel of Unit 1 greater than 742'-0" (which is the top of the highest point on the spent fuel pool racks) plus the accuracy of the SFP level instrumentation, which is to be determined. This monitoring level assures that there is adequate water level above the stored fuel seated in the rack.

Indicated level on either the primary or backup instrument channel of Unit 2 greater than 742'-0" (which is the top of the highest point on the spent fuel pool racks) plus the accuracy of the SFP level instrumentation, which is to be determined. This monitoring level assures that there is adequate water level above the stored fuel seated in the rack.

4. Instruments

The planned design for the SFP level system instrumentation satisfies the requirements and guidelines of NRC JLD-ISG-2012-03 and NEI 12-02 Rev. 1 as discussed below.

Both the primary and backup instrument channels will consist of fixed components. The plan is for both channels to utilize guided wave radar, which functions according to the principle of time domain reflectometry. A generated pulse of electromagnetic energy

travels down the probe. Upon reaching the liquid surface, the pulse is reflected and based upon reflection times, level is determined. Guided wave radar attributes:

- Cable assembly is a fixture located close to the operating level floor that suspends a cable into the pool. The guided wave radar cable assembly is smaller, and therefore easier to protect from event generated missiles or falling objects.
- Guided wave radar is effectively immune to interference as the signal stays in the immediate vicinity of the wire antenna. As the cable assembly will be located close to the pool wall it is better protected from interference from foreign objects.
- This technology is immune to the changes in temperature or the specific gravity of the SFP water.

Measured range will be continuous from the top of the SFP to the top of the spent fuel racks.

5. Reliability

Reliability of the primary and backup instrument channels will be assured by conformance with the guidelines of NRC JLD-ISG-2012-03 and NEI 12-02, Rev. 01. Reliability will be ensured through proper mounting, arrangement, qualification, testing, maintenance and calibration of the primary and backup instrument channels as discussed below.

6. Instrument Channel Design Criteria

Instrument channel design criteria will be consistent with the guidelines of NRC JLD-ISG-2012-03 and NEI 12-02 Rev. 1.

7. Arrangement

The planned design of this system will consist of two measurement channels, one primary and one backup. Each channel consists of a level sensor, an electronics unit and an indicator. The primary and backup instrument channel sensors would be protected against missiles that may result from damage to the structure over the SFP. The sensors will be mounted as close to the different SFP corners as possible to minimize the possibility of a single event or missile damaging both channels. The sensor arrangement has been proposed in a manner limiting any interference with existing equipment in or around the SFP. This proposed design would not pose any potential hazard to personnel working around the pool or on the level instrumentation itself.

The proposed design locates the electronics enclosures in an area removed from the SFP environment, which would be accessible in the event of a beyond-design basis external event that would restrict access to the SFP. The enclosures for the two instrument channels will be separated to minimize the possibility of a single event damaging both

channels. Cabling for each channel will be run in separate conduit and/or cable tray to the control room indicators.

8. Mounting

Installed primary and back up SFP level instrument channel equipment within the spent fuel pool shall be mounted to retain its design configuration during and following the maximum seismic ground motion considered in the design of the spent fuel pool structure in accordance with NRC JLD-ISG-2012-03 and NEI 12-02 Rev. 1 guidance requirements.

9. Qualification

The primary and backup instrumentation for the proposed design will be suitable and reliable at temperature, humidity, and radiation levels consistent with the SFP water at saturated conditions for an extended period of time. This reliability will be established through use of an augmented quality assurance process. Using the guidance of NEI 12-02 Rev. 1 and NRC JLD-ISG-2012-03 the equipment design will include reliability against effects of shock and vibration and seismic motion.

The design will consider the environmental conditions as discussed by NEI 12-02, Rev. 1 which recommends considering temperature, humidity, and radiation levels during normal operation and after an external beyond design basis event for no fewer than seven days post-event or until off-site resources can be deployed by the mitigating strategies. Conditions considered are the radiological conditions for a normal refueling quantity of freshly discharged (100 hours) fuel with SFP water level at Level 3 as defined by NRC Order EA-12-051, temperatures of 212°F and 100% relative humidity, boiling water and/or steam, and concentrated borated water.

The sensor elements of the guided wave radar approach will consist solely of special cable that will not be negatively impacted by the environmental conditions described. The electronic enclosures will be mounted in an area outside the SFP area that is accessible by personnel after an external beyond design basis event and is expected to be a mild environment. The analog indicator will be mounted in the main control room, and as such will be suitable for the environmental conditions of the main control room following an external beyond design basis event.

