



Order No. EA-12-051

RS-13-027

February 28, 2013

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

Braidwood Station, Units 1 and 2  
Facility Operating License Nos. NPF-72 and NPF-77  
NRC Docket Nos. STN 50-456 and STN 50-457

Subject: Overall Integrated Plan in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-051)

References:

1. NRC Order Number EA-12-051, "Issuance of Order to Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation," dated March 12, 2012
2. NRC Interim Staff Guidance JLD-ISG-2012-03, "Compliance with Order EA-12-051, 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. Exelon Generation Company, LLC's Initial Status Report in Response to March 12, 2012 Commission Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation (Order Number EA-12-051), dated October 25, 2012

On March 12, 2012, the Nuclear Regulatory Commission ("NRC" or "Commission") issued an order (Reference 1) to Exelon Generation Company, LLC (EGC). Reference 1 was immediately effective and directs EGC to have a reliable indication of the water level in associated spent fuel storage pools. 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 which 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 this Overall Integrated Plan. The purpose of this letter is to provide the Overall Integrated Plan pursuant to Section IV, Condition C.1, of Reference 1. This letter confirms EGC has received Reference 2 and has an Overall Integrated Plan complying with the guidance for the purpose of ensuring a reliable indication of the water level in associated spent fuel storage pools capable of supporting identification of required wide range pool water level conditions by trained personnel.

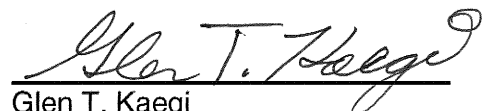
Reference 4 provided the EGC initial status report regarding reliable spent fuel pool instrumentation, as required by Reference 1.

Reference 3, Appendix A-2 contains the specific reporting requirements for the Overall Integrated Plan. The information in the enclosure provides the Braidwood Station, Units 1 and 2 Overall Integrated Plan pursuant to Appendix A-2 of Reference 3. The enclosed Integrated Plan is based on conceptual design information. Final design details and associated procedure guidance, as well as any revisions to the information contained in the Enclosure, will be provided in the 6-month Integrated Plan updates required by Reference 1.

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

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 28<sup>th</sup> day of February 2013.

Respectfully submitted,



Glen T. Kaegi  
Director - Licensing & Regulatory Affairs  
Exelon Generation Company, LLC

Enclosure:

1. Braidwood Station, Units 1 and 2 Reliable Spent Fuel Pool Instrumentation (SFPI) Overall Integrated Plan

cc: Director, Office of Nuclear Reactor Regulation  
NRC Regional Administrator - Region III  
NRC Senior Resident Inspector - Braidwood Station, Units 1 and 2  
NRC Project Manager, NRR - Braidwood Station, Units 1 and 2  
Mr. Robert J. Fretz, Jr, NRR/IJLD/PMB, NRC  
Mr. Robert L. Dennig, NRR/DSS/SCVB, NRC  
Illinois Emergency Management Agency - Division of Nuclear Safety

**Enclosure 1**

**Braidwood Station, Units 1 and 2**

**Reliable Spent Fuel Pool Instrumentation (SFPI)**

**Overall Integrated Plan**

(9 pages)

# Braidwood Station, Unit 1 and 2

## Reliable Spent Fuel Pool Instrumentation

### Overall Integrated Plan

**Applicability:**

This integrated plan applies to Braidwood Station, Units 1 and 2 and is based on current conceptual design information and will be revised as detailed design engineering proceeds. Consistent with the requirements of Order EA-12-051 (Ref.1) and the guidance in NEI 12-02 (Ref.3), Exelon's 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 basis.

**General Description:**

Braidwood Station is a two unit Pressurized Water Reactor Station. The two units share a single Spent Fuel Pool (SFP) located in the Fuel Handling Building (FHB). Normal SFP water level is approximately El. 424'-6". Top of the spent fuel rack is El. 400'-1¾" and top of active fuel is approximately El. 400'-0".

Note: The elevations' reference mark tolerances are  $\pm 1/2"$ .

**Schedule:**

The installation of reliable level instrumentation for the SFP associated with Unit 1 and Unit 2 is scheduled for completion by the end of A1R18 (Spring 2015) based on the end of the second refueling outage for Unit 1 following submittal of this integrated plan. This is the earlier outage sequence of the units discharging to the pool.

