VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

10 CFR 2.202
EA-12-051

February 28, 2013

Attention: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Serial No.: 12-167B
NL&OS/MAE: R2
Docket Nos.: 50-280/281
License Nos.: DPR-32/37

VIRGINIA ELECTRIC AND POWER COMPANY
SURRY POWER STATION UNITS 1 AND 2
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, Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation, dated March 12, 2012 (ML12073A202)

2. NRC Interim Staff Guidance JLD-ISG-2012-03, Compliance with Order EA-12-051, Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation, Revision 0, dated August 29, 2012 (ML12221A339)

On March 12, 2012, the Nuclear Regulatory Commission (NRC) issued an order (Reference 1) to Virginia Electric and Power Company (Dominion). Reference 1 (the Order) was immediately effective and directs Dominion to have a reliable indication of the water level in associated spent fuel storage pools. Specific requirements are outlined in Attachment 2 of the Order.

An answer to the Order was provided on March 26, 2012 (Serial No. 12-167) and an Initial Status Report was provided within 60 days of the issuance of Reference 2, on October 25, 2012 (Serial No. 12-167A). This letter confirms that Dominion has applied Reference 2 and developed an Overall Integrated Plan in accordance with the guidance. This letter also provides the Overall Integrated Plan as required by Section IV, Condition C.1.a of the Order as an enclosure to this letter. The Overall Integrated Plan is based on conceptual design information. Finalized design details and associated procedural guidance as well as any modifications or clarifications to the information contained in the enclosure, will be provided in the 6-month Integrated Plan updates required by the Order.

A001
NRR

If you have any questions, please contact Ms. Margaret Earle at (804) 273-2768.

Sincerely,

David A. Heacock
President and Chief Nuclear Officer
Virginia Electric and Power Company

Enclosure

Commitments made by this letter: No New Regulatory Commitments

COMMONWEALTH OF VIRGINIA)
)
COUNTY OF HENRICO)

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by David A. Heacock who is President and Chief Nuclear Officer of Virginia Electric and Power Company. He has affirmed before me that he is duly authorized to execute and file the foregoing document in behalf of the Company, and that the statements in the document are true to the best of his knowledge and belief.

Acknowledged before me this 28TH day of February, 2013.

My Commission Expires: May 31, 2014.

Vicki L. Hull
Notary Public

(SEAL)

VICKI L. HULL
Notary Public
Commonwealth of Virginia
140542
My Commission Expires May 31, 2014

cc: Director of Office of Nuclear Reactor Regulation (w/o Enclosure)
U. S. Nuclear Regulatory Commission
One White Flint North
Mail Stop 13H16M
11555 Rockville Pike
Rockville, MD 20852-2738

U. S. Nuclear Regulatory Commission, Region II
Regional Administrator
Marquis One Tower
245 Peachtree Center Ave., NE
Suite 1200
Atlanta, Georgia 30303-1257

Ms. Karen R. Cotton
NRC Project Manager Surry
U. S. Nuclear Regulatory Commission
One White Flint North
Mail Stop O8 G-9A
11555 Rockville Pike
Rockville, MD 20852-2738

Mr. David H. Jaffe
U. S. Nuclear Regulatory Commission
Two White Flint North
Mail Stop T6 D23
11545 Rockville Pike
Rockville, MD 20852-2738

NRC Senior Resident Inspector
Surry Power Station

Enclosure

Surry Units 1 & 2 Overall Integrated Plan

Reliable Spent Fuel Pool Instrumentation

Surry Power Station

Virginia Electric and Power Company (Dominion)

Surry Units 1 & 2 Overall Integrated Plan Reliable Spent Fuel Pool Instrumentation

I. Introduction

The Nuclear Regulatory Commission (NRC) issued Order EA-12-051, *Issuance of Order to Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation*, (Reference 1) on March 12, 2012. The Order requires licensees to have a reliable indication of the water level in spent fuel pools (SFPs) 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 no longer be deferred. The Order also requires an overall integrated plan that provides a description of how the requirements of the Order will be achieved.

NEI 12-02, *Industry Guidance for Compliance with NRC Order EA-12-051, "To Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation,"* (Reference 2) provides an approach for complying with Order EA-12-051. NRC Interim Staff Guidance (ISG) JLD-ISG-2012-03, *Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation*, (Reference 3) considers that the methodologies and guidance in conformance with the guidelines provided in NEI 12-02, Revision 1, subject to the clarifications and exceptions specific to Section 3.4, Qualification, are an acceptable means of meeting the requirements of Order EA-12-051.

This integrated plan provides the Surry Power Station (SPS) approach for complying with Order EA-12-051 using the methods described in NRC ISG JLD-ISG-2012-03. The current revision of the SPS Integrated Plan is based on conceptual design information and will be revised as detailed design engineering proceeds. Consistent with the requirements of Order EA-12-051 and the guidance in NEI 12-02, 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.

II. Schedule

The schedule for providing reliable SFP Instrumentation at SPS is consistent with the requirements of Order EA-12-051 in that the new systems will be installed and functional no later than two refueling cycles following submittal of this overall integrated plan or December 2016, which ever occurs first. The two units share a common pool. The next SPS outage (SU1-R-25) is for Unit 1 in the fall of 2013 thereby making it the limiting case and requiring a functional system prior to completion of refueling SU1-R-26 in the spring of 2015. The current project milestones are:

- Commence Engineering and Design 1Q2013
- Complete Engineering and Design 3Q2013
- Complete Procurement of SFP Instruments 4Q2013
- Commence Installation of SFP Instruments 2Q2014
- Level Measurement System Functional 3Q2014

III. Identification of Spent Fuel Pool Water Levels

Spent fuel is stored in the SFP in the Fuel Building, which is shared by Units 1 and 2. The SFP is a reinforced concrete, Seismic Class I structure lined with stainless steel plate a minimum of 0.25-inch thick and is designed for the underwater storage of spent fuel assemblies and control rod assemblies after their removal from the reactor. Normal water level of the SFP is at elevation 45'-4" which is approximately 24'-1" above to top of the spent fuel.

1) **Level 1 –** This is indicated level on either the primary or back-up instrument channel of greater than approximate elevation 42'-2" plus the accuracy of the SFP level instrument channel, which is to be determined. This level is based on the elevation at which the top of the SFP cooling pump suction lines penetrate the pool walls.

2) **Level 2 –** This is indicated level on either the primary or back-up instrument channel of greater than approximate elevation 31'-3" plus the accuracy of the SFP level instrument channel, which is to be determined. This elevation is approximately 10' above the top of the fuel racks and ensures a minimum level of 10' above the top of the fuel (Reference 4). This water level ensures there is sufficient depth to provide radiation shielding for personnel to respond to Beyond-Design-Basis External Events and to initiate SFP makeup strategies.

3) **Level 3** – Indicated level on either the primary or back-up instrument channel of greater than approximate elevation 21'-3" plus the accuracy of the SFP level instrument channel, which is to be determined. This monitoring level assures that the fuel remains covered.

IV. Instruments

Design of the instruments will be consistent with the guidelines of NRC ISG JLD-ISG-2012-03 and NEI 12-02 as discussed below.

The SPS SFP Primary and Back-up instrument channels will use Guided Wave Radar (GWR) based level measurement technology. GWR level measurement instruments work based on the Time Domain Reflectometry (TDR) principal. The device transmits low-intensity electromagnetic pulses along a rigid or flexible conductor where pulses move at the speed of light. When the pulses reach the surface of the medium to be measured, a portion of the signal is reflected back to the electronics. The instrument measures the time from when the pulse is transmitted to when it is received; half of the measured time will be equivalent to the distance from the reference point of the device to the surface of the measured process. The time value will be representative of the measured level and converted for use in displaying level information.

Attributes of a GWR/TDR system include:

- A sensor probe that is submerged in the process medium.
- Device performance that is not affected by dust, foam, agitated surfaces, boiling surfaces, changes in pressure, changes in temperature, changes in dielectric constant, or changes in density.
- The requirement to locate sensitive electronic equipment outside of the SFP area.
- Low power consumption.
- No mechanical moving parts which simplifies the installation and reduces maintenance.
- The ability to detect level with accuracy that meets the requirements of NEI 12-02.

The primary and back-up channels will utilize a fixed instrument providing continuous level measurement over the entire range. The measured range will be from approximately elevation 45'-10" to elevation 21'-3" – for a total indicated range of approximately 24'-7" (295 inches). SFP level is verified daily in accordance with existing procedures.

Primary instrument channel level sensing components will be located on the west wall of the SFP. Back-up instrument channel level sensing components will be located in the southeast corner of the SFP.

V. Reliability

Reliability of the primary and back-up instrument channels will be assured by conformance with the guidelines of NRC ISG JLD-ISG-2012-03 and NEI 12-02, as discussed in Section IX, Qualification. Reliable level indication will be functional at all times consistent with Section XIII, Testing.

VI. Instrument Channel Design Criteria

Instrument channel design criteria will be consistent with the guidelines of NRC ISG JLD-ISG-2012-03, Revision 0 and NEI 12-02, Revision 1.

Design criteria for both the primary and back-up channels will be consistent with the design criteria and basis associated with the SFP as described in the SPS UFSAR Section 9.5.1. Design requirements will be used as input to drive the detailed design, final equipment and vendor selection and final implementation.

VII. Arrangement

The primary and back-up channel level sensor probes will be installed on opposite sides of the SFP to maintain adequate channel separation. In the conceptual design, the SFP probes bolt to a triangular mounting plate for installation at the corner of the SFP or a rectangular plate for mounting at the side of the SFP. The mounting options will allow the probe to be installed within a few inches of the SFP liner, minimizing the chances of interference with other structures, and occupying limited space on the SFP deck. Existing barriers and physical separation will be used to provide a level of protection for the sensor and interconnecting cable located along the SFP wall or on the refueling floor. These physical barriers will protect the instrument sensors and cables from potential missiles generated by an event. The final sensor mounting design and cable routing will maintain a low profile to ensure that there is no

interference with the existing fuel handling equipment. Specific details will be developed during the detailed design phase.

Vendor electronics will be located in a mild environment of the Auxiliary Building providing adequate protection from temperature, humidity, and radiation. Level indicators will be located in the Cable Spreading Room. This display location meets the guidance of NEI 12-02 since the Cable Spreading Room is promptly accessible from the Main Control Room, is within the Service Building which is designed to withstand tornado effects, and is not within a very high radiation or locked high radiation area. Specific details will be developed during the detailed design phase.

Cables associated with a channel's sensor, power supply and indicator will be independently routed in separate raceways from cables associated with the other channel.

VIII. Mounting

Both the primary and backup systems will be installed as Seismic Category I to meet the NRC ISG JLD-ISG-2012-03 and NEI 12-02 guidance requirements.

IX. Qualification

General

The sensors and cables for both channels will be reliable at temperature, humidity, and radiation levels consistent with the spent fuel pool water at saturation conditions over an extended period of time. Post event temperature at sensors and for cables located above the SFP is assumed to be 212°F. Post event humidity in the SFP floor area near and above the SFP is assumed to be 100% with condensing steam. The sensors and cables located in the vicinity of the SFP will be qualified to withstand peak and total integrated dose radiation levels for their installed location based on post event SFP water level equal to Level 3 for an extended period of time.

Sensor cable terminations will not be subject to pool overflow. The mounting and cable connecting the sensors will be qualified to the SFP environment described above. Conduit design in the SFP area will be installed to Seismic Class 1 criteria. Both existing and new barriers will be used to provide a level of protection for the exposed cable located on or near the

refueling floor from missiles that may be generated by an event. The existing and new raceways used to route the sensor cable to the indicating transmitters (electronics) enclosures will be installed to Seismic Class 1 criteria.

Instrument channel reliability will be demonstrated via a 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 components,
- Effects of shock and vibration on the instrument channel components, and
- Seismic effects on instrument channel components used during and following a potential seismic event.

Augmented quality requirements consistent with NEI 12-02, Appendix A-1 will be applied to this project.

Conditions

Temperature, humidity and radiation levels consistent with conditions in the vicinity of the SFP and the area of use considering normal operational, event and post-event conditions will be addressed in the engineering and design phase. These conditions will be considered 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 (Reference 5). Examples of post-event (beyond-design-basis) conditions that will be considered are:

- Radiological conditions for a normal refueling quantity of freshly discharged (100 hours) fuel with Level 3 SFP water level as described in Section III,
- Temperatures 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.

Shock and Vibration

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* (Reference 6)) with shock and vibration requirements included in the purchase specification at levels commensurate with portable hand-held device or transportation applications;
- Components have a substantial history of operational reliability in environments with significant shock and vibration loading, such as portable hand-held device or transportation applications; or
- Components are inherently resistant to shock and vibration loadings, such as cables.

Seismic

For seismic effects on the installed instrument channel components, the following measures will be used to verify that the design and installation are adequate. Applicable components of the instrument channels are rated by the manufacturer (or otherwise tested) for seismic effects at levels commensurate with those of postulated design basis event conditions at the location of the instrument channel component using one or more of the following methods:

- 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 will 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*, (Reference 7) or a substantially similar industrial standard; or
- 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).

These requirements will be used as design input for the detailed design, vendor selection, and final implementation.

X. Independence

The primary instrument channel will be redundant to and independent of the back-up instrument channel. Both the primary and back-up instrument channels will be of the same technology, manufacturer, and model.

Independence will be achieved through physical separation of the final installed instruments. The two (2) permanently installed instrument sensors will be separated by a distance comparable to the shortest length of a side of the pool, to the extent practical, based on the existing SFP geometry and construction. The cables associated with each channel will follow separate and independent routes from the instruments to each electronic's enclosure and from the enclosures to the displays. The normal AC or DC power source for each channel will be provided from independent and separate sources.

XI. Power Supplies

The normal power supply for each channel will be provided by different power sources such that loss of one power source will not result in the loss of both channels. In addition to the normal plant AC and/or DC power supply to each channel, a back-up power source will also be provided to each channel in the form of a back-up battery independent of the normal AC or DC power sources.

Specific details will be developed during the detailed design phase.

XII. Accuracy

The instrument channels will maintain their design accuracy following a power interruption or change in power source without requiring recalibration. Since the instrumentation is generally commercial off the shelf supplied components, the vendor published instrument accuracies will be verified as acceptable and will be used as a basis for final configuration and calibration procedures.

Accuracy requirements will consider SFP conditions, e.g., saturated water, steam environment, and concentrated borated water. Additionally, instrument 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 and 3) without conflicting or ambiguous indication. The GWR/TDR

equipment selected will have accuracy within the resolution requirements of NEI 12-02, Figure 1.

Specific details regarding accuracy will be obtained from the supplier during the detailed design phase.

XIII. Testing

Instrument channel design will provide for routine testing and calibration consistent with Order EA-12-051 and the guidance in NEI 12-02. Sensors will be designed to allow testing and/or calibration via in-situ methods while mounted in the pool. Removal of the sensor from the pool will not be required for calibration or testing.

Specific details regarding testing procedures and calibration requirements will be reviewed and determined with the supplier during the detailed design phase.

XIV. Display

Trained personnel must be capable of monitoring the SFP water level from a location remote to that of the SFP area (e.g. control room, remote shutdown panel or other appropriate and accessible location). To that end, the selected location for the display(s) will ensure SFP level information is promptly made available to plant staff and key decision makers.

Since final indicator location will be based on the detailed design package, the distance between the sensing element and the display is currently not fully defined. However, it is expected that the display will be located at a distance within 500 feet from the sensing element in an appropriate and accessible area with 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 SFP,
- Inside a structure providing protection against adverse weather, and
- Outside any very high radiation area or locked high radiation area during normal operation.

The conceptual design locates the electronic enclosure and primary display in the Cable Spreading Room. Specific details regarding the display and display location(s) will be finalized during the detailed design phase.

XV. Instrument Channel Program Criteria

Training

The Systematic Approach to Training (SAT) will be used to identify the population to be trained and to determine both the initial and continuing elements of the required training. Training will be completed prior to placing the instrumentation in service.

Specific details regarding training will be reviewed and determined between the plant and the supplier as part of the procurement process for the new instruments.

Procedures

Procedures will be developed using guidelines and vendor instructions to address the maintenance, operation, and abnormal response issues associated with the new SFP instrumentation.

Procedures will address a strategy to ensure SFP water level addition is initiated at an appropriate time consistent with implementation of NEI 12-06, *Diverse and Flexible Coping Strategies (FLEX) Implementation Guide* (Reference 8).

Procedures will also address the following situations:

- 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 apply 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, commercially available components that may or may not meet all of the qualifications (Section VII) may be used to maintain the instrument channel functionality.

Testing and Calibration

Processes will be established and maintained for scheduling and implementing necessary testing and calibration of the primary and back-up spent fuel pool level instrument channels to maintain the instrument channels at the design accuracy. Testing and calibration of the instrumentation will be consistent with vendor recommendations and any other documented basis. Calibration will be specific to the mounted instrument and the monitor.

XVI. Need for Relief and Basis

Virginia Electric and Power Company (Dominion) is not requesting relief from the requirements of Order EA-12-051 or the guidance in NRC ISG JLD-ISG-2012-03 at this time.

Consistent with the requirements of Order EA-12-051 and the guidance in NEI 12-02, 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.

XVII. References

1) US Nuclear Regulatory Commission Order EA-12-051, "Issuance of Order to Modify Licenses with Regard to Reliable Spent Fuel Pool Instrumentation," March 12, 2012

2) 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, August 2012

3) NRC Interim Staff Guidance JLD-ISG-2012-03, "Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation," Revision 0, August 29, 2012

4) Surry Power Station Updated Final Safety Analysis Report, Revision 44.01, October 31, 2012

5) US Nuclear Regulatory Commission Order EA-12-049, "Issuance of Order to Modify Licenses with Regard to Requirements for Mitigation Strategies for Beyond-Design-Basis External Events," March 12, 2012

6) ISO9001, "Quality management systems – Requirements," Fourth Edition

7) IEEE Standard 344-2004, "IEEE Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations"

8) NEI 12-06, "Diverse and Flexible Coping Strategies (FLEX) Implementation Guide," Revision 0, August 2012