10. Independence

The primary instrument channel will be independent of the backup instrument channel. The primary and backup instrument channels will be physically and electrically separated to maintain channel independence. The sensors will be separated as far apart as practical within the constraints of existing pool geometry and equipment. Electronics enclosures will be separated by a suitable distance or may utilize structural features of the room in

which they are located as a barrier to provide protection against a single event (missile, explosion, etc.) from damaging the electronics of both instrument channels. Power will be supplied from two separate power buses at a minimum, with a preference of different power divisions or channels as available. Cabling will be run in separate conduit and/or cable tray. The same technology will be used for both the primary and backup instrument channels.

11. Power Supplies

Each channel will normally be powered from independent 120 VAC power sources and will have a dedicated battery backup. A minimum battery life of 24 hours will be provided to allow for power restoration from portable equipment.

12. Accuracy

The guided wave radar design provides continuous monitoring of the SFP water level. The accuracy of the SFP level instrument channel, from sensor to main control room indicator, will be consistent with the guidelines of NRC JLD-ISG-2012-03 and NEI 12-02, Rev. 1. Instrument channels will be designed to maintain their design accuracy without recalibration following a power interruption or change in power source.

13. Testing

Testing will be consistent with the guidelines of NRC JLD-ISG-2012-03 and NEI 12-02, Rev. 1. The instrument channel design will include provisions for routine testing and calibration. The instrumentation will allow for in-situ testing and calibration of the level instrumentation to minimize calibration effort and instrument downtime. Calibration procedures will be developed in accordance with plant procedures and vendor recommendation.

14. Display

The display will be consistent with the guidelines of NRC JLD-ISG-2012-03 and NEI 12-02 Rev. 1. Trained personnel will, at a minimum, be able to monitor the SFP water level from an appropriate and accessible location, and will provide on demand or continuous indication of SFP water level. The SFP level instrumentation will provide for display of fuel pool level using an indicator located in the main control room. The indicator will be powered by the instrument loop and will not require additional power circuits from those described above.

Beaver Valley Power Station Reliable Spent Fuel Pool Instrumentation Overall Integrated Plan

15. Instrument Channel Program Criteria:

15.1. Training

The Systematic Approach to Training will be utilized when developing and implementing training. Training for maintenance and operations personnel will be developed and provided. Training will be provided for the personnel in the use of, and provision of alternate power to, primary and backup instrument channels in compliance with the NRC Order EA-12-051 Attachment 2, Section 2.1.

15.2. Procedures

Procedures will be established and maintained for the testing, calibration, operation and abnormal response issues associated with the primary and backup spent fuel pool instrumentation channels.

15.3. Testing and Calibration

Per NRC Order EA-12-051, processes will be established and maintained for scheduling and implementing necessary testing and calibration of primary and backup SFP level instrument channels in order to maintain the design accuracy.

16. Need for Relief and Basis

The Beaver Valley Power Station is not requesting relief from the requirements of Order EA-12-051 or the guidance in NRC JLD-ISG-2012-03 at this time.

Consistent with the requirements of Order EA-12-051 and the guidance of NEI 12-02 Rev. 1, the six-month reports will delineate progress made, any proposed changes in compliance methods, updates to the schedule and, if needed, requests for relief and their bases.

Davis-Besse Nuclear Power Station
Reliable Spent Fuel Pool Level Instrumentation
Overall Integrated Plan

In response to NRC Order EA-12-051
Based on NEI-12-02, Revision 1 and NRC Interim Staff Guidance JLD-ISG-2012-03

February 2013

Prepared by: Steven J. Brouwer — Date: 2-22-13

Reviewed by: Thomas M. Gulvas — Date: 2/22/2013

Approved by: Jon G. Hook — Date: 2/25/13

FirstEnergy Nuclear Operating Company (FENOC)

Davis-Besse Nuclear Power Station Reliable Spent Fuel Pool Level Instrumentation Overall Integrated Plan

1. Introduction

On March 12, 2012, the Nuclear Regulatory Commission (NRC) issued Order EA-12-051, *Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation*. EA-12-051 requires licensees to "have a reliable indication of the water level in associated spent fuel storage pools capable of supporting identification of the following pool water level conditions by trained personnel: 1) level that is adequate to support operation of the normal fuel pool cooling system, 2) level that is adequate to provide substantial radiation shielding for a person standing on the spent fuel pool operating deck, and 3) level where fuel remains covered and actions to implement make-up water addition should be no longer deferred." Order EA-12-051 requires all holders of operating licenses issued under 10 CFR Part 50 to submit to the Commission for review an overall integrated plan, including a description of how compliance with Order EA-12-051 requirements will be achieved, by February 28, 2013.

The NRC issued Japan Lessons-Learned Project Directorate, JLD-ISG-2012-03, *Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation,* Revision 0, dated August 29, 2012, that endorses with exceptions and clarifications, the methodologies described in Nuclear Energy Institute (NEI) 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 24, 2012.

This integrated plan for the Davis-Besse Nuclear Power Station (DBNPS) provides the approach for complying with Order EA-12-051 using the methods described in NRC JLD-ISG-2012-03. The DBNPS integrated plan is based on evaluations performed during development of a preliminary design that will be further developed in a detailed design engineering package. Any values provided will be confirmed during the final design process. Consistent with the requirements of Order EA-12-051 and the guidance of NEI 12-02 Rev. 1, six-month reports will delineate progress made, any proposed changes in compliance methods, updates to the schedule and, if needed, requests for relief and the bases.

2. Schedule

Installation of reliable spent fuel pool (SFP) level instrumentation for the SFP associated with DBNPS is scheduled for completion prior to startup from refueling outage 1R19 (spring 2016) based on the end of the second refueling outage following the submittal of this integrated plan. The following milestones are planned dates subject to change as design and implementation details are developed.

• Commence SFP Instrumentation Design	4Q12 (complete)
• Commence SFP Instrumentation Procurement	2Q13
• Complete SFP Instrumentation Design	1Q14
• SFP Instrumentation Delivery	4Q14
• Begin SFP Instrumentation Installation	1Q15
• Commissioning of SFP Instrumentation	2Q16
• NRC Order Implementation Date (based on the scheduled end of the second refueling outage after implementation plan submittal)	Spring 2016

3. Identification of Spent Fuel Pool Water Levels

DBNPS discharges irradiated fuel to a single spent fuel storage pool. With the exception of limited time periods for maintenance or non-refueling operations, administrative controls maintain gates in the open position between the following pools: spent fuel pool, fuel transfer canal and cask loading pit. Thus, these pools are normally inter-connected and at the same water level when the water level in the spent fuel pool is greater than 1 foot above the top of stored fuel seated in the storage racks.

The water levels for the SFP for DBNPS will be determined based on the existing design attributes, commitments, and licensing basis of the station. This is also consistent with the NRC JLD-ISG-2012-03 and NEI 12-02 requirements. The levels that are yet to be determined will be established by the Complete SFP Instrumentation Design milestone defined in Section 2, Schedule. The proposed design for DBNPS will be based on the following key spent fuel pool water levels:

Level 1 - Level adequate to support operation of the normal fuel pool cooling system

Indicated level on either the primary or backup instrument channel of greater than a to-be-determined elevation plus the accuracy of the SFP level instrument channel.

Once the water level in the pool drops below a to-be-determined elevation, water will no longer be extracted from the pool to be sent to SFP cooling equipment to provide heat removal from the SFP.

Level 2 - Level adequate to provide substantial radiation shielding for a person standing on the spent fuel pool operating deck

Indicated level on either primary or backup instrument channel of greater than 587'-8" plus the accuracy of the SFP level instrument channel, which is to be determined. This monitoring level ensures there is an adequate water level to provide substantial radiation shielding for a person standing on the SFP operating deck.

This level was selected based on the NEI 12-02 Rev. 1 guidance for selecting the plant specific elevation for Level 2 given as 10 feet (+/- 1 foot) above the highest point of any fuel rack seated in the spent fuel pool.

Level 3 - Level where fuel remains covered and actions to implement make-up water addition should no longer be deferred

Indicated level on either the primary or backup instrument channel of greater than 577'-8" (which is the top of the highest point on the spent fuel pool racks) plus the accuracy of the SFP level instrumentation, which is to be determined. This monitoring level assures that there is adequate water level above the stored fuel seated in the rack.

4. Instruments

The planned design for the SFP level system instrumentation will be consistent with the guidelines of NRC JLD-ISG-2012-03 and NEI 12-02 Rev. 1 as discussed below.

The instrumentation will consist of permanent, fixed primary and backup instrument channels. The plan is for both channels to utilize guided wave radar, which functions according to the principle of time domain reflectometry. A generated pulse of electromagnetic energy travels down the probe. Upon reaching the liquid surface the pulse is reflected and based upon reflection times level is determined. Guided wave radar attributes:

- Cable assembly is a fixture located close to the operating level floor that suspends a cable into the pool. The guided wave radar cable assembly is smaller, and therefore easier to protect from event generated missiles or falling objects.
- Guided wave radar is effectively immune to interference as the signal stays in the immediate vicinity of the wire antenna. As the cable assembly will be located close to the pool wall it is better protected from interference from foreign objects.
- This technology is immune to the changes in temperature or the specific gravity of the SFP water.

Measured range will be continuous from the top of the SFP to the top of the spent fuel racks.

5. Reliability

Reliability of the primary and backup instrument channels will be assured by conformance with the guidelines of NRC JLD-ISG-2012-03 and NEI 12-02, Rev. 01. Reliability will be ensured through proper mounting, arrangement, qualification, testing, maintenance and calibration of the primary and backup instrument channels as discussed below.

6. Instrument Channel Design Criteria

Instrument channel design criteria will be consistent with the guidelines of NRC JLD-ISG-2012-03 and NEI 12-02, Rev. 01.

7. Arrangement

The planned design of this system will consist of two measurement channels, one primary and one backup. Each channel consists of a level sensor, an electronics unit and an indicator. The primary and backup instrument channel sensors would be protected against missiles that may result from damage to the structure over the SFP. The sensors will be mounted as close to the different SFP corners as possible to minimize the possibility of a single event or missile damaging both channels. The sensor arrangement

has been proposed in a manner limiting any interference with existing equipment in or around the SFP. This proposed design would not pose any potential hazard to personnel working around the pool or on the level instrumentation itself.

The proposed design locates the electronics enclosures in an area removed from the SFP environment, which would be accessible in the event of a beyond-design basis external event that would restrict access to the SFP. The enclosures for the two instrument channels will be separated to minimize the possibility of a single event damaging both channels. Cabling for each channel will be run in separate conduit and/or cable tray to the control room indicators.

8. **Mounting**

Installed primary and back up SFP level instrument channel equipment within the spent fuel pool shall be mounted to retain its design configuration during and following the maximum seismic ground motion considered in the design of the spent fuel pool structure in accordance with NRC JLD-ISG-2012-03 and NEI 12-02 Rev. 1 guidance requirements.

9. **Qualification**

The primary and backup instrumentation for the proposed design will be suitable and reliable at temperature, humidity, and radiation levels consistent with the SFP water at saturated conditions for an extended period of time. This reliability will be established through use of an augmented quality assurance process. Using the guidance of NEI 12-02 Rev. 1 and NRC JLD-ISG-2012-03 the equipment design will include reliability against effects of shock and vibration and seismic motion.

The design will consider the environmental conditions as discussed by NEI 12-02, Rev. 1 which recommends considering temperature, humidity, and radiation levels during normal operation and after a beyond-design basis external event for no fewer than seven days post-event or until off-site resources can be deployed by mitigating strategies. Conditions to be considered are the radiological conditions for a normal refueling quantity of freshly discharged (100 hours) fuel with SFP water level at Level 3 as defined by NRC Order EA-12-051, temperatures of 212°F and 100% relative humidity, boiling water and/or steam, and concentrated borated water.

The sensor elements of the guided wave radar approach will consist solely of special cable that will not be negatively impacted by the environmental conditions described. The electronic enclosures will be mounted in an area outside the SFP area that would be accessible by personnel after a beyond-design basis external event and is expected to be a mild environment. The analog indicator will be mounted in the main control room, and as such will be suitable for the environmental conditions of the main control room following a beyond-design basis external event.

10. **Independence**

The primary instrument channel will be independent of the backup instrument channel. The primary and backup instrument channels will be physically and electrically separated to maintain channel independence. The sensors will be separated as far apart as practical within the constraints of existing pool geometry and equipment. Electronics enclosures will be separated by a suitable distance or may utilize structural features of the room in which they are located as a barrier to provide protection against a single event (missile, explosion, etc.) from damaging the electronics of both instrument channels. Power will be supplied from two separate power buses at a minimum, with a preference of different power divisions or channels as available. Cabling will be run in separate conduit and/or cable tray. The same technology will be used for both the primary and backup instrument channels.

