Thomas D. Gatlin
Vice-President Nuclear Operations
(803)345-4342

SCE&G®
A SCANA COMPANY

February 28, 2013
RC-13-0031

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

Dear Sir / Madam:

Subject: VIRGIL C. SUMMER NUCLEAR STATION (VCSNS) UNIT 1
DOCKET NO. 50-395
OPERATING LICENSE NO. NPF-12
SOUTH CAROLINA ELECTRIC & GAS (SCE&G) COMPANY'S INTEGRATED PLAN 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 [ML 12054A682]
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 [ML 12221A339]
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, August 2012

South Carolina Electric & Gas Company (SCE&G), acting for itself and as agent for South Carolina Public Service Authority, hereby submits the Overall Integrated Plan as required by the March 12, 2012 Commission Order Number EA-12-051, Order Modifying Licenses with Regard to Requirements for Reliable Spent Fuel Pool Instrumentation (Reference 1). SCE&G utilized guidance provided in Reference 2 and 3 to develop the integrated plan to be implemented at Virgil C. Summer Nuclear Station Unit 1.

This letter contains no new regulatory commitments. If you have any questions regarding this report, please contact Mr. Bruce L. Thompson at (803) 931-5042.

A001
NRR

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

2-28-2013
Executed on

Thomas D. Gatlin

BJQ/TDG/jg
Enclosure: V.C. Summer Nuclear Station Integrated Plan with Regard to Reliable Spent Fuel Pool Instrumentation

c: K. B. Marsh
S. A. Byrne
J. B. Archie
N. S. Carns
J. H. Hamilton
J. W. Williams
W. M. Cherry
E. J. Leeds
V. M. McCree
E. A. Brown
B. A. Purnell
S. R. Jones
D. C. Dambly
NRC Resident Inspector
K. M. Sutton
NSRC
RTS (CR-12-01070)
File (815.07)
PRSF (RC-13-0031)

V.C. Summer Nuclear Station Integrated Plan with Regard to 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 licenses 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 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 JLD-ISG-2012-03, *Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation*, (Reference 3) considers 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 V.C. Summer Nuclear Power Station (VCSNS) approach for complying with Order EA-12-051 using the methods described in NRC JLD-ISG-2012-03. The current revision of the VCSNS Integrated Plan is based on our conceptual design information and will be improved as we proceed with detailed design engineering. Consistent with the requirements of Order EA-12-051 and the guidance in NEI 12-02, our six-month reports will provide a detailed description of progress made, proposed changes in our compliance methods, updates to the schedule, and if needed, requests for relief.

II. Schedule

Installation of reliable spent fuel pool level instrumentation is scheduled to be completed prior to startup from the Fall 2015 refueling outage (Reference 11).

The current milestones are:

- Initiate Procurement of SFP Instruments 06/07/2013
- Commence Engineering and Design 01/07/2014
- Complete Engineering and Design 07/07/2014
- Commence Installation of SFP Instruments 10/07/2014
- Close out Project/Plant Turnover 04/01/2015

III. Identification of Spent Fuel Pool Water Levels

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

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 460 feet and 3 inches (based on the design level of the anti-siphoning holes that prevent pool drainage below this water level). The low water level alarm is at the 461 foot elevation for the present spent fuel pool (SFP) level monitoring system. (Reference 12)

2. **Level adequate to provide substantial radiation shielding for a person standing on the spent fuel pool operating deck** - Indicated level on either the primary or backup instrument channel of greater than elevation 447.5 feet. This elevation is approximately 11 feet above the top of the fuel assemblies stored in the racks (Reference 13). This level would allow radiation shielding protection for personnel on the spent fuel operating deck by limiting the dose rates to approximately 210 mrem/hr. However, it is desirable to limit the dose rates to less than 100 mrem/hr which would require the level to be maintained at greater than elevation 455.5 feet or approximately 19 feet above the top of the fuel assemblies stored in the racks (Reference 5). This monitoring level ensures there is adequate margin in the water level to provide substantial radiation shielding for personnel to respond to Beyond-Design-Basis External Events and to initiate SFP makeup strategies.

