UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA STREET, N.W., SUITE 2900
ATLANTA, GEORGIA 30323-0199

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Report Nos.: 50-280/93-29 and 50-281/93-29

Licensee: Virginia Electric and Power Company
Glen Allen, VA 23060

Docket Nos.: 50-280 and 50-281 License Nos.: DPR-32 and DPR-37

Facility Name: Surry 1 and 2

Inspection Conducted: December 6-10, 1993, and telephone conversation on December 15, 1993

Inspector: William B. Gloersen 12/30/93
W. B. Gloersen Date Signed

Approved by: Thomas R. Decker 1/5/94
R. Decker, Chief Date Signed
Radiological Effluents and Chemistry Section
Radiological Protection and Emergency Preparedness Branch
Division of Radiation Safety and Safeguards

SUMMARY

Scope:

This routine, announced inspection was conducted in the areas of audits, confirmatory measurements, and the status of previously identified inspection findings.

Results:

Followup on a previously identified inspection finding concerning the methodology for measuring gross alpha particle radioactivity in liquid effluent and water samples resulted in a non-cited violation of Technical Specification 6.4.N.3 for an inadequate gross alpha measurement procedure (Paragraph 4.b).

REPORT DETAILS

1. Persons Contacted

Licensee Employees

*W. Benthall, Supervisor, Licensing
*R. Bilyeu, Licensing Engineer
*M. Biron, Supervisor, Radiological Engineering
*P. Blount, Staff Health Physicist
*D. Erickson, Superintendent, Radiological Protection
P. Harris, Health Physics (HP) Technician
*D. Hart, Supervisor, Quality
M. Kansler, Station Manager
R. Lasalle, Supervisor, Radiological Analysis
*M. Olin, Supervisor, HP Technical Services
*J. Price, Assistant Station Manager
G. Topping, Supervisor, Radioactive Material Control

Other licensee employees contacted included engineers, technicians, and office personnel.

Nuclear Regulatory Commission

S. Tingen, Resident Inspector
*J. York, Resident Inspector

*Attended exit meeting on December 10, 1993

2. Status on Previously-Identified Inspection Findings (92701)

(Closed) Inspector Followup Item (IFI) 50-280, 281/93-19-01: Review the methodology for measuring gross alpha particle radioactivity in liquid effluent and water samples.

After a review of this IFI, the inspector noted an apparent violation of Technical Specification (TS) 6.4.N.3 requirements due to an inadequate procedure for gross alpha measurements. This matter was further discussed in Paragraph 4.b of this report.

3. Audits (84750)

TS 6.1.C.2.h requires that audits of unit activities be performed under the cognizance of the Management Safety Review Committee (MSRC) in the following areas: (1) the conformance of facility operation to provisions contained within the TSs and applicable license conditions at least once per 12 months; (2) the radiological environmental monitoring program at least once per 12 months; (3) the OFFSITE DOSE CALCULATION MANUAL (ODCM) and implementing procedures at least once per 12 months; and (4) the PROCESS CONTROL PROGRAM (PCP) and implementing procedures for processing and packaging of radioactive wastes at least once per 12 months.

The inspector reviewed the following audit report:

- QA Audit 93-08: Radiological Protection Audit, dated September 22, 1993

The above audit assessed the adequacy and effectiveness of the radiological protection audit, including shipping and transportation of radioactive materials and radwaste. In general, the audit was thorough, detailed, and well documented. There were no significant findings or followup issues for the Surry site.

No violations or deviations were identified.

4. Confirmatory Measurements (84750)

10 CFR 20.201(a) defines a "survey" as an evaluation of the radiation hazards incident to the production, use, release, disposal, or presence of radioactive materials or other sources of radiation under a specific set of conditions.

10 CFR 20.201(b) requires that each licensee shall make or cause to be made such surveys as: (1) may be necessary for the licensee to comply with the regulations and, (2) are reasonable under the circumstances to evaluate the extent of radioactive hazards that may be present.

a. Laboratory Equipment

The inspector examined the licensee's facilities for performing required radioanalytical measurements of alpha radioactive material in various sampling media. This examination included a review of the licensee's analytical equipment, including the Gamma Products Series 5000 alpha/beta proportional counter.

b. Confirmatory Measurements

During an inspection conducted July 12-16, 1993, the inspector noted a concern with the procedure for the measurement of alpha particle activity in liquid samples (IFI: 50-280, 50-281/93-19-01). It was noted that there was no apparent guidance nor methodology described in the licensee's procedures for correcting for interferences due to solids content in liquid samples containing alpha emitters. According to ASTM D1943-81, Standard Test Method for Alpha Particle Radioactivity of Water, solids content in the sample containing the alpha emitter produces significant losses in sample counting rates of about 10 to 15 percent loss at absorber density thicknesses of 1 mg/cm^2. Liquid samples must be evaporated to dryness onto sample dishes that allow the sample to be "seen" directly by the detector. In effect, the licensee would underestimate the amount of alpha radioactivity in a liquid sample with solids content without the use of an alpha self-absorption correction factor. The inspector

reviewed the gross alpha results for liquid effluent samples during the last four quarters and noted that the gross alpha activity was essentially zero. The inspector also reviewed the quarterly QC cross check results for the third and fourth quarter 1992, and first quarter for 1993. The inspector noted a low bias of approximately 15-20 percent for gross alpha measurements for the time period noted. An inspector followup item was tracked in Inspection Report (IR) 50-280, 50-281/93-19 since it appeared that the licensee's method for measurements of gross alpha particle activity in water was inadequate.

On July 27, 1993, in a telephone conversation initiated by the licensee, licensee and NRC RII representatives discussed the concern regarding the gross alpha analysis procedure for liquid effluent composites. The discussion included a review of a faxed copy of revised procedure HP-7.3A.21, Radioactive Liquid Waste Sampling and Analysis. The revised procedure provided enhanced guidance for sample preparation. The guidance indicated that if high solids were present in the sample (e.g., greater than 1 mg/cm^2 in a planchet), a smaller aliquot may be required to avoid excessive self-attenuation of alpha particles. If less than 50 ml were used, then the licensee would be required to recalculate the lower limit of detection (LLD). The procedural guidance further stated that if high solids were present, then an aliquot should be selected such that the sample to be evaporated contains less than 20 mg of solids. This guidance was based on the information provided in ASTM D1943-81 (noted above) indicating that significant losses in sample counting rates of about 10 to 15 percent occur at absorber density thicknesses of 1 mg/cm^2. The sampling planchets used at Surry were 20 cm^2. Therefore, the 20 mg limit on the weight of the evaporated sample was added to the procedure. The licensee further indicated that liquid waste was processed using a thin film evaporator technology. The resulting distillate was the effluent and, according to the licensee, was essentially demineralized water. The licensee indicated that the distillate samples had produced no build-up on the sample planchet and therefore alpha self attenuation had not been a concern. During the inspection conducted December 6-10, 1993, the inspector reviewed the third and fourth quarter 1993 (post implementation of revised procedure HP-7.3A.21, Radioactive Liquid Waste Sampling and Analysis) cross check program results for gross alpha radioactivity in water and noted that the low biases only ranged from one to seven percent. Although it appeared that the additional information provided by the licensee and the implementation of the revised procedure would rectify the issue noted above, the inspector indicated to the licensee that the methodology for measuring gross alpha particle radioactivity in liquid effluent and water samples including a review of calibration methods and quality control (QC) cross check results would be reviewed further.

During the inspection conducted December 6-10, 1993, the inspector provided to the licensee three capability test samples containing Am-241 and varying amounts of absorber material. The spiked samples were prepared by the Department of Energy's Radiological and Environmental Sciences Laboratory (RESL). The RESL measured activities were as follows:

Table 1

Sample #	Absorber (mg/ml)	Activity (dpm/ml)
1	0	8.3 +/- 4.2%
2	1.3	9.0 +/- 4.2%
3	5.4	8.8 +/- 4.2%

The results of the confirmatory measurements were as follows:

Table 2

Sample #	Concentration (uCi/ml) Licensee	NRC	Resolution	Ratio	Agree
1	4.15E-06	3.74+/-0.16E-06	24	1.11	Yes
2	3.49E-06	4.06+/-0.17E-06	24	0.86	Yes
3	2.58E-06	3.97+/-0.17E-06	24	0.65	No

As can be seen from the data in Table 2, as the amount of absorber increased, the licensee's measurements resulted in underestimating the amount of alpha radioactivity actually present. The NRC's acceptance criteria are listed in Attachment 1. The confirmatory measurement results indicated that the licensee's present method for alpha radioactivity analysis was inadequate. The inadequacy was due to the licensee's procedure lacking a self-absorption curve to correct for the decrease in counting efficiency as the amount of absorber increased. It should be noted that since the inspection in July 1993 (IR 50-280, 50-281/93-19), the licensee had unsuccessfully attempted to develop a self-absorption curve for the Tennelec Products 5000 proportional counter. The study was unsuccessful due to difficulties encountered with the use of boric acid for an absorber. During the exit meeting on December 10, 1993, licensee management committed to have the self-absorption study completed by the end of January 1994.

TS 6.4.N.3 requires that monitoring, sampling, and analysis of radioactive liquid and gaseous effluents be performed in accordance with 10 CFR 20.106 and with the methodology and parameters in the ODCM. The capability to measure alpha radioactivity in water samples for batch and continuous releases is required by VPAP-2103, Offsite Dose Calculation Manual (ODCM), Revision Surry P2-4, Attachment 8. The inspector identified this concern as a violation of TS 6.4.N.3 requirements for failure to

have an adequate procedure to measure gross alpha radioactivity in water samples for batch and continuous releases. This NRC identified violation is not being cited (non-cited violation (NCV)) because the criteria specified in Section VII.B of the NRC Enforcement Policy were satisfied (NCV: 50-280, 281/93-29-01).

c. Quality Control and Quality Assurance

Regulatory Guide 4.15, Quality Assurance for Radiological Monitoring Programs (Normal Operations)- Effluent Streams and the Environment, Revision 1, February 1979, specifies a program acceptable to the NRC to assure the quality of results of measurements of radioactive materials in the effluents and the environment outside nuclear facilities during normal operations. The inspector reviewed the licensee's quality assurance (QA) program with respect to Regulatory Guide 4.15. This inspection included a review of QC and calibration procedures for alpha/beta proportional counting equipment; calibration records; and quality control data. The following procedures were reviewed:

- HP-7.3A.21, Radioactive Liquid Waste Sampling and Analysis, Revision 3, dated July 23, 1993
- HP-9.0.321, Calibration of Gamma Products G-5000, Revision 3, dated June 25, 1992
- HP-9.0.221, Operation of the Gamma Products G-5000, Revision 2, dated April 16, 1992
- HP-9.0.121, Performance Checks of the Gamma Products G-5000, Revision 2, dated June 25, 1992

Except for the concern with HP-7.3A.21 noted above, the procedures were acceptable and readily available for use by the count room analysts. The inspector also reviewed calibration records, daily background, and source checks. The G-5000 had been recalibrated on December 8, 1993, due to the installation of a new detector. The previous calibration had been performed on October 18, 1993. The licensee utilized Am-241 and Tc-99 as calibration sources for the alpha and beta regions of the high voltage plateaus, respectively. Certificates of calibration traceable to the National Institute of Standards and Technology (NIST) were readily available for review. The alpha/beta proportional counter calibration procedure also required the licensee to calculate the LLD for alpha in both liquid and air samples and beta in air samples. In all cases the licensee's sample volume, counting time, and background count rate were acceptable which ensured that the LLD criteria would be met.

One NCV was identified.

5. Exit Meeting

The inspector met with licensee representatives indicated in Paragraph 1 at the conclusion of the inspection on December 10, 1993. The inspector summarized the scope and findings of the inspection, including the N.V. The inspector also discussed the likely informational content of the inspection report with regard to documents or processes reviewed by the inspector during the inspection. The licensee did not identify any proprietary documents or processes during this inspection. Dissenting comments were not received from the licensee.

During a telephone conversation on December 15, 1993, the NRC informed licensee representatives that the violation regarding the methodology for measuring gross alpha particle radioactivity in water samples identified during the exit meeting would become a non-cited NRC-identified violation of TS 6.4.N.3 requirements.

Type	Item Number	Status	Description and Reference
IFI	50-280, 281/93-19-01	Closed	Review the methodology for measuring gross alpha particle radioactivity in liquid effluent and water samples (Paragraph 2).
NCV	50-280, 281/93-29-01	Closed	Failure to have an adequate procedure to measure gross alpha radioactivity in water samples for batch and continuous releases as required by TS 6.4.N.3. (Paragraph 4.b).

ATTACHMENT 1

CRITERIA FOR COMPARING ANALYTICAL MEASUREMENTS

This enclosure provides criteria for comparing results of capability tests and verification measurements. The criteria are based on an empirical relationship which combines prior experience and the accuracy needs of this program.

In this criteria, the judgement limits denoting agreement or disagreement between licensee and NRC results are variable. This variability is a function of the NRC's value to its associated uncertainty. As the ratio of the NRC value to its uncertainty, referred to in this program as the resolution[1] increases, the range of acceptable differences between the NRC and licensee values should be more restrictive. Conversely, poorer agreement between NRC and licensee values must be considered acceptable as the resolution decreases.

For comparison purposes, a comparison ratio[2] of the licensee value to the NRC value for each individual nuclide is computed. This ratio is then evaluated for agreement based on the calculated resolution. The corresponding resolution and calculated ratios which denote agreement are listed in Table 1 below. Values outside of the agreement ratio for a particular nuclide are considered in disagreement.

TABLE 1

Confirmatory Measurements Acceptance Criteria
Resolutions vs. Comparison Ratio

Resolution	Comparison Ratio for Agreement
< 4	0.40 - 2.5
4 - 7	0.50 - 2.0
8 - 15	0.60 - 1.66
16 - 50	0.75 - 1.33
51 - 200	0.80 - 1.25
> 200	0.85 - 1.18

[1] Resolution = $\frac{\text{NRC Reference Value for a Particular Nuclide}}{\text{Associated Uncertainty for the Value}}$

[2] Comparison Ratio = $\frac{\text{Licensee Value}}{\text{NRC Reference Value}}$