11. **Power Supplies**

Each channel will normally be powered from independent 120 VAC power sources and will have a dedicated battery backup. A minimum battery life of 24 hours will be provided to allow for power restoration from portable equipment.

12. **Accuracy**

The guided wave radar design provides continuous monitoring of the SFP water level. The accuracy of the SFP level instrument channel, from sensor to main control room indicator, will be consistent with the guidelines of NRC JLD-ISG-2012-03 and NEI 12-02 Rev. 1. Instrument channels will be designed to maintain their design accuracy without recalibration following a power interruption or change in power source.

13. **Testing**

Testing will be consistent with the guidelines of NRC JLD-ISG-2012-03 and NEI 12-02 Rev. 1. The instrument channel design will include provisions for routine testing and calibration. The instrumentation will allow for in-situ testing and calibration of the level instrumentation to minimize calibration effort and instrument downtime. Calibration procedures will be developed in accordance with plant procedures and vendor recommendations.

14. **Display**

The display will be consistent with the guidelines of NRC JLD-ISG-2012-03 and NEI 12-02 Rev. 1. Trained personnel will, at a minimum, be able to monitor the SFP water level from an appropriate and accessible location, and will provide on demand or continuous indication of SFP water level. The SFP level instrumentation will provide for display of fuel pool level using an indicator located in the main control room. The

indicator will be powered by the instrument loop and will not require additional power circuits from those described above.

15. Instrument Channel Program Criteria:

15.1 Training

The Systematic Approach to Training will be utilized when developing and implementing training. Training for maintenance and operations personnel will be developed and provided. Training will be provided for the personnel in the use of, and provision of alternate power to, primary and backup instrument channels in compliance with the NRC Order EA-12-051 Attachment 2, Section 2.1.

15.2 Procedures

Procedures will be established and maintained for the testing, calibration, operation and abnormal response issues associated with the primary and backup spent fuel pool instrumentation channels.

15.3 Testing and Calibration

Per NRC Order EA-12-051, processes will be established and maintained for scheduling and implementing necessary testing and calibration of primary and backup SFP level instrument channels in order to maintain the design accuracy.

16. Need for Relief and Basis

The Davis-Besse Nuclear Power Station is not requesting relief from the requirements of Order EA-12-051 or the guidance in NRC JLD-ISG-2012-03 at this time.

Consistent with the requirements of Order EA-12-051 and the guidance of NEI 12-02 Rev. 1, the six-month reports will delineate progress made, any proposed changes in compliance methods, updates to the schedule and, if needed, requests for relief and their bases.

Perry Nuclear Power Plant
Reliable Spent Fuel Pool Level Instrumentation
Overall Integrated Plan

In response to NRC Order EA-12-051
Based on NEI-12-02, Revision 1 and NRC Interim Staff Guidance JLD-ISG-2012-03

February 2013

Prepared by: William S. Howell — 2/21/13 Date

Reviewed by: Ryan Briggs — 2/22/13 Date

Approved by: Benjamin Huck — 2/25/13 Date

FirstEnergy Nuclear Operating Company (FENOC)

Perry Nuclear Power Plant Reliable Spent Fuel Pool Instrumentation Overall Integrated Plan

1. Introduction

On March 12, 2012, the Nuclear Regulatory Commission (NRC) issued Order EA-12-051, *Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation.* Order EA12-051 requires licensees to "have a reliable indication of the water level in associated spent fuel storage pools capable of supporting identification of the following pool water level conditions by trained personnel: 1) level that is adequate to support operation of the normal fuel pool cooling system, 2) level that is adequate to provide substantial radiation shielding for a person standing on the spent fuel pool operating deck, and 3) level where fuel remains covered and actions to implement make-up water addition should be no longer deferred." Order EA-12-051 also requires all holders of operating licenses issued under 10 CFR Part 50 to submit to the Commission for review an overall integrated plan, including a description of how compliance with Order EA-12-051 requirements will be achieved, by February 28, 2013.

The NRC issued Japan Lessons-Learned Project Directorate, JLD-ISG-2012-03, *Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation,* Revision 0, dated August 29, 2012, that endorses with exceptions and clarifications, the methodologies described in Nuclear Energy Institute (NEI) 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 24, 2012.