3. **Level where fuel remains covered** - Monitoring level on either the primary or backup instrument channel of greater than elevation 436 feet and 8 inches, plus the accuracy of the SFP level instrument channel, assures there is adequate water level above the stored fuel seated in the rack. (Reference 13)

IV. Instruments

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

Primary instrument channels:
Primary instrument channels will consist of fixed components. The back-up instrument channel will consist of fixed and portable components. The plan is for both channels to utilize Through Air Radar, which functions according to the principle of Time Domain Reflectometry. A generated pulse of microwave energy travels down the antenna. Upon reaching the liquid surface the pulse is reflected, which provides a level, based on the reflection time.

Through Air Radar attributes include:

- Short microwave pulses are emitted by the antenna system in the direction of the measured pool surface, reflected by the surface and received back again by the antenna system. They propagate at the speed of light. The time from emission to reception of the signals is proportional to the level in the vessel.

- Through Air Radar is effectively immune to interference as the signal stays in the immediate vicinity of the horn antenna and remains reliable even when measuring through large debris fields.

- Technology is immune to the changes in temperature, the specific gravity of the SFP water, saturated steam, dense smoke and agitated surfaces including foam.

Measured range will be continuous from the normal pool level elevation 461 feet and 5 inches to the top of the spent fuel seated in the racks at elevation 437 feet and 5 inches (Reference 4). The normal value for SFP level of 461 feet and 6 inches is verified twice daily per Operations Administrative Procedure (OAP-106.1) *Operating Rounds* (Reference 6).

Primary instrument channel level sensing components will be located in the southwest corner of the SFP. Backup instrument channel level sensing components will be located in the northwest corner of the SFP. See *Plan View of SFP Showing New SFP Level Instrumentation* in Section XVIII, Drawings.

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, and further discussed in Section VII, Qualification. Reliable level indication will be functional during all modes of operation as described in Section XV, Testing and Calibration.

Instrument Channel Design Criteria:
Instrument channel design criteria will be consistent with the guidelines of NRC JLD-ISG-2012-03 and NEI 12-02.

Antennas will consist of approximately 60 feet of small diameter stainless steel piping (waveguide) with a horn antenna attached to the end and suspended over the pool surface. There are no components located within the spent fuel pool or penetrate the pools surface. Interaction between the signal and the spent fuel pool wall has been evaluated and there is no adverse impact or interference with the reflected signal. The horn antenna and wave guide are seismically mounted, shielded from postulated falling debris and are expected to survive the event without damage. The horn antenna and wave guide for the back-up channel will be available for post-event installation should damage to the primary channel become inoperable for any reason.

The sensors will be located outside of the fuel handling building walls and will be protected from radiation and high temperatures generated from the spent fuel pool during a loss of spent fuel cooling event. All electronics are seismically mounted and located outside of the building that contains the spent fuel pool. The readout display will also be located outside of the fuel handling building and will be accessible per NEI 12-02 Section 3.9.

V. Arrangement

SFP level horn antenna and wave guide will be installed at the southwest corner of the SFP for the primary channel. The sensor and display for the primary channel will be located outside of the fuel handling building, in the vicinity of the south wall at the 463 foot elevation of the auxiliary building, adjacent to the southwest corner of the spent fuel pool. The auxiliary building is a Seismic Class 1 safety related structure meeting the requirements of NEI 12-02 Section 3.9 for protection of the sensor and display against extreme external events. The back-up channel horn antenna and wave guide would be stored in the east stairwell of the auxiliary building at approximately the 463 foot elevation. The backup channel sensor and display will be permanently installed at a location that is readily accessible to the operator, in the vicinity of the 463 foot elevation of the east stairwell of the auxiliary building.

Separation of the primary and backup channel locations will meet the guidance of NEI 12-02 Section 3.2 by being located at opposite corners of the pool area, and separated by a distance comparable to the shortest length of a side of the pool. The portable components of the backup channel (i.e. the horn antenna and wave guide pipe) will be capable of a deployment time of 30 minutes from the identification of the need for the backup channel to be placed in service. The sensor and display will be permanently installed. Installation of the horn antenna and wave guide piping will require no more than two trained personnel for deployment. The supports for the horn antenna and wave guide piping will be part of the portable components and will allow for flexibility of location of the antenna if the predetermined location is inaccessible. The personnel access pathways for the display readout are located in the auxiliary building, which is Seismic Class 1 safety related structure, meeting the requirements of NEI 12-02 Section 3.9

The horn antenna and wave guide piping supports for the primary channel will be seismically designed with shielding to protect the horn antenna and wave guide piping from event generated missiles such as light fixtures, ductwork and roofing panels. The design of the antenna and antenna support will allow the spent fuel pool bridge to be utilized without interference. The sensors and displays are located outside of the area of concern with respect to event generated missiles.

The Through Air Radar system has capability for both intermittent monitoring as well as continuous monitoring once the system is place into service. FLEX Support Guidelines will provide the operating instructions for intermittent or continuous monitoring.

VI. Mounting

All permanently installed equipment associated with the level monitoring system will be mounted in accordance with Seismic Class I requirements. Installed equipment will be seismically qualified to withstand the maximum seismic ground motion considered in the design of the plant area in which it is installed and will be consistent with the highest seismic and safety classification applied to the Spent Fuel Pool original design. Should the plant seismic design basis change, changes to the seismic design mountings for the installed level monitoring system will be processed in accordance with station procedures.

VII. Qualification

Both channels will be reliable at temperature, humidity, and radiation levels consistent with the spent fuel pool water at saturation conditions for an extended period. Sensors and displays are located outside of the area of the pool and are not subject to the radiation, temperature and humidity conditions that are postulated for the areas in the vicinity of the pool during post event conditions. Post event humidity in the Auxiliary Building near and above the SFP is assumed to be 100% with condensing steam. Equipment will be qualified for expected conditions at the installed location assuming that normal power is unavailable and that the SFP has been at saturation for an extended period. Equipment located in the vicinity of the SFP will be qualified to withstand peak and total integrated dose radiation levels for its installed location assuming that post event SFP water level remains above the fuel for an extended period of time.

The horn antenna and wave guide piping are insensitive to temperature. The "Through Air Radar" system performance is unaffected by vapor, gas composition, pressure and temperature changes at the surface of the pool. The sensor is able to penetrate foam, saturated steam and smoke without any adverse affect on the accuracy of the pool level measurement. Antenna location will not be subject to pool overflow and the mounting of the antenna to the sensor at the wall penetration will be qualified to the SFP area post event environment.

Instrument channel reliability 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 all instrument channel components, and
- seismic effects on instrument channel components used during and following a potential seismic event for only installed components.

Augmented quality requirements, similar to those applied to fire protection, will be applied to this project.

Post-event (beyond-design-basis) conditions that will be considered in the design of the components that are subject to conditions in the vicinity of the Spent Fuel Pool are:

- radiological conditions for a normal refueling quantity of freshly discharged (100 hours) fuel with the SFP water level 3 as described in this EA-12-049 (Reference 7),
- 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.

Components of the instrument channels will be qualified for shock to Mil-S-901D *"Requirements for Shock Tests, High Impact, Shipboard Machinery, Equipment and Systems"* (Reference 8) and for vibration to Mil-Std-167 *"Mechanical Vibrations of Shipboard Equipment"* (Reference 9). 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 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 in the area of instrument channel component use. 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 10) or a substantially similar industrial standard.

VIII. Independence

The primary instrument channel will be redundant to and independent of the backup instrument channel. The power sources for the primary and backup channels will be independent through the utilization of standalone battery power. The channels will be separated by a distance commensurate with the shortest length of a side of the spent fuel pool as defined by NEI 12-02 Section 3.2.

IX. Power Supplies

Both the primary and back-up channels will be powered from dual selectable power supplies utilizing dedicated lithium ion batteries with backup batteries available for easy replacement. Minimum expected battery life each battery supply provides for 7 days of continuous service. The battery systems will include provision for battery replacement should the installed battery be non-functional following the event. Spare batteries will be readily available to maintain power to the system for the entire period of the FLEX response.

X. Accuracy

Instrument channels will be designed such that they will maintain their design accuracy following a power interruption or change in power source without recalibration.

Accuracy will consider SFP conditions, e.g., saturated water, steam environment, or 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 Through Air Radar system has accuracy equal to or better than +/- 3 inches.

