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

JAN 28 1993

Report No: 50-261/93-01

Licensee: Carolina Power and Light Company
P. O. Box 1551
Raleigh, NC 27602

Docket No.: 50-261 License No.: DPR-23

Facility Name: H. B. Robinson Nuclear Power Plant

Inspection Conducted: January 4 - 8, 1993

Inspector: Thomas R Decker for 1/25/93
R. P. Carrion, Radiation Specialist Date Signed

Accompanied by: T. R. Volk, Physical Sciences Technician

Approved by: Thomas R Decker 1/25/93
T. 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 the organization of the Chemistry/Effluent Department and Radioactive Waste Group, confirmatory measurements, plant water chemistry, the Semiannual Radiological Effluent Release Report, radioactive material processing and transportation, and records for decommissioning planning.

Results:

The licensee's organization of its Chemistry/Effluent Department and radioactive material processing and shipping unit satisfied Technical Specification (TS) requirements (Paragraph 2).

The confirmatory measurements comparison showed good agreement between the results of the licensee and the NRC mobile laboratory. The licensee had established a good Counting Room radiochemical analysis program (Paragraph 3).

Plant water chemistry was maintained well within TS limits (Paragraph 4).

The licensee's Semiannual Radioactive Effluent Release Report was complete and satisfied regulatory requirements (Paragraph 5).

The licensee will develop a system to identify and maintain events/incidents significant with respect to decommissioning planning (Paragraph 6).

Radioactive material processing and shipping was conducted in a competent, professional manner (Paragraph 7).

# REPORT DETAILS

1. Persons Contacted

Licensee Employees

*S. Billings, Technical Aide, Regulatory Compliance
*R. Chambers, Plant General Manager
*W. Christensen, Chemistry Supervisor, Environmental and Radiation Control (E&RC)
*C. Dietz, Vice President, Robinson Nuclear Power Division
*J. Eaddy, Supervisor, E&RC Technical Support
*J. Harrison, Manager, Regulatory Compliance
*J. Padgett, Manager, E&RC
R. Slone, Records Management Supervisor

Other licensee employees contacted during this inspection included engineers, technicians, and administrative personnel.

Nuclear Regulatory Commission

L. Garner, Senior Resident Inspector
*C. Ogle, Resident Inspector

*Attended exit interview

Acronyms and Initialisms used throughout this report are listed in the last paragraph.

2. Organization (84750)

Technical Specification (TS) 6.2 describes the licensee's organization.

The inspector reviewed the licensee's organization, staffing levels, and lines of authority as they related to the Chemistry/Effluents Department and Radioactive Waste Group to verify that the licensee had not made organizational changes since the last inspection which would adversely affect the control of radiation exposures and/or radioactive material.

The Environmental and Radiation Control (E&RC) Unit consisted of the same number of positions (sixty) as during the last inspection (92-23), conducted in August. It was still organized into six functional areas: Chemistry/Effluents, Radioactive Waste, Technical Support, and three groups for Job Coverage.

Although some of the technicians had changed due to normal rotation of assignments, the Chemistry/Effluents Unit and the Radioactive Waste Unit had not experienced any changes at all since the previous inspection.

The inspector concluded that the licensee's E&RC organization satisfied TS requirements.

No violations or deviations were identified.

3. Confirmatory Measurements (84750)

10 CFR 20.201(b) requires the licensee to perform surveys as necessary to evaluate the extent of radiation hazards.

To evaluate the licensee's analytical capability to make consistently accurate radioactivity measurements, six samples were analyzed for radionuclide concentrations by the licensee and the NRC Region II mobile laboratory, including: two reactor coolant system (RCS) samples (one which had been collected prior to the inspector's arrival and had decayed for forty-eight hours and another whose collection the inspector observed and had decayed for one and a half hours), a liquid sample from the "D" Waste Condensate Tank, a noble gas sample in the form of RCS stripped gas, a particulate filter loaded with the filtrate of the above-referenced forty-eight hour decay RCS sample, and an NRC-spiked charcoal cartridge. The purpose of these comparative measurements was to verify the licensee's capability to accurately detect and identify gamma-emitting radionuclides and to quantify their concentrations. The licensee analyzed all samples in the Chemistry Counting Room, which was equipped with three Germanium-Lithium (GeLi) gamma spectroscopy detectors, one manufactured by Applied Physical Technology, Inc. (APTEC 1299), one manufactured by Nuclear Data, Inc (PGT 1452), and one manufactured by Gamma Products, Inc. (ORTEC 1602A). The inspector noted that the gamma operating data log was posted on each detector and that it included calibration information for the geometries used by the particular detector to which it was posted.