This integrated plan for the Perry Nuclear Power Plant (PNPP) provides the approach for complying with Order EA-12-051 using the methods described in NRC JLD-ISG-2012-03. The PNPP integrated plan is based on evaluations performed during development of a preliminary design that will be further developed in a detailed design engineering package. Any values provided will be confirmed during the final design process. Consistent with the requirements of Order EA-12-051 and the guidance of NEI 12-02 Rev. 1, six-month reports will delineate progress made, any proposed changes in compliance methods, updates to the schedule and, if needed, requests for relief and the bases.

2. Schedule

Installation of reliable spent fuel pool (SFP) level instrumentation for the SFP associated with PNPP is scheduled for completion prior to startup from refueling outage 1R15 (spring 2015). The following milestones are planned dates subject to change as design and implementation details are developed.

• Commence SFP Instrumentation Design	4Q12 (complete)
• Commence SFP Instrumentation Procurement	2Q13
• Complete SFP Instrumentation Design	3Q13
• SFP Instrumentation Delivery	2Q14
• Begin SFP Instrumentation Installation	3Q14
• Commissioning of SFP Instrumentation	1Q15
• NRC Order Implementation Date (based on the scheduled end of the second refueling outage after integrated plan submittal)	Spring 2015

3. Identification of Spent Fuel Pool Water Levels

PNPP discharges irradiated fuel to a single spent fuel storage pool. With the exception of limited time periods for maintenance or non-refueling operations, administrative controls maintain gates in the open position between the following pools: fuel storage & preparation pool, fuel transfer pool, spent fuel storage pool, and cask pit. Thus, these pools are normally inter-connected and at the same water level when the water level in the spent fuel pool is greater than 3.5 feet above the top of stored fuel seated in the storage racks.

The water levels for the SFP for the Perry Station will be determined based on the existing design attributes, commitments, and licensing basis of the station. This is also consistent with the NRC JLD-ISG-2012-03 and NEI 12-02 requirements. The proposed design for PNPP is based on the following key spent fuel pool water levels:

Level 1 - Level adequate to support operation of the normal fuel pool cooling system

Indicated level on either the primary or backup instrument channel of greater than elevation 619'-6" plus the accuracy of the SFP level instrument channel, which is to be determined. The highest point on the spent fuel pool racks is at elevation 591'-4".

This level is based on the elevation of the skimmers that will prevent water transfer from the SFP to the Surge Tanks that feed normal spent fuel pool cooling. Once the water level in the pool drops below elevation 619'-6", water will no longer be extracted from the pool to be sent to Surge Tanks to provide water make up for Spent Fuel Pool Cooling.

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Level 2 - Level adequate to provide substantial radiation shielding for a person standing on the spent fuel pool operating deck

Indicated level on either primary or backup instrument channel of greater than 601'-4" plus the accuracy of the SFP level instrument channel, which is to be determined. This monitoring level ensures there is an adequate water level to provide substantial radiation shielding for a person standing on the SFP operating deck.

This level was selected based on the NEI 12-02 Rev. 1 guidance for selecting the plant specific elevation for Level 2 given as 10 feet (+/- 1 foot) above the highest point of any fuel rack seated in the spent fuel pool. This level will provide adequate radiation shielding for a person standing on the spent fuel pool operating deck from the fuel in the pool. However, the Perry SFP contains other materials capable of providing sufficient dose such that the pool deck would not be inhabitable should the materials be uncovered. The detailed design will update or develop applicable plant procedures to address actions required to address radiological conditions created due to the stored radioactive material.

Level 3 - Level where fuel remains covered and actions to implement make-up water addition should no longer be deferred

Indicated level on either the primary or backup instrument channel of greater than 594'-6" plus the accuracy of the SFP level instrumentation, which is to be determined. This monitoring level assures that there is adequate water level above the stored fuel seated in the rack.

The top of the highest point on the spent fuel racks is located at 591'-4". The top of the gate seat that separates the two pools containing spent fuel (the fuel storage and preparation pool and the spent fuel storage pool) from the fuel transfer pool is at elevation 594'-6". Once the water drops below this point, the single SFP has effectively been segregated into four separate pits. Consequently, 594'-6" is the level at which actions to initiate water make-up will not be further delayed. This setting is in compliance with the Order; however, it represents a slight variation to the NEI guidance. The NEI guidance recommends using the top of the highest fuel rack in the spent fuel pool as level 3. The conditions described above make it undesirable to use top of the highest fuel rack as level 3. This is a conservative decision to treat 594'-6" as top of the fuel and necessary to ensure proper actions are taken in the event that one of the channels of SFP level instrumentation is lost or in the event that level is decreasing due to a hole in one of the pools.

4. Instruments

The planned design for the SFP level system instrumentation satisfies the requirements and guidelines of NRC JLD-ISG-2012-03 and NEI 12-02 Rev. 1 as discussed below.

The instrumentation will consist of permanent, fixed primary and backup instrument channels. The plan is for both channels to utilize guided wave radar, which functions according to the principle of time domain reflectometry. A generated pulse of electromagnetic energy travels down the probe. Upon reaching the liquid surface the pulse is reflected and based upon reflection times level is determined. Guided wave radar attributes:

- Cable assembly is a fixture located close to the operating level floor that suspends a cable into the pool. The guided wave radar cable assembly is smaller, and therefore is easier to protect from event generated missiles or falling objects.
- Guided wave radar is effectively immune to interference as the signal stays in the immediate vicinity of the wire antenna. As the cable assembly will be located close to the pool wall it is better protected from interference from foreign objects.
- This technology is immune to the changes in temperature or the specific gravity of the SFP water.

Measured range will be continuous from the top of the SFP to the top of the spent fuel racks.

5. Reliability

Reliability of the primary and backup instrument channels will be assured by conformance with the guidelines of NRC JLD-ISG-2012-03 and NEI 12-02, Rev. 01. Reliability will be ensured through proper mounting, arrangement, qualification, testing, maintenance and calibration of the primary and backup instrument channels as described below.

6. Instrument Channel Design Criteria

Instrument channel design criteria will be consistent with the guidelines of NRC JLD-ISG-2012-03 and NEI 12-02 Rev. 1.

The fuel storage & preparation pool and the spent fuel storage pool are the only pools that contain spent fuel racks. The cask pit and the fuel transfer pool do not hold spent fuel. Additionally, the gates that separate the fuel storage and preparation pool and the spent fuel storage pool from the fuel transfer pool have not been installed in more than 15 years and will require evaluation to be re-installed. Therefore, these pools are treated as one pool with regard to this Order.

The design of the fuel transfer pool and its gates is such that there is an approximate 3.5 foot gap between the top of the fuel racks in the two pools containing spent fuel (the fuel storage & preparation pool and the spent fuel storage pool) and the top of the fuel transfer pool gate seat. As a result, the top of the fuel transfer pool gate seat (approximately 3 feet above the fuel racks) will be used as Level 3. This setting is in compliance with the Order; however, it represents a slight variation to the NEI 12-02, Rev. 1 guidance (which recommends using top of the fuel racks for level 3). This is a conservative decision and it will ensure that actions are taken to prevent the spent fuel from being uncovered.

7. Arrangement

The planned design of this system will consist of two measurement channels, one primary and one backup. Each channel will consist of a level sensor, an electronics unit and an indicator. The primary and backup instrument channel sensors will be protected against missiles that may result from damage to the structure over the SFP. The sensors will be mounted at the western end of the fuel pool (the fuel preparation and storage pool), but as close to the adjacent corners as possible to minimize the possibility of a single event or missile damaging both channels. The sensor arrangement has been proposed in a manner limiting any interference with existing equipment in or around the SFP. This planned design is conservative and is in compliance with Order EA-12-051 however, it does represent a minor deviation from the NEI Guidance. The NEI Guidance recommends putting instrumentation in opposite (diagonal) ends of the spent fuel pool. Due to the limited available locations (caused by interference) for installation, the instrumentation cannot be installed on opposite (diagonal) ends of the pool. This planned design will also not pose any potential hazard to personnel working around the pool or on the level instrumentation itself.

The proposed design locates the electronics enclosures in an area removed from the SFP environment, which would be accessible in the event of a beyond-design basis external event that would restrict access to the SFP. The enclosures for the two instrument channels will be separated to minimize the possibility of a single event damaging both channels. Cabling for each channel will be run in separate conduit and/or cable tray to the control room indicators.

8. Mounting

Installed primary and back up SFP level instrument channel equipment within the spent fuel pool shall be mounted to retain its design configuration during and following the maximum seismic ground motion considered in the design of the spent fuel pool structure in accordance with NRC JLD-ISG-2012-03 and NEI 12-02 Rev. 1 guidance requirements.

9. Qualification

The primary and backup instrumentation for the proposed design will be suitable and reliable at temperature, humidity, and radiation levels consistent with the SFP water at saturated conditions for an extended period of time. This reliability will be established through use of an augmented quality assurance process. Using the guidance of NEI 12-02 Rev. 1 and NRC JLD-ISG-2012-03, the equipment design will include reliability against effects of shock and vibration and seismic motion.

The design will consider the environmental conditions as discussed by NEI 12-02, Rev. 1 which recommends considering temperature, humidity, and radiation levels during normal operation and after a beyond design basis external event for no fewer than seven days post-event or until off-site resources can be deployed by the mitigating strategies. Conditions considered are the radiological conditions for a normal refueling quantity of freshly discharged (100 hours) fuel with SFP water level at Level 3 as defined by NRC Order EA-12-051, temperatures of 212°F and 100% relative humidity, boiling water and/or steam, and concentrated borated water.

The sensor elements of the guided wave radar approach will consist solely of special cable that will not be negatively impacted by the environmental conditions described. The electronic enclosures will be mounted in an area outside the SFP area that is accessible by personnel after a beyond design basis external event and is expected to be a mild environment. The analog indicator will be mounted in the main control room, and as such will be suitable for the environmental conditions of the main control room following a beyond design basis external event. The vendor supplied sensors and associated electronics will be required to be tested and qualified for shock and vibration as a result of a beyond design basis external event. Seismic qualification of equipment will be equivalent to the maximum ground motion spectrum for the area in which it is to be installed.

10. Independence

The primary instrument channel will be independent of the backup instrument channel. The primary and backup instrument channels will be physically and electrically separated to maintain channel independence. The sensors will be separated as far apart as practical within the constraints of existing pool geometry and equipment. Electronics enclosures will be separated by a suitable distance or may utilize structural features of the room in which they are located as a barrier to provide protection against a single event (missile, explosion, etc.) from damaging the electronics of both instrument channels. Power will be supplied from two separate power buses at a minimum, with a preference of different power divisions or channels as available. Cabling will be run in separate conduit and/or cable tray. The same technology will be used for both the primary and backup instrument channels.

11. Power Supplies

Each channel will normally be powered from independent 120 VAC power sources and will have a dedicated battery backup. A minimum battery life of 24 hours will be provided to allow for power restoration from portable equipment.

12. Accuracy

The guided wave radar design provides continuous monitoring of the SFP water level. The accuracy of the SFP level instrument channel, from sensor to main control room indicator, will be consistent with the guidelines of NRC JLD-ISG-2012-03 and NEI 12-02, Rev. 1. Instrument channels will be designed to maintain their design accuracy without recalibration following a power interruption or change in power source.

13. Testing

Testing will be consistent with the guidelines of NRC JLD-ISG-2012-03 and NEI 12-02, Rev. 1. The instrument channel design will include provisions for routine testing and calibration. The instrumentation will allow for in-situ testing and calibration of the level instrumentation to minimize calibration effort and instrument downtime. Calibration procedures will be developed in accordance with plant procedures and vendor recommendations.

14. Display

The display will be consistent with the guidelines of NRC JLD-ISG-2012-03 and NEI 12-02 Rev. 1. Trained personnel will, at a minimum, be able to monitor the SFP water level from an appropriate and accessible location, and will provide on demand or continuous indication of SFP water level. The SFP level instrumentation will provide for display of fuel pool level using an indicator located in the main control room. The

indicator will be powered by the instrument loop and will not require additional power circuits from those described above.

15. Instrument Channel Program Criteria:

15.1 Training

The Systematic Approach to Training will be utilized when developing and implementing training. Training for maintenance and operations personnel will be developed and provided. Training will be provided for the personnel in the use of, and provision of alternate power to, primary and backup instrument channels in compliance with the NRC Order EA-12-051 Attachment 2, Section 2.1.

15.2 Procedures

Procedures will be established and maintained for the testing, calibration, operation and abnormal response issues associated with the primary and backup spent fuel pool instrumentation channels.

15.3 Testing and Calibration

Per NRC Order EA-12-051, processes will be established and maintained for scheduling and implementing necessary testing and calibration of primary and backup SFP level instrument channels in order to maintain the design accuracy.

16. Need for Relief and Basis

The Perry Station is not requesting relief from the requirements of Order EA-12-051 or the guidance in NRC JLD-ISG-2012-03 at this time.

Consistent with the requirements of Order EA-12-051 and the guidance of NEI 12-02 Rev. 1, the six-month reports will delineate progress made, any proposed changes in compliance methods, updates to the schedule and, if needed, requests for relief and their bases.