UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

July 29, 2013

Mr. Thomas D. Gatlin
Vice President, Nuclear Operations
South Carolina Electric & Gas Company
Virgil C. Summer Nuclear Station
Post Office Box 88, Mail Code 800
Jenkinsville, SC 29065

SUBJECT: VIRGIL C. SUMMER NUCLEAR STATION, UNIT 1 – REQUEST FOR ADDITIONAL INFORMATION REGARDING OVERALL INTEGRATED PLAN FOR RELIABLE SPENT FUEL POOL INSTRUMENTATION (ORDER NUMBER EA-12-051) (TAC NO. MF1173)

Dear Mr. Gatlin:

By letter dated February 28, 2013, South Carolina Electric & Gas submitted an Overall Integrated Plan (OIP) in response to the March 12, 2012, Commission Order to modify licenses with regard to requirements for Reliable Spent Fuel Pool (SFP) Instrumentation (Order EA-12-051) for the Virgil C. Summer Nuclear Station, Unit 1.

The Nuclear Regulatory Commission staff finds that additional information, as requested in the enclosure, is needed to complete its review. Please provide a response to the questions within 30 days of the date of this letter. If any part of this information is not available within 30 days of this request, please provide the date that this information will be provided.

Sincerely,

for

Robert E. Martin, Senior Project Manager
Plant Licensing Branch II-1
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-395

Enclosure:
Request for Additional Information

cc w/encl: Distribution via Listserv

UNITED STATES
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REQUEST FOR ADDITIONAL INFORMATION

OVERALL INTEGRATED PLAN IN RESPONSE TO

ORDER EA-12-051 "RELIABLE SPENT FUEL POOL INSTRUMENTATION"

SOUTH CAROLINA ELECTRIC & GAS COMPANY

VIRGIL C. SUMMER NUCLEAR STATION, UNIT 1

DOCKET NO. 50-395

1.0 INTRODUCTION

By letter dated February 28, 2013 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13063A099), South Carolina Electric & Gas (SCE&G) Company submitted an Overall Integrated Plan (OIP) in response to the March 12, 2012, Commission Order modifying licenses with regard to requirements for Reliable Spent Fuel Pool (SFP) Instrumentation (Order Number EA-12-051; ADAMS Accession No. ML12054A679) for Virgil C. Summer Nuclear Station (VCSNS), Unit 1. The NRC staff endorsed Nuclear Energy Institute (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 2012 (ADAMS Accession No. ML12240A307), with exceptions, as documented in Interim Staff Guidance (ISG) 2012-03 "Compliance with Order EA-12-051, Reliable Spent Fuel Pool Instrumentation," Revision 0, dated August 29, 2012 (ADAMS Accession No. ML12221A339).

The NRC staff has reviewed the February 28, 2013, response by the licensee and determined that the following Request for Additional Information (RAI) is needed to complete its Technical Review. If any part of this information is not available within the 30-day response date for this RAI, please provide the date this information will be submitted.

2.0 LEVELS OF REQUIRED MONITORING

The OIP states, in part, that

> 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.

Enclosure

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. 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. 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.

RAI-1

Please provide the following:

a) For level 1, specify how the identified location represents the HIGHER of the two points described in the NEI 12-02 guidance for this level.

b) A clearly labeled sketch depicting the elevation view of the proposed typical mounting arrangement for the portions of the instrument channel consisting of permanent measurement channel equipment (e.g., fixed level sensors and/or stilling wells, and mounting brackets). Indicate on this sketch the datum values representing Level 1, Level 2, and Level 3 as well as the top of the fuel racks. Indicate on this sketch the portion of the level sensor measurement range that is sensitive to measurement of the fuel pool level, with respect to the Level 1, Level 2, and Level 3 datum points.

3.0 INSTRUMENTATION DESIGN FEATURES

3.2 Arrangement

The OIP states, in part, that

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.

RAI-2

Please provide the following:

a) A clearly labeled sketch or marked-up plant drawing of the plan view of the SFP area, depicting the SFP inside dimensions, the planned locations/ placement of the primary and back-up SFP level sensing electronics, and the proposed routing of the cables that will extend from the sensing electronics toward the location of the read-out/display device.

b) A description of how the backup channel waveguide and horn is to be attached to the electronics assembly when needed. Provide clarification on whether the waveguides are run through wall penetrations to the sensing electronics or whether any electronics are within the environment of the spent fuel pool area.

c) A description of the installation process for the backup level channel from the identification of the need for the backup channel to be placed in service, to subsequent communication with plant decision makers, final installation and verification of proper functioning of the equipment.

d) A copy of the analysis performed to determine a deployment time of 30 minutes for the backup channel from the identification of the need for this channel to be placed in service. Include primary and alternate access route evaluation, habitability at installation location, and resource availability for personnel responsible to install instrumentation for the various SFP drain down scenarios and external events.

e) A description of the shielding design to protect the horn antenna and wave guide piping from event generated missiles.

3.3 Mounting

The OIP states, in part, that

> 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.

RAI-3

Please provide the following:

a) The design criteria that will be used to estimate the total loading on the mounting device(s), including static weight loads and dynamic loads. Describe the methodology that will be used to estimate the total loading, inclusive of design basis maximum seismic loads and the hydrodynamic loads that could result from pool sloshing or other effects that could accompany such seismic forces.

b) A description of the manner in which the level sensor (and stilling well, if appropriate) will be attached to the refueling floor and/or other support structures for each planned point of attachment of the sensing/waveguide assembly. Indicate in a schematic the portions of the level sensor/waveguide that will serve as points of attachment for mechanical/ mounting or electrical connections.

c) A description of the manner by which the mechanical connections will attach the level instrument to permanent SFP wall or floor structures so as to support the waveguide/level sensor assembly.

3.4 Qualification

The OIP states, in part, that

> 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.

RAI-4

Please provide the following:

a) A description of the specific method or combination of methods you intend to apply to demonstrate the reliability of the permanently installed equipment under beyond-design-basis (BDB) ambient temperature, humidity, shock, vibration, and radiation conditions.

b) A description of the testing and/or analyses that will be conducted to provide assurance that the equipment will perform reliably under the worst-case credible design basis loading at the location where the equipment will be mounted. Include a discussion of this seismic reliability demonstration as it applies to a) the level sensor/waveguide mounted in the spent fuel pool area, and b) any control boxes, electronics, or read-out and re-transmitting devices that will be employed to convey the level information from the level sensor/waveguide, to the electronics assembly, and then to the plant operators or emergency responders.

c) A description of the specific method or combination of methods that will be used to confirm the reliability of the permanently installed equipment, including primary and back-up electronics assemblies, such that following a seismic event each instrument will maintain its required accuracy.

3.5 Independence

The OIP states, in part, that

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.

RAI-5

Please provide the following:

a) A description of how the two channels of the proposed level measurement system meet this requirement so that the potential for a common cause event to adversely affect both channels is minimized to the extent practicable.

b) Further information describing the design and installation of each level measurement system, consisting of level sensor electronics, cabling, and readout devices. Please address how independence of these components of the primary and back-up channels is achieved through the application of independent power sources, physical and spatial separation, independence of signals sent to the location(s) of the readout devices, and the independence of the displays.

3.6 Power Supplies

The OIP states, in part, that

> 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.

RAI-6

Please provide the following:

a) A description of the electrical AC power sources and capacities for the primary and backup channels.

b) If the level measurement channels are to be powered through a battery system (either directly or through an Uninterruptible Power Supply (UPS)), please provide the design criteria that will be applied to size the battery in a manner that ensures, with margin, that the channel will be available to run reliably and continuously following the onset of the BDB event for the minimum duration needed, consistent with the plant mitigation strategies for BDB external events (Order EA-12-049).

c) If it is expected that battery changes will be necessary prior to restoration of power using the FLEX mitigation strategies, provide a description of the ease of access to the point at which batteries are attached, and the minimum time requirements needed to restore level indication.

3.7 Accuracy

The OIP states, in part, that

> 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.

RAI-7

Please provide the following:

a) An estimate of the expected instrument channel accuracy performance (e.g., in % of span) under both a) normal SFP level conditions (approximately Level 1 or higher) and b) at the BDB conditions (i.e., radiation, temperature, humidity, post-seismic and post-shock conditions) that would be present if the SFP level were at the Level 2 and Level 3 datum points.

b) A description of the methodology that will be used for determining the maximum allowed deviation from the instrument channel design accuracy that will be employed under normal operating conditions as an acceptance criterion for a calibration procedure to flag to operators and to technicians that the channel requires adjustment to within the normal condition design accuracy.

3.8 Testing

The OIP states, in part, that

> 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.

RAI- 8

Please provide the following:

a) It is not clear to the staff which instrument does not need to be calibrated, as suggested in your submittal. Provide clarification on whether one or both instruments will be periodically calibrated.

b) A description of the capability and provisions the proposed mounted and portable level sensing equipment will have to enable periodic testing and calibration, including how this capability enables the equipment to be tested in-situ.

c) A description of how such testing and calibration will enable the conduct of regular channel checks of each independent channel against the other, and against any other permanently-installed SFP level instrumentation.

d) A description of how calibration tests and functional checks will be performed and the frequency at which they will be conducted. Discuss how these surveillances will be incorporated into the plant surveillance program.

e) A description of the preventive maintenance tasks required to be performed during normal operation, and the planned maximum surveillance interval that is necessary to ensure that the channels are fully conditioned to accurately and reliably perform their functions when needed.

3.9 Display

The OIP states, in part, that

> 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.

RAI-9

Please provide the following:

a) Since both the primary and backup display locations are not in the main control room, provide a description of the display locations that address primary and alternate access route evaluation, continuous habitability at display locations, continual resource availability for personnel responsible to promptly read displays, and provisions for verbal communications with decision makers for the various SFP drain down scenarios and external events.

b) The reasons justifying why the locations selected will enable the information from these instruments to be considered "promptly accessible". Include consideration of various drain-down scenarios.

4.0 PROGRAM FEATURES

4.1 Training

The OIP states, in part, that

> Training will consist of the use of the level instrumentation system as well as deployment of the portable components of the backup channel.

RAI-10

Please provide a description of the training, and resources that are needed to ensure that sufficient plant personnel are available and trained to install the backup channel within 30 minutes of the loss of the operating channel.

4.2 Procedures

The OIP states, in part, that

> 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.

RAI-11

Please provide the following:

a) A list of the operating (both normal and abnormal response) procedures, calibration/test procedures, maintenance procedures, and inspection procedures that will be developed for use of the SFP instrumentation in a manner that addresses the order requirements.

b) A brief description of the specific technical objectives to be achieved within each procedure. If your plan incorporates the use of portable spent fuel level monitoring components, please include a description of the objectives to be achieved with regard to the storage location and provisions for installation of the portable components when needed.

4.3 Testing and Calibration

The OIP states, in part, that

> 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.

RAI-12

Please provide the following:

a) Further information describing the maintenance and testing program the licensee will establish and implement to ensure that regular testing and calibration is performed and verified by inspection and audit to demonstrate conformance with design and system readiness requirements. Include a description of your plans for ensuring that necessary channel checks, functional tests, periodic calibration, and maintenance will be conducted for the level measurement system and its supporting equipment.

b) A description of how the guidance in NEI 12-02 Section 4.3 regarding compensatory actions for one or both non-functioning channels will be addressed.

c) A description of the compensatory actions to be taken in the event that one of the instrument channels cannot be restored to functional status within 90 days.

Principal Contributors: Carla P. Roque-Cruz
Jack Zhao

Date: July 29, 2013

Mr. Thomas D. Gatlin
Vice President, Nuclear Operations
South Carolina Electric & Gas Company
Virgil C. Summer Nuclear Station
Post Office Box 88, Mail Code 800
Jenkinsville, SC 29065

SUBJECT: VIRGIL C. SUMMER NUCLEAR STATION, UNIT 1 – REQUEST FOR ADDITIONAL INFORMATION REGARDING OVERALL INTEGRATED PLAN FOR RELIABLE SPENT FUEL POOL INSTRUMENTATION (ORDER NUMBER EA-12-051) (TAC NO. MF1173)

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Robert E. Martin, Senior Project Manager
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