The current milestone schedule is as follows:

- Complete Conceptual Design (CD) for Pilot Plant (Limerick) Complete
- Complete CD Follow-up Walkdowns at Remaining 9 Exelon Sites Complete
- Submit Initial 60-day Status Report Complete
- Develop Request for Proposal for Detailed Engineering Design Services Complete
- Submit Integrated Plan Complete with this submittal
- Order SFP Instrumentation 2Q2013
- Begin Detailed Engineering Design 3Q2013

# Braidwood Station, Unit 1 and 2

## Reliable Spent Fuel Pool Instrumentation

### Overall Integrated Plan

- Complete and Issue SFPI Modification Package 4Q2013
- Begin SFPI Installation 1Q2015
- Complete SFPI Installation and Put Into Service 2Q2015

#### Identification of Spent Fuel Pool Water Levels:

Key spent fuel pool water levels will be identified as follows:

**Level adequate to support operation of the normal fuel pool cooling system (Level 1):** Indicated level on either primary or backup instrument channel of greater than 18 feet (elevation 418'-1 $\frac{3}{4}$ "") above the top of the storage racks based on the design accuracy of the instrument channel (which will be determined in the detailed design phase) and a resolution of 1 foot or better of both the primary and backup instrument channels. This is based on Spent Fuel Pool Cooling Pump suction strainer elevation. A calculation demonstrating adequate water level will be performed as part of the detailed engineering design phase to ensure the level is adequate for normal fuel pool cooling system operation.

**Level adequate to provide substantial radiation shielding for a person standing on the spent fuel pool operating deck (Level 2):** Indicated level on either the primary or backup instrument channel of greater than 10 feet (elevation 410'-1 $\frac{3}{4}$ "") plus instrument channel accuracy (which will be determined in the detailed design phase) above the top of the storage racks based on specification of this level as adequate in NRC JLD-ISG-2012-03 (Ref. 2) and NEI 12-02 (Ref. 3), the specified design accuracy of the instrument channel, and the relatively low sensitivity of dose rates to changes in water depth at this level. This monitoring level ensures there is an adequate water level to provide substantial radiation shielding for a person standing on the spent fuel pool operating deck from direct gamma radiation from stored spent fuel.

**Level where fuel remains covered (Level 3):** Indicated level on either the primary or backup instrument channel of greater than 0 feet (elevation 400'-1 $\frac{3}{4}$ "") plus instrument channel accuracy above the top of the storage racks based upon the design accuracy (which will be determined in the detailed design phase) of the instrument channel for both the primary and backup instrument channels. This monitoring level assures that water is covering the stored fuel seated in the rack.

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## Reliable Spent Fuel Pool Instrumentation

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#### **Instruments:**

The design of the instruments will be consistent with the guidelines of NRC JLD-ISG-2012-03 (Ref. 2) and NEI 12-02 (Ref. 3). Specifically, the channels will be designed as discussed below:

**Primary (fixed) instrument channel:** The primary instrument channel level sensing components will be located and permanently mounted in the Spent Fuel Pool. The primary instrument channel will provide continuous level indication over a minimum range of approximately 24 feet 8 inches from the high pool level elevation of 424'-9 ½" to the top of the spent fuel racks at elevation 400'-1 ¾". This continuous level indication will be provided by a guided wave radar system, submersible pressure transducer, or other appropriate level sensing technology that will be determined during the detailed engineering design phase of the project.

**Backup instrument channel:** The backup instrument channel level sensing components will also be located and permanently mounted in the Spent Fuel Pool. The backup instrument channel will provide continuous level indication over a minimum range of approximately 24 feet 8 inches from the high pool level elevation of 424'- 9 ½" to the top of the spent fuel racks at elevation 400'- 1 ¾". This continuous level indication will be provided by the same level sensing technology as the primary instrument channel.

#### **Reliability:**

Reliability of the primary and backup instrument channels will be assured by conformance with the guidelines of NRC JLD-ISG-2012-03 (Ref. 2) and NEI 12-02 (Ref.3) as discussed below under Design Features and Program Features. Both primary and backup level instrumentation channels will be functional at all times, when there is fuel in the SFP with allowances for testing, maintenance or repair per NEI 12-02 (Ref.3). Reliability will be established through the use of an augmented quality assurance process (e.g., a process similar to that applied to the site fire protection program).

#### **Design Features**

**Instrument Channel Design:** Instrument channel design will be consistent with the guidance of NRC JLD-ISG-2012-03 (Ref. 2) and NEI 12-02 (Ref. 3).

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**Arrangement:** The current plan is to install SFP level sensors in the southwest and northwest corners of the SFP separated by a distance in excess of 20 feet. The sensors themselves will be mounted, to the extent practical, near the pool walls and below the pool curb to minimize their exposure to damaging debris and not interfere with SFP activities. Instrument channel electronics and power supplies will be located in seismic and missile protected areas either at an elevation below the SFP operating floor or in buildings other than the FHB. The areas to be selected will provide suitable radiation shielding and environmental conditions for the equipment consistent with instrument manufacturer's recommendations. Equipment and cabling for power supplies and indication for each channel will be separated equivalent to that provided for redundant safety related services.

**Mounting:** Design of the mounting of the sensors in the SFP shall be consistent with the seismic Class I criteria. Installed equipment will be verified to be seismically adequate for the seismic motions associated with the maximum seismic ground motion considered in the design of the plant area in which it is installed.

**Qualification:** Reliability of both instrument channels will be demonstrated via an appropriate combination of design, analyses, operating experience, and/or testing of channel components for the following sets of parameters:

- conditions in the area of instrument channel component use for all instrument components,
- effects of shock and vibration on instrument channel components used during and following any applicable event, and
- seismic effects on instrument channel components used during and following a potential seismic event.

Temperature, humidity and radiation levels consistent with the conditions in the vicinity of the SFP and the area of use considering normal operation, event and post-event conditions for no fewer than seven days post-event or until off-site resources can be deployed by the mitigating strategies resulting from Order EA-12-049 (Ref.4), will be addressed in the detailed design engineering phase of the project. Examples of post-event (beyond-design-basis) conditions to be considered are:

- radiological conditions for a normal refueling quantity of freshly discharged (100 hour) fuel with SFP water level 3 as described in Order EA-12-051,

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- temperature of 212 degrees F and 100% relative humidity environment,
- boiling water and/or steam environment,
- a concentrated borated water environment, and
- the impact of FLEX mitigating strategies.

Components of the instrument channels will be qualified for shock and vibration using one or more of the following methods:

- components are supplied by manufacturers using commercial quality programs (such as ISO9001, “Quality management systems – Requirements”) with shock and vibration requirements included in the purchase specification at levels commensurate with portable hand-held devices or transportation applications;
- components have substantial history of operational reliability in environments with significant shock and vibration loadings, such as portable hand-held devices or transportation applications; or
- components are inherently resistant to shock and vibration loadings, such as cables.

For seismic effects on instrument channel components used after a potential seismic event for only installed components (with the exception of battery chargers and replaceable batteries), the following measures will be used to verify that the design and installation is adequate. Applicable components are rated by the manufacturer (or otherwise tested) for seismic effects at levels commensurate with those of postulated design basis event conditions in the area of instrument channel component use using one or more of the following methods:

- instrument channel components use known operating principles and are supplied by manufacturers with commercial quality programs (such as ISO9001). The procurement specification and/or instrument channel design shall include the seismic requirements and specify the need for commercial design and testing under seismic loadings consistent with design basis values at the installed locations;



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- substantial history of operational reliability in environments with significant vibration, such as for portable hand-held devices or transportation applications. Such a vibration design envelope shall be inclusive of the effects of seismic motion imparted to the components proposed at the location of the proposed installation;
- adequacy of seismic design and installation is demonstrated based on the guidance in Sections 7, 8, 9, and 10 of IEEE Standard 344-2004, "IEEE Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations", or a substantially similar industrial standard;
- demonstration that proposed devices are substantially similar in design to models that have been previously tested for seismic effects in excess of the plant design basis at the location where the instrument is to be installed (g-levels and frequency ranges); or
- seismic qualification using seismic motion consistent with that of existing design basis loading at the installation location.

**Independence:** The primary instrument channel will be independent of the backup instrument channel. This independence will be achieved through physical and electrical separation of each channels' components commensurate with hazard and electrical isolation needs.

**Power Supplies:** Each channel will be normally powered from a different 120Vac bus. Upon loss of normal ac power, individual channel installed batteries will automatically maintain continuous channel operation. The batteries will be replaceable and be sized to maintain channel operation until off-site resources can be deployed by the mitigating strategies resulting from Order EA-12-049(Ref.4). Additionally, each channel will have provisions for connection to another suitable power source.

**Accuracy:** The instrument channels will be designed to maintain their design accuracy following a power interruption or change in power source without recalibration. Instrument channel accuracy, to be determined during detailed design, will consider Spent Fuel Pool conditions (e.g., saturated water, steam environment, concentrated borated water), as well as, other applicable radiological and environmental conditions and include display accuracy. Instrument channel

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accuracy will be sufficient to allow trained personnel to determine when the actual level exceeds the specified lower level of each indicating range (levels 1, 2 or 3) without conflicting or ambiguous indications.

**Testing:** Instrument channel design will provide for routine testing and calibration consistent with the guidelines of NRC JLD-ISG-2012-03 (Ref. 2) and NEI 12-02 (Ref. 3). Details will be determined during detailed design engineering phase.

**Display:** The primary and backup instrument displays will be located at the control room, alternate shutdown panel, or other appropriate and accessible location. The specific location will be determined during detailed design. An appropriate and accessible location will include the following characteristics:

- occupied or promptly accessible to the appropriate plant staff giving appropriate consideration to various drain down scenarios,
- outside the area surrounding the SFP floor (e.g., an appropriate distance from the radiological sources resulting from an event impacting the Spent Fuel Pool),
- inside a structure providing protection against adverse weather, and
- outside of very high radiation areas or LOCKED HIGH RAD AREA.

#### **Program Features**

**Training:** Personnel performing functions associated with these Spent Fuel Pool level instrumentation channels will be trained to perform the job specific functions necessary for their assigned tasks (maintenance, calibration, surveillance, etc.). This training will be consistent with equipment vendor guidelines, instructions and recommendations. The Systematic Approach to Training (SAT) will be used to identify the population to be trained and to determine the initial and continuing elements of the required training. Training will be completed prior to placing the instrumentation in service.

**Procedures:** Procedures will be developed using guidelines and vendor instructions to address the maintenance, operation and abnormal response issues associated with the primary and backup channels of Spent Fuel Pool instrumentation.

Procedures will also address the following situations:

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- If, at the time of an event or thereafter until the unit is returned to normal service, an instrument channel ceases to function, its function will be recovered within a period of time consistent with the emergency conditions that may exist at the time.
- If, at the time of an event or thereafter until the unit is returned to normal service, an instrument channel component must be replaced, it may be replaced with a commercially available component that may or may not meet all of the qualifications noted above to maintain instrument channel functionality.

**Testing and Calibration:** The testing and calibration of the instrumentation will be consistent with vendor recommendations or other documented basis. Calibration will be specific to the mounted instruments and the displays. Calibration will be performed to an Instrument Maintenance Procedure (BIP/BISR series). A Passport PMID will be used to direct frequency for performance of the instrument calibration. Both primary and backup instrumentation channels will be functional at all times when there is fuel in the SFP with allowance for testing, maintenance or repair per NEI 12-02(Ref.3),.

**Need for Relief and Basis:** Exelon is not requesting relief from the requirements of Order EA-12-051 or the guidance in NRC IJD-ISG-2012-03 at this time.

Consistent with the requirements of Order EA-12-051(Ref.1), and the guidance in NEI 12-02(Ref.3), Exelon's 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 basis.

#### **References:**

1. NRC Order Number EA-12-051, Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation, dated March 12, 2012
2. NRC Interim Staff Guidance JLD-ISG-2012-03, Compliance with Order EA-12-051, Order Modifying Licenses with Regard to Reliable Spent Fuel Pool Instrumentation, Revision 0, dated August 29, 2012
3. NEI 12-02, Industry Guidance for Compliance with NRC Order EA-12-051, "To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation", Revision 1, dated August 24, 2012

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4. NRC Order Number EA-12-049, Order Modifying Licenses with Regard to Requirements for Mitigating Strategies for Beyond-Design-Basis External Events, dated March 12, 2012