XI. Testing

Instrument channel design will provide for routine testing and in-situ calibration consistent with Order EA-12-051 and the guidance in NEI 12-02. The backup portable channel will not require additional calibration or testing at the time of deployment. Details will be determined during the engineering and design phase for PM Program requirements, testing and calibration frequencies. It is expected that the batteries will be changed annually at the recommended frequency suggested by the OEM. Calibration of the instrument itself is not required. The recommended surveillance testing will be performed within 60 days of a refueling outage and not more than once in a 12 month period to verify channel operability for both the primary channel and the back-up.

XII. Display

Remote indication will be provided in two "appropriate and accessible locations" in the Auxiliary Building. The primary channel display will provide a read-out in the vicinity of the north wall 463 foot elevation adjacent to and outside of the southwest corner of the Spent Fuel Pool and Fuel Handling Building. The backup channel will provide a readout in the northeast stairwell of the Auxiliary Building in the vicinity of the 463 foot elevation and adjacent to the northwest corner of the Spent Fuel Pool and west wall of the Fuel Handling Building.

The display areas in the Auxiliary Building are:

- promptly accessible to the appropriate plant staff giving appropriate consideration to various drain down scenarios,
- outside of the area surrounding the SFP floor, e.g., an appropriate distance from the radiological sources resulting from an event impacting the SFP,
- in a Seismic Category I structure providing protection against adverse weather, and
- outside of any very high radiation areas or LOCKED HIGH RAD AREA during normal operation.

XIII. Training

The Systematic Approach to Training 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 consist of the use of the level instrumentation system as well as the deployment of the portable components of the backup channel. Training will be completed prior to placing the instrumentation in service.

XIV. 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. For the portable components of the backup channel, the procedures will also specify the storage location and the installation instructions.

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* (References 11).

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, we may use commercially available components that may or may not meet all of the qualifications (Section VII) to maintain the instrument channel functionality.

XV. Testing and Calibration

Processes will be established for scheduling the necessary testing and calibration of all spent fuel pool level instrument channels. This schedule will also be used to maintain the instrument channels at the design accuracy. Testing and calibration of the instrumentation will be consistent with vendor recommendations and other documented basis during the design process. Calibration will be specific to the mounted sensor and the display and will include an in-situ check of the entire channel including the wave guide piping and horn antenna. Surveillance and testing will be performed at frequencies consistent with those specified in NEI-12-02 Section 4.3.

XVI. Need for Relief and Basis

No relief requested at this time from the requirements of Order EA-12-051 or the guidance in NRC JLD-ISG-2012-03.

This integrated plan provides the V.C. Summer Nuclear Power Station (VCSNS) approach for complying with Order EA-12-051 using the methods described in NRC JLD-ISG-2012-03. The current revision of the VCSNS Integrated Plan is based on our conceptual design information and will be improved as we proceed with detailed design engineering. Consistent with the requirements of Order EA-12-051 and the guidance in NEI 12-02, our six-month reports will provide a detailed description of progress made, proposed changes in our compliance methods, updates to the schedule, and if needed, requests for relief.

XVII. References

1) 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 JLD-ISG-2012-03, Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation, Revision 0, August 29, 2012
4) VCSNS Setpoint Data Base
5) DC-00030-057 Calculation: *Operator Dose as a Function of Spent Fuel Pool Water Level* (ECR-71643)
6) OAP-106.1 *Operating Rounds* Revision 16 d.
7) 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
8) Mil-S-901D *"Requirements for Shock Tests, High Impact, Shipboard Machinery, Equipment and Systems"*
9) Mil-Std-167 *"Mechanical Vibrations of Shipboard Equipment"*
10) IEEE Standard 344-2004, IEEE Recommended Practice for Seismic Qualification of Class 1E Equipment for Nuclear Power Generating Stations
11) NEI 12-06, Diverse and Flexible Coping Strategies (FLEX) Implementation Guide, Revision 0, August 2012
12) V.C. Summer Nuclear Station Updated Final Safety Analysis Report
13) DC 01360-003, Rev. 0, Spent Fuel Pool Water Cover Over Spent Fuel.

XVIII. Drawings