



UNITED STATES
NUCLEAR REGULATORY COMMISSION

REGION II
101 MARIETTA ST., N.W.
ATLANTA, GEORGIA 30323

SEP 21 1988

Report Nos.: 50-338/88-26 and 50-339/88-26

Licensee: Virginia Electric and Power Company
Richmond, VA 23261

Docket Nos.: 50-338 and 50-339

License Nos.: NPF-4 and NPF-7

Facility Name: North Anna 1 and 2

Inspection Conducted: August 15-17, 1988

Inspector:

Hugh Bernice
H. Bernice

9/20/88
Date Signed

Accompanying Personnel: J. B. Kahle
T. Volk

Approved by:

John B. Kahle
J. B. Kahle, Section Chief
Division of Radiation Safety and Safeguards

9/20/88
Date Signed

SUMMARY

Scope: This routine, announced inspection was conducted in the areas of Confirmatory Measurements and Counting Room Quality Assurance for in-plant radiochemical analyses.

Results: Overall, the NRC's and the licensee's measurements were in agreement. Biases on the high side were noted in several counting geometries. The licensee was in the process of calibrating the gamma spectrometry systems at the time of the inspection. The licensee agreed to provide Region II with the new calibration data for review and evaluation to determine the comparison of counting data with the new calibration against NRC measurements. No violations or deviations were identified.

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REPORT DETAILS

1. Persons Contacted

Licensee Employees

- *E. Dreyer, Supervisor, Health Physics
- *R. Driscoll, Manager, Quality Assurance
- *G. Kane, Station Manager
- *P. Kemp, Licensing Coordinator
- *K. LeFevre, Sr. Health Physicist (Corporate)
- *D. Vandewalle, Supervisor, Licensing
- M. Young, Counting Room Technician

Other licensee employees contacted included technicians, security office members, and office personnel.

NRC Resident Inspectors

- *J. Caldwell
- L. King

*Attended exit interview

2. Licensee Action on Previous Enforcement Matters

This subject was not addressed in the inspection.

3. Confirmatory Measurements (84725)

During the inspection, reactor coolant, a particulate filter, charcoal cartridges and selected liquid and gaseous samples were obtained by or provided to the licensee for analysis by their gamma spectrometry systems. The licensee's results were compared against those obtained by the inspector from the same samples analyzed by the NRC Region II Mobile Laboratory gamma spectrometry system. The purpose of these comparative measurements was to verify the licensee's capability to accurately identify and quantify gamma-emitting radionuclides in various plant systems and effluent streams. Comparisons were made against the three detectors located in the licensee's health physics counting room.

Sample types compared included the following: (1) degassed reactor coolant, (2) reactor coolant gas (3) waste gas decay tank (4) simulated liquid waste (licensee-spiked), (5) plant stack charcoal cartridge (for iodine determinations), (6) spiked charcoal cartridge (provided by the NRC) and (7) spiked particulate filter (provided by the NRC).

A more detailed description of the sample types and counting geometries along with a comparison of the NRC and licensee results is listed in Attachment 1. The methodology for determining agreement with licensee results is discussed in Attachment 2.

Approximately two months prior to this inspection, the licensee was informed by its Corporate Office of the results of a recent cross-check study of radiation measurement capabilities among the company's facilities. The results of that study showed that the licensee had been overestimating activities in the particulate filter geometry. The licensee then began recalibrating the gamma spectrometry systems and investigated the cause of the disagreements. At the time of the inspection, licensee representatives indicated that the most likely cause of the disagreements was a defective balance used during the preparation of the calibration standards.

Since the new calibration parameters had not been officially incorporated into the counting room operations, the inspector tested the performance of the gamma spectrometry systems using the current (old) calibration parameters.

Results indicated disagreements and biases on the high side for the particulate filter geometry. High results were also noted in the 100 ml liquid Marinelli and charcoal cartridge geometries. Much closer agreement was obtained in the gas chamber and 100 ml liquid geometries.

Initial disagreements associated with cadmium-109 (Cd-109) determinations were attributed to the licensee's use of an older version of computer software. The software's library reflected a gamma decay abundance of approximately 5% while the newer version being currently installed showed an abundance of approximately 3.8%. Disagreements in Cd-109 determinations were resolved as soon as licensee representatives incorporated the updated abundance values into the software.

Disagreements in the determinations of mercury-203 (Hg-203) in the charcoal cartridge geometry were attributed to a substantial difference between the old and the new calculated detection efficiencies for that particular radioisotope. The inspector determined that disagreement in Hg-203 determinations in the charcoal cartridge geometry was not safety-significant since the licensee only used charcoal cartridges for radioiodine determinations, and there were no disagreements in iodine results other than noted biases on the high side.

The inspector requested that the licensee provided the NRC with the new calibration data for analysis to determine whether closer agreement between licensee and NRC values may be obtained. Licensee management agreed to the inspector's request. The inspector indicated that analysis and evaluation of the new calibration data will be considered an Inspector Followup Item (IFI) (50-338,339/88-26-01).

The inspector witnessed the sampling of reactor coolant and gaseous waste decay tanks and determined that sampling techniques and health physics practices were adequate.

No violations or deviations were identified.

3. Quality Assurance - Counting Room Operations

The inspector reviewed quality control data for the licensee's gamma spectrometry systems, liquid scintillation counter and gas-flow proportional counters. Data reviewed included the gamma spectrometer, Beckman LS-100C (liquid scintillation counter) and NMC/PC-5 (alpha-beta counter) daily performance test data for the period July - August 1988.

The inspector also reviewed current voltage plateau determinations for the gas-flow proportional counters, the current annual calibration data package for the gamma spectrometers and the sample logbook.

The inspector verified that standards used during performance tests and calibrations were traceable to the National Bureau of Standards (NBS). However, due to the problems encountered during the previous calibration of the gamma spectrometry systems, the inspector discussed with cognizant licensee management the benefits of cross-checking the accuracy of the calibration standards prepared from NBS-traceable standards. The inspector referred licensee representatives to Regulatory Guide 4.15, "Quality Assurance for Radiological Monitoring Programs (Normal Operations) - Effluent Streams and the Environment," February 1978, for guidance.

The inspector also reviewed the most recent audit of the health physics program performed by the licensee's Corporate Office. A very small portion of the audit covered counting room operations. The audit was general and lacked depth to be able to identify weaknesses in the licensee's health physics program.

No violations or deviations were identified.

4. Followup on Information Notices (92701)

The inspector determined that the following Information Notices (INs) had been received by the licensee, reviewed for applicability, distributed to appropriate personnel and that action, as appropriate, was taken or scheduled.

IN 88-22: Disposal of Sludge from Onsite Sewage Treatment Facilities at Nuclear Power Stations

IN 81-31: Steam Generator Tube Rupture Analysis Deficiency

5. Exit Interview

The inspection scope and findings were summarized on August 19, 1988, with those persons indicated in Paragraph 1 above. The inspector described the areas inspected and discussed in detail the inspection findings. No dissenting comments were received from the licensee.

This licensee did not identify as proprietary any of the material provided to or reviewed by the inspector during this inspection.

ATTACHMENT 1

NRC-LICENSEE SAMPLE COMPARISON EVALUATION
NORTH ANNA NUCLEAR PLANT, AUGUST 15-19, 1988

| SAMPLE | ISOTOPE | LICENSEE CONCENTRATION [uCi/ml] | NRC | RESOLUTION | RATIO LICENSEE/NRC | COMPARISON |
|---|---------|------------------------------------|-----------------|------------|-----------------------|--------------|
| 1. Particulate Filter (RIG Spike) HPGE #1 | | | | | | |
| | Co-60 | 5.40 E-2 | 4.56 ± 0.06 E-2 | 76 | 1.19 | Agreement |
| | Cd-109 | 1.80 E-1 | 1.56 ± 0.02 E-1 | 78 | 1.15 | Agreement |
| | Sr-85 | 9.08 E-3 | 6.69 ± 0.27 E-3 | 25 | 1.36 | Disagreement |
| | Ce-139 | 3.56 E-3 | 2.72 ± 0.08 E-3 | 34 | 1.31 | Agreement |
| | Co-57 | 6.57 E-3 | 4.51 ± 0.09 E-3 | 50 | 1.46 | Disagreement |
| | Y-88 | 1.53 E-2 | 1.27 ± 0.04 E-2 | 52 | 1.20 | Agreement |
| | Cs-137 | 5.11 E-2 | 4.12 ± 0.05 E-2 | 82 | 1.24 | Agreement |
| | Co-60 | 5.65 E-2 | 4.56 ± 0.06 E-2 | 76 | 1.24 | Agreement |
| | Cd-109 | 1.75 E-1 | 1.56 ± 0.02 E-1 | 78 | 1.12 | Agreement |
| | Sr-85 | 8.49 E-3 | 6.69 ± 0.27 E-3 | 25 | 1.27 | Agreement |
| | Ce-139 | 3.31 E-3 | 2.72 ± 0.08 E-3 | 34 | 1.22 | Agreement |
| | Co-57 | 6.37 E-3 | 4.51 ± 0.09 E-3 | 50 | 1.41 | Disagreement |
| | Y-88 | 1.50 E-2 | 1.27 ± 0.04 E-2 | 32 | 1.28 | Agreement |
| | Cs-137 | 5.01 E-2 | 4.12 ± 0.05 E-2 | 82 | 1.22 | Agreement |
| | Co-60 | 5.40 E-2 | 4.56 ± 0.06 E-2 | 76 | 1.18 | Agreement |
| | Cd-109 | 1.69 E-1 | 1.56 ± 0.02 E-1 | 78 | 1.08 | Agreement |
| | Sr-85 | 8.83 E-3 | 6.69 ± 0.27 E-3 | 25 | 1.32 | Agreement |
| | Ce-139 | 3.32 E-3 | 2.72 ± 0.08 E-3 | 24 | 1.22 | Agreement |
| | Co-57 | 6.05 E-3 | 4.51 ± 0.09 E-3 | 50 | 1.34 | Disagreement |
| | Y-88 | 1.51 E-2 | 1.27 ± 0.04 E-2 | 32 | 1.19 | Agreement |
| | Cs-137 | 4.92 E-2 | 4.12 ± 0.05 E-2 | 82 | 1.19 | Agreement |
| | Co-60 | 2.36 E-4 | 2.01 ± 0.02 E-4 | 100 | 1.17 | Agreement |
| | Sr-85 | 1.32 E-4 | 1.05 ± 0.01 E-4 | 105 | 1.26 | Disagreement |
| | Cd-109 | 8.08 E-4 | 9.02 ± 0.13 E-4 | 69 | 0.90 | Agreement |
| | Sr-85 | 1.40 E-4 | 1.22 ± 0.01 E-4 | 122 | 1.15 | Agreement |
| | Ce-139 | 4.20 E-5 | 3.66 ± 0.06 E-5 | 61 | 1.15 | Agreement |
| | Ag-103 | 6.34 E-5 | 5.07 ± 0.06 E-5 | 84 | 1.25 | Agreement |
| | Co-57 | 4.19 E-5 | 3.43 ± 0.05 E-5 | 69 | 1.22 | Agreement |
| | Y-88 | 2.79 E-4 | 2.50 ± 0.02 E-4 | 125 | 1.12 | Agreement |
| | Cs-137 | 1.88 E-4 | 1.74 ± 0.01 E-4 | 174 | 1.08 | Agreement |
| 2. Liquid Marinetti Plant Standard HPGE #1 | | | | | | |

SAMPLE

ISOTOPE

CONCENTRATION (uCi/ml)
REC

RESOLUTION

RATIO
LICENSL/NRC

COMPARISON

HPGE #2

Co-60

2.35 E-4

2.01 ± 0.02 E-4

100

1.17

Agreement

Sr-85

1.27 E-4

1.05 ± 0.01 E-4

105

1.21

Agreement

Cd-109

7.78 E-4

9.02 ± 0.13 E-4

69

0.86

Agreement

Sm-113

1.43 E-4

1.72 ± 0.01 E-4

122

1.17

Agreement

Co-139

4.00 E-5

3.66 ± 0.06 E-5

61

1.09

Agreement

Hg-203

6.18 E-5

5.07 ± 0.06 E-5

84

1.22

Agreement

Co-57

8.22 E-5

3.43 ± 0.05 E-5

69

1.23

Agreement

Y-88

2.90 E-4

2.50 ± 0.02 E-4

125

1.16

Agreement

Cs-137

1.89 E-4

1.74 ± 0.01 E-4

174

1.09

Agreement

HPGE #3

Co-60

2.40 E-4

2.01 ± 0.02 E-4

100

1.19

Agreement

Sr-85

1.28 E-4

1.05 ± 0.01 E-4

105

1.22

Agreement

Cd-109

6.34 E-4

9.02 ± 0.13 E-4

69

0.92

Agreement

Sm-113

1.43 E-4

1.72 ± 0.01 E-4

122

1.17

Agreement

Co-139

4.08 E-5

3.66 ± 0.06 E-5

61

1.11

Agreement

Hg-203

6.26 E-5

5.07 ± 0.06 E-5

84

1.23

Agreement

Co-57

8.10 E-5

3.43 ± 0.05 E-5

69

1.20

Agreement

Y-88

2.83 E-4

2.50 ± 0.02 E-4

125

1.13

Agreement

Cs-137

1.93 E-4

1.74 ± 0.01 E-4

174

1.11

Agreement

3. Charcoal Cartridge
(REC 50100)

HPGE #1

Co-60

5.29 E-2

4.61 ± 0.07 E-2

66

1.15

Agreement

Cd-109

1.07 E-0

1.07 ± 0.01 E-0

107

1.00

Agreement

Sr-113

2.06 E-2

1.69 ± 0.03 E-2

56

1.22

Agreement

Co-139

1.27 E-2

1.07 ± 0.02 E-2

54

1.19

Agreement

Hg-203

5.00 E-3

3.13 ± 0.15 E-3

21

1.60

Disagreement

Co-57

2.27 E-2

1.80 ± 0.02 E-2

90

1.26

Agreement

Y-88

3.07 E-2

2.86 ± 0.06 E-2

48

1.07

Agreement

Cs-137

5.06 E-2

4.47 ± 0.05 E-2

89

1.13

Agreement

Co-60

5.33 E-2

4.61 ± 0.07 E-2

66

1.16

Agreement

Cd-109

1.07 E-0

1.07 ± 0.01 E-0

107

1.00

Agreement

Sm-113

2.03 E-2

1.69 ± 0.03 E-2

56

1.20

Agreement

Co-139

1.20 E-2

1.07 ± 0.02 E-2

54

1.12

Agreement

Hg-203

4.72 E-3

3.13 ± 0.15 E-3

21

1.51

Disagreement

Co-57

2.16 E-2

1.80 ± 0.02 E-2

90

1.20

Agreement

Y-88

3.12 E-2

2.86 ± 0.06 E-2

48

1.09

Agreement

Cs-137

4.90 E-2

4.47 ± 0.05 E-2

89

1.10

Agreement

HPGE #3

Co-60

5.30 E-2

4.61 ± 0.07 E-2

66

1.15

Agreement

Cd-109

1.04 E-0

1.07 ± 0.01 E-0

107

0.97

Agreement

Sm-113

2.04 E-2

1.69 ± 0.03 E-2

56

1.21

Agreement

Co-139

1.24 E-2

1.07 ± 0.02 E-2

54

1.16

Agreement

Hg-203

4.67 E-3

3.13 ± 0.15 E-3

21

1.49

Disagreement

Co-57

2.15 E-2

1.80 ± 0.02 E-2

90

1.19

Agreement

Y-88

3.06 E-2

2.86 ± 0.06 E-2

48

1.07

Agreement

Cs-137

4.96 E-2

4.47 ± 0.05 E-2

89

1.11

Agreement

SAMPLE

| SAMPLE | ISOTOPE | CONCENTRATION (uCi/ml) LICENSEE | RESOLUTION | RATIO LICENSEE/HRC | COMPARISON |
|---|---------|------------------------------------|------------|-----------------------|------------|
| 4. MGD, Gas Bulb HPGE #1 | Xe-133 | 1.06 E-1 | 102 | 1.04 | Agreement |
| | HPGE #2 | 1.11 E-1 | 102 | 1.09 | Agreement |
| | HPGE #3 | 1.02 E-1 | 102 | 1.00 | Agreement |
| 5. Waste Gas Charcoal Cartridge HPGE #1 | 1-131 | 3.54 E-8 | 40 | 1.25 | Agreement |
| | 1-133 | 8.06 E-9 | 16 | 1.14 | Agreement |
| | 1-131 | 2.83 ± 0.07 E-8 | 40 | 1.29 | Agreement |
| | 1-133 | 8.98 E-9 | 16 | 1.27 | Agreement |
| | 1-131 | 2.83 ± 0.07 E-8 | 40 | 1.24 | Agreement |
| | 1-133 | 7.46 E-9 | 16 | 1.06 | Agreement |
| 6. Deaerated Reactor Coolant Sample HPGE #1 | 1-131 | 3.13 ± 0.37 E-3 | 8 | 1.04 | Agreement |
| | 1-132 | 3.56 E-2 | 48 | 0.93 | Agreement |
| | 1-133 | 2.32 ± 0.05 E-2 | 46 | 0.98 | Agreement |
| | 1-134 | 8.05 E-2 | 31 | 0.87 | Agreement |
| | 1-135 | 4.29 E-2 | 20 | 0.90 | Agreement |
| | CS-138 | 1.13 E-1 | 20 | 0.95 | Agreement |
| | 1-131 | 2.91 E-3 | 8 | 0.93 | Agreement |
| | 1-132 | 3.21 E-2 | 48 | 0.84 | Agreement |
| | 1-133 | 2.28 E-2 | 46 | 0.98 | Agreement |
| | 1-134 | 8.24 E-2 | 31 | 0.89 | Agreement |
| | 1-135 | 4.72 E-2 | 20 | 0.99 | Agreement |
| | CS-138 | 1.11 E-1 | 20 | 0.93 | Agreement |
| HPGE #2 | 1-131 | 3.13 ± 0.37 E-3 | 8 | 0.94 | Agreement |
| | 1-132 | 3.62 ± 0.08 E-2 | 48 | 0.89 | Agreement |
| | 1-133 | 2.32 ± 0.05 E-2 | 46 | 1.00 | Agreement |
| HPGE #3 | 1-131 | 3.13 ± 0.37 E-3 | 8 | 0.94 | Agreement |
| | 1-132 | 3.80 E-2 | 48 | 0.89 | Agreement |
| | 1-133 | 2.32 ± 0.05 E-2 | 46 | 1.00 | Agreement |
| 7. Stripped Gas HPGE #1 | 1-131 | 9.60 ± 0.27 E-2 | 36 | 1.24 | Agreement |
| | Kr-85M | 2.16 ± 0.06 E-2 | 36 | 1.03 | Agreement |
| | Kr-87 | 3.36 ± 0.16 E-2 | 21 | 1.15 | Agreement |
| | Kr-88 | 5.16 ± 0.20 E-2 | 26 | 0.98 | Agreement |
| | Xe-133 | 2.33 ± 0.02 E-1 | 116 | 1.03 | Agreement |
| | Xe-135 | 1.61 E-1 | 140 | 1.15 | Agreement |

| SAMPLE | ISOTOPE | CONCENTRATION (uCi/ml) | | RESOLUTION | RATIO LICENSEE/NRC | COMPARISON |
|---------|---------|------------------------|-----------------|------------|-----------------------|------------|
| | | LICENSEE | NRC | | | |
| HPGE #2 | Ar-41 | 1.21 E-1 | 9.64 ± 0.27 E-2 | 36 | 1.26 | Agreement |
| | Kr-85M | 2.95 E-2 | 2.16 ± 0.06 E-2 | 36 | 1.18 | Agreement |
| | Kr-87 | 4.11 E-2 | 3.36 ± 0.16 E-2 | 21 | 1.22 | Agreement |
| | Kr-88 | 5.75 E-2 | 5.16 ± 0.20 E-2 | 26 | 1.11 | Agreement |
| | Xe-133 | 2.67 E-1 | 2.33 ± 0.02 E-1 | 116 | 1.15 | Agreement |
| | Xe-135 | 1.70 E-1 | 1.40 ± 0.01 E-1 | 140 | 1.21 | Agreement |
| HPGE #3 | Ar-41 | 1.19 E-1 | 9.64 ± 0.27 E-2 | 36 | 1.23 | Agreement |
| | Kr-85M | 2.36 E-2 | 2.16 ± 0.06 E-2 | 36 | 1.09 | Agreement |
| | Kr-87 | 3.87 E-2 | 3.36 ± 0.16 E-2 | 21 | 1.15 | Agreement |
| | Kr-88 | 5.31 E-2 | 5.16 ± 0.20 E-2 | 26 | 1.03 | Agreement |
| | Xe-133 | 2.46 E-1 | 2.33 ± 0.02 E-1 | 116 | 1.06 | Agreement |
| | Xe-135 | 1.61 E-1 | 1.40 ± 0.01 E-1 | 140 | 1.15 | Agreement |

ATTACHMENT 2

CRITERIA FOR COMPARING ANALYTICAL MEASUREMENTS

This attachment 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 these 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 relative to its associated uncertainty, referred to in this program as "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 ratio² 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 ratios for a selected nuclide are considered in disagreement.

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

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

TABLE 1

Confirmatory Measurements Acceptance Criteria
Resolutions vs. Comparison Ratio

| <u>Resolution</u> | <u>Comparisons Ratio for Agreement</u> |
|-------------------|--|
| <4 | 0.4 - 2.5 |
| 4 - 7 | 0.5 - 2.0 |
| 8 - 15 | 0.6 - 1.66 |
| 16 - 50 | 0.75 - 1.33 |
| 51 - 200 | 0.80 - 1.25 |
| >200 | 0.85 - 1.18 |