



UNITED STATES
NUCLEAR REGULATORY COMMISSION

REGION II
SAM NUNN ATLANTA FEDERAL CENTER
61 FORSYTH STREET, SW, SUITE 23T85
ATLANTA, GEORGIA 30303-8931

October 13, 2006

South Carolina Electric & Gas Company
ATTN: Mr. Jeffrey B. Archie
Vice President, Nuclear Operations
Virgil C. Summer Nuclear Station
P. O. Box 88
Jenkinsville, SC 29065

SUBJECT: VIRGIL C. SUMMER NUCLEAR STATION - NRC SUPPLEMENTAL
INSPECTION REPORT NO. 05000395/2006013

Dear Mr. Archie:

On September 15, 2006, the U.S. Nuclear Regulatory Commission (NRC) completed a supplemental inspection at your Virgil C. Summer Nuclear Station. The enclosed report documents the inspection results which were discussed on September 15, 2006, with you and other members of your staff.

This supplemental inspection was an examination of your problem identification, root cause analysis, extent of condition and cause determinations, and corrective actions associated with the White finding identified in the Public Radiation Safety Cornerstone. The finding involved the failure to prepare a shipment of radioactive waste in such a manner as to not exceed U.S. Department of Transportation radiation limits upon arrival at its destination.

Based on the results of this inspection, no findings of significance were identified. We have concluded that your root cause evaluation effectively identified the primary and contributing causes. The completed and proposed corrective actions, including actions to prevent recurrence, appropriately addressed the results of your root cause evaluation. As such, the inspection objectives of Inspection Procedure 95001, "Inspection For One Or Two White Inputs In A Strategic Performance Area," have been satisfied.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter and its enclosure will be available electronically for public inspection in the NRC Public Document Room or from the Publicly Available Records (PARS) component of NRC's document system

(ADAMS). ADAMS is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html> (the Public Electronic Reading Room).

Sincerely,

/RA: Original signed by Charles Ogle for/

Joseph Shea, Director
Division of Reactor Safety

Docket No.: 50-395
License No.: NPF-12

Enclosure: NRC Supplemental Inspection Report 05000395/2006013
w/Attachment: Supplemental Information

cc w/encl:
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(cc w/encl cont'd - See page 3)

SCE&G

3

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(ADAMS). ADAMS is accessible from the NRC Web site at <http://www.nrc.gov/reading-rm/adams.html> (the Public Electronic Reading Room).

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ADAMS: Yes ACCESSION NUMBER: _____

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NAME	HAMILTON	DIAZ	GUTHRIE	HAAG			
DATE	10/13/2006	10/13/2006	10/13/2007	10/13/2007			
E-MAIL COPY?	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO

U. S . NUCLEAR REGULATORY COMMISSION

REGION II

Docket No.: 50-395

License No.: NPF-12

Report No.: 05000395/2006013

Licensee: South Carolina Electric & Gas (SCE&G) Company

Facility: Virgil C. Summer Nuclear Station

Location: P. O. Box 88
Jenkinsville, SC 29065

Dates: September 11-15, 2006

Inspectors: Ruben Hamilton, Senior Health Physicist
Jose Diaz, Health Physicist

Approved by: Robert Haag, Chief,
Plant Support Branch 1,
Division of Reactor Safety

Enclosure

SUMMARY OF FINDINGS

IR 05000395/2006013, 9/11-15/2006, Virgil C. Summer Nuclear Station, Supplemental Inspection for a White finding in the Public Radiation Safety Cornerstone.

This inspection was conducted by a regional senior health physics inspector and a regional health physics inspector. No findings of significance were identified. The Nuclear Regulatory Commission's program for overseeing the safe operation of commercial nuclear power reactors is described in NUREG-1649, "Reactor Oversight Process," Revision 3, dated July 2000.

Cornerstone: Public Radiation Safety

The U. S. Nuclear Regulatory Commission (NRC) performed this supplemental inspection to assess the licensee's evaluation and corrective actions associated with the arrival of a radioactive waste shipment at its destination with a dose rate on the exterior surface of the shipping container that exceeded U. S. Department of Transportation (DOT) limits. The performance issue for the finding was previously characterized as having low to moderate risk significance (White) in NRC Inspection Report No. 05000395/2006009, dated May 5, 2006. During this supplemental inspection, performed in accordance with Inspection Procedure 95001, "Inspection for One or Two White Inputs in a Strategic Performance Area," the inspectors determined that the licensee performed a comprehensive evaluation of the events that led up to the event.

The licensee's evaluation identified several root and contributing causes which led to a shipping container arriving at its destination with a dose rate that exceeded DOT limits. The licensee's analysis determined that the most proximate root cause was that industry operating experience was not used properly. Specifically, there have been several similar events where failures to properly measure radiation levels on radioactive waste shipments were attributed to lack of audible response on the instrument. This resulted in the survey missing highly localized dose fields. If the industry operating experience had been incorporated into survey practices and procedures the vulnerability to this type of event could have been addressed. Additional root causes were also identified by the licensee. These include the failure of the survey to detect the hot particle when the bag of trash that contained the particle was initially surveyed and the failure to detect the elevated dose rates on the exterior surface of the shipping container resulting from the hot particle. As a result of the evaluation, the licensee has implemented numerous policy and procedure changes as corrective actions to prevent recurrence. The inspectors concluded that the licensee's evaluation identified the appropriate causes for the event and that adequate corrective actions have been implemented.

Given the licensee's acceptable performance in addressing the shipment of radioactive waste that exceeded DOT dose rate limits, the White finding associated with this issue will only be considered in assessing plant performance for a total of four quarters in accordance with the guidance in IMC 0305, "Operating Reactor Assessment Program."

Report Details

01 Inspection Scope

This supplemental inspection was performed by the NRC to assess the licensee's evaluation and corrective actions associated with a low to moderate risk significant (White) finding for a radioactive waste shipment that arrived at its destination with dose rates that exceeded DOT limits. This performance issue was previously characterized as "White" in NRC Inspection Report No. 05000395/2006009 and is related to the public radiation safety cornerstone of the radiation safety strategic performance area.

The inspectors assessed the adequacy of the licensee's root cause analysis, determined if appropriate corrective actions were specified and scheduled commensurate with risk, and determined if the proposed actions were sufficient to prevent recurrence. This assessment included a review of the licensee's Condition Evaluation Reports (CERs), root cause analysis, completed and scheduled corrective actions, procedures, additional related documents, and interviews with key plant personnel.

This supplemental inspection was conducted in accordance with the requirements of NRC Inspection Procedure (IP) 95001. Consequently, the following report details are organized by the specific inspection requirements of IP 95001, which are noted in italics.

02 Evaluation of Inspection Requirements

02.01 Problem Identification

- a. *Determination of who identified the issue and under what conditions.*

The elevated dose rate was discovered on May 26, 2005, when a radioactive waste processor performed an initial receipt survey on the exterior surface of a shipping container. During the receipt survey, the health physics technicians used low range Geiger-Mueller (GM) instruments that had an audible response. The technicians identified a distinct location that caused the instrument to go off-scale high (>200 millirem per hour). The radioactive waste processor then surveyed the shipment with other instruments and identified a point where the dose rate was approximately 600 millirem per hour (mrem/hr). The radioactive waste processor notified the State of Tennessee and V.C. Summer Nuclear Plant. They isolated the shipping container until a representative of V.C. Summer could travel to the site and verify the dose rates.

The licensee representative brought two instruments to use in verifying the dose rate, one of which had been used for the original shipping survey at V. C. Summer. The licensee's representative was able to verify that the dose rate exceeded the DOT limit. The radioactive waste processor and the licensee's representative identified that a bag of waste/ trash inside the container was the source for the elevated dose rate on the exterior of the shipping container. Specifically, the bag was found to contain a hot particle approximately 2 millimeters in diameter on a cotton rag. The highest contact dose rate measured on the particle was 1000 mrem/hr.

b. *Determination of how long the issue existed, and prior opportunities for identification.*

The licensee reviewed the shipping surveys and radioactive materials tag from the bag containing the particle. Instrument calibrations were verified to be accurate and were independently validated by another licensee. The licensee determined that the bag containing the hot particle could have shifted at any point in transit and thus assumed that the dose rate on the exterior of the shipping container was elevated from the time it left the site until it reached its destination. The transit time was approximately six hours. Opportunities for discovery of the particle existed when the bag was initially surveyed with an ion chamber instrument on May 5, 2005, prior to being removed from inside the containment. The dose rate measured at that time was 100 mrem/hr contact. The bag was resurveyed later with a GM instrument which yielded a reading of 200 mrem/hr contact and again when the bag was loaded into the shipping container. In addition, it is possible that the elevated dose rate existed on the shipping container prior to departure and that it was missed during the shipping and verification surveys on May 26, 2005.

c. *Determination of the plant-specific risk consequences and compliance concerns associated with the issue.*

Although there are no plant specific risk consequences, there were potential consequences to members of the public. The DOT regulations were written to protect members of the public from unnecessary exposure to radiation. This includes emergency responders as well as personnel who must handle a package in the course of a shipment. The inspectors agreed with the licensee's assessment that the location of the elevated dose rate, approximately 10 feet high on the side of the shipping container, was not likely to have caused appreciable exposure to a member of the public in an uninterrupted transit from shipper to its destination. However, there are scenarios where an unnecessary exposure situation could occur. For example, if the driver had stopped at a truck stop, unnecessary exposure of a driver in an adjacent truck could occur.

The inspectors identified a concern that plant procedures had a provision that could lead to a recurrence of this event. The plant procedures called for the use of GM instruments for transportation shipments. The use of large volume ion chamber instrument was also allowed with the stipulation that the dose be recorded at a distance of one inch. The use of detectors that are physically large in relation to the size of the source has historically been the cause of many inadequate shipping surveys. Although this particular allowance did not contribute to the cause of the White finding, it could lead to future problems. Additionally the use of instruments with an audible response has been documented in several industry experience documents as being helpful in locating discrete, elevated dose rate points. The absence of an audible response on the instrument used for the shipping survey was a likely contributor to this event in that the meter response was not quick enough to allow the surveyor to locate the point even when its location was known. The licensee has revised the procedures to eliminate this concern.

d. *Assessment*

The radioactive waste processor was able to find the elevated dose rate on the shipping container by the use of a highly sensitive GM instrument that provided an audible indication of count rate that had a much faster response time than meter movement. The licensee performed dose surveys prior to shipment with an instrument that did not have an audible indication and did not identify the elevated dose rate. Due to the relatively short transit time, the consequence of the elevated dose rates on the exterior surfaces of the shipping container were minimal. The licensee documented this event in its corrective action program.

02.02 Root Cause, Extent of Condition, and Extent of Cause Evaluation

a. *Evaluation of method(s) used to identify root cause(s) and contributing cause(s).*

To evaluate this issue, the licensee initially performed an apparent cause analysis in which the evaluator reviewed all of the known information and determined what was the most likely cause. Later, a formal root cause team comprised of licensee personnel and an individual from another licensee was formed. This team conducted interviews and document reviews to perform an event and causal factor analysis using the Taproot methodology. The apparent cause analysis determined the cause to be associated with technical issues involving radiation protection practices, whereas the formal root cause identified program related issues that contributed to the finding.

b. *Level of detail of the root cause evaluation.*

The licensee's root cause evaluation was thorough and identified multiple root causes. One of the root causes was an inadequate utilization of industry operation experience. The licensee identified a 2003 operating experience event that described problems with surveys of radioactive material shipments. In response to this operating experience, the licensee changed procedures to require the use of a GM instrument. They had not incorporated the need described in the same operating experience document for an audible indication to detect discrete radioactive sources. The root cause evaluation also identified problems with the dose rate surveys associated with the trash that contained the hot particle. The initial survey of the trash containing the hot particle used an ion chamber instrument and failed to detect an elevated dose rate. Also, the elevated dose rate on the shipping container that was caused by the particle was not found during container surveys.

The licensee identified that they had not adequately reviewed or incorporated industry operating experience into policies and procedures in other disciplines as well. This was found to be a root cause for a previous event related to a plant equipment failure (RCA 04-0884).

c. *Consideration of prior occurrences of the problem and knowledge of prior operating experience.*

The licensee's evaluation included a review of operating experience to see how prevalent the problem was with elevated dose rates on shipments. The licensee determined that there was an abundance of industry operating experience that should have provided robust barriers had a more rigorous evaluation been employed. Of seven related industry events reviewed, four were attributed to the type of survey instruments used and three involved human performance. The licensee did not find any previous instances of elevated dose rates on shipments in its own condition reporting system databases. This problem is unique to the radioactive material shipping portion of the organization and does not affect how dose rates for plant personnel are set. Dose rates inside the plant are set using an ion chamber instrument that is approximately dose equivalent. GM instruments are not routinely used for personnel dose rate determination because of their lack of tissue equivalent response.

d. *Consideration of extent of cause and extent of condition of the problem.*

The licensee's evaluation considered the potential for common causes and extent of condition associated with inadequate incorporation of industry operating experience and identified that it had contributed to a prior event in another area. The extent of condition evaluation for radiation surveys is discussed in the above paragraph.

e. *Assessment*

The licensee's root cause and apparent cause analyses associated with this issue were adequate. Both the root and contributing causes for this event were identified.

02.03 Corrective Actions

a. *Appropriateness of corrective actions.*

The licensee took several corrective actions to prevent recurrence and to enhance their radioactive material shipping program. Specific corrective actions were taken to increase the likelihood of detection of hot particles, prevent trash containing hot particles from being shipped in 'Sealand' type shipping container, implement administrative controls to provide margin from the DOT dose rate limits, and establish a system of checks and balances to ensure that the shipment contains only the radioactive materials meant to be shipped. These actions were incorporated into the appropriate procedures. Several program enhancements were also identified and proceduralized as well.

The licensee has implemented corrective actions to improve their operating experience review program following a previous event that involved inadequate incorporation of industry operating experience. However, the licensee's 2003 review that failed to incorporate all relevant shipping improvements was prior to these operating experience changes. The inspectors verified that the current operating experience review program was adequate to address the concerns associated with the White finding.

b. *Prioritization of corrective actions.*

The licensee's immediate actions were to suspend shipments of 'Sealand' type containers until an initial corrective action plan could be formulated and implemented.

This included a series of procedure and policy changes. The inspectors reviewed the changes and determined that they were appropriate and should reduce the likelihood of recurrence.

c. *Establishment of schedule for implementing and completing the corrective actions.*

All identified corrective actions except those related to training contractor health physics technicians on expectations regarding radiation surveys and the consequences of an inadequate survey have been completed. The licensee stated that this training will be provided to the contract employees when they arrive to support the refueling outage.

d. *Establishment of quantitative or qualitative measures of success for determining the effectiveness of the corrective actions to prevent recurrence.*

The licensee indicated that they will monitor the shipping program for shipping events and near misses in the future and will adjust the program as needed.

e. *Assessment*

The licensee's corrective actions should reduce the probability of a shipment containing a discrete radioactive particle from causing surface dose rates that exceed the DOT limits.

03. **Management Meetings**

Exit Meeting Summary

On September 15, 2006, an exit meeting was held with V.C. Summer plant management and Radiation Protection supervision. This meeting provided the results of the inspection. The inspectors verified with the licensee that they had not been provided any proprietary information.

Following the exit meeting, a Regulatory Performance Meeting was held in which Mr. Robert Haag and the licensee discussed the evaluation and corrective actions associated with the White inspection finding. This meeting confirmed that the NRC and licensee have a shared understanding of the performance issues, the underlying causes, and planned licensee actions.

SUPPLEMENTAL INFORMATION

KEY POINT OF CONTACT

Licensee Personnel

J. Archie, VP Nuclear Operations
T. Gatlin, General Manager, Nuclear Plant Operations
P. Mothena, Manager Health Physics and Safety Services
J. Schafer, Radioactive Waste Supervisor
D. Perez, Health Physics Supervisor
M. Jordan, Health Physics Supervisor
J. Hunsicker, Health Physics Supervisor
R. Sweet, Manager Nuclear Licensing
A. Cribb, Supervisor Licensing
S. Reese, Licensing Specialist
C. Crowley, Operating Experience Coordinator

NRC Personnel

J. Zeiler, Sr. Resident Inspector
J. Polickoski, Resident Inspector

LIST OF ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

None

Closed

None

Discussed

None

Documents Reviewed

NRC Inspection Report 2006011

RCA 05-2289 DAW Shipment Exceeding DOT Limits

HPP-0703, Shipping Radioactive Material, Rev. 16

CER 0-C-05-2289, 40 foot LSA seavan of DAW sent to Duratek was received at Duratek with dose rates higher than Department of Transportation limits.

Data package on V.C. Summer shipment:

- Duratek First Notification Form, CP-AD-PR-005 dated 5/27/05
- Duratek Manifest and Shipping Evaluation Form, CP-SR-PR-201-F1, dated 5/27/05
- VC Summer Vehicle Survey Form Shipment Number 05-061, dated 5/26/05
- Duratek Vehicle Survey Form, CP-SR-PR-201-F2, dated 5/27/05
- Duratek Cargo Container Survey Form, HP-AD-105-F1, dated 5/27/05
- Duratek Manifest Summary Report, Manifest Number 552-05-61, dated 5/31/05
- Duratek Shipment Summary Form, WM-A-501-F1, dated 5/26/05
- NRC Form 540, Uniform Low Level Radioactive Waste Manifest, Shipment 05-061
- NRC Form 541, Uniform Low Level Radioactive Waste Manifest Container and Waste Description, container 05-61-1

Calibration Data Sheet Eberline RO-20 Serial Number 0755, 8/17/05

Calibration Data Sheet Bicron Micro-Rem Serial Number E068A, 7/12/05

Calibration Data Sheet Ludlum Model 14C Serial Number 189209, 8/18/05

VC Summer Radioactive Waste Supervisors Trip report for 6/6/05 trip to Duratek

Email from Duratek Radiation Safety Officer to VC Summer Radioactive Waste Supervisor regarding the failure of the Ludlum Model 78 instrument used to measure the dose rate on the seavan upon receipt, dated 1/13/06

Calibration Data Sheet Ludlum Model 78 Serial Number 187475, 1/17/06

Addenda to CER 05-2289 dated 4/10/06

Surry Power Station Calibration Point Comparison for VC Summer Teletector 101890, dated 10/5/05

Instrument Calibration- Maintenance History Teletector 14380, 3/10/1993- 6/13/2005

Instrument Calibration- Maintenance History Teletector 11726, 5/26/1993- 9/04/2004

Calibration Certificate Eberline Teletector 14380, 12/20/2004

Calibration Certificate Eberline Teletector 14380, 7/13/2005

Calibration Certificate Eberline Teletector 11726, 1/28/2005

Calibration Certificate Eberline Teletector 11726, 7/13/2005

H.B. Robinson Comparison Study Eberline RO-20 and Eberline Teletector

Picture of sealand sent to VCS, 5/27/05

ACRONYMS

CER	Condition Evaluation Report
DAW	Dry Active Waste
DOT	United States Department of Transportation
GM	Geiger Mueller
HP	Health Physics
HPP	Health Physics Procedure
mrem/hr	millirem per hour
NRC	United States Nuclear Regulatory Commission