The inspector reviewed several calibration curves for the detectors used for the confirmatory measurement exercise, including geometries of: a one-liter Marinelli beaker on shelf zero, a 47-millimeter filter on shelf zero, and a 125-milliliter bottle on shelf zero for the APTEC 1299; a one-liter Marinelli beaker on shelf zero, a 1260 cc gas beaker on shelf zero, and a 500-milliliter bottle on shelf zero for the PGT 1452; and an iodine cartridge on shelf zero, a 47-millimeter filter on shelf one, and a 125-milliliter bottle on shelf one for the ORTEC 1602A. The calibration curves were developed using mixed gamma sources (which typically contained Cd-109, Co-57, Ce-139, Hg-203, Sn-113, Cs-137, Co-60, and Y-88) plus Am-241. The licensee used nine sources for various geometry calibrations. The inspector reviewed Certificates of Calibration for several of the sources used to generate the referenced calibration curves. Each source was prepared using an aliquot measured gravimetrically from a calibrated master radionuclide solution source. The calibration had been confirmed by the National Institute of Standards and Technology (NIST) in a Measurements Assurance Program as described in NRC Regulatory Guide 4.15, Rev. 1, dated February 1979. Confirmation was obtained for each gamma ray listed to within the limits stated on the certificate.

The inspector concluded that the calibration curves and Certificates of Calibration were current and sufficient.

Daily performance checks for the detectors were done using Am-241, Co-60, and Cs-137 sources. The inspector reviewed the 1992 control charts for the detectors. Some drifting and biases had been experienced by the detectors and the mean (and the associated warning and control limits) had been adjusted to reflect this behavior.

The inspector reviewed selected portions of Chemistry Procedure CP-003, Revision (Rev.) 13, "Systems Sampling Procedure," effective on August 29, 1992, and Environmental Monitoring Procedure EMP-023, Rev. 16, "Liquid Waste Release and Sampling," effective January 1, 1993. The portions reviewed included sampling instructions and were adequate for the intended purpose. The inspector observed licensee technicians obtain a reactor coolant sample and the liquid sample from the "D" Waste Condensate Tank and noted that the procedures were followed closely as they completed their duties. Proper sampling techniques and health physics practices were utilized.

Attachment 1 provides a comparison of the licensee's results to the NRC's results for each sample. Attachment 2 provides the criteria for assessing the agreement between the analytical results. As indicated in Attachment 1, all licensee results compared favorably with the NRC results, indicating that the licensee's analysis system was capable of identifying isotopes over a wide energy spectrum.

From the observations made during this inspection, the inspector concluded that the licensee demonstrated that a good Count Room radiochemical analysis program was in place.

No violations or deviations were identified.

4. Plant Water Chemistry (84750)

At the time of this inspection, the unit was in its fifteenth fuel cycle. The next refueling outage is scheduled for September, 1993. The inspector reviewed the plant chemistry controls and operational controls affecting plant water chemistry for the period of November 21 through December 25, 1992.

TS 3.1.6 specifies that the concentrations of dissolved oxygen (DO) and chloride in the RCS be maintained below 0.10 parts per million (ppm) and 0.15 ppm, respectively, when the reactor coolant temperature exceeds 250 °F. TS 3.1.4 specifies that the total specific activity of the reactor coolant be limited to less than or equal to 1.0 microcuries/gram ($\mu$Ci/g) dose equivalent iodine (DEI) under all modes of operation.

Table 4.1-2 of TS 4.1 specifies the sampling frequencies for these parameters. These parameters are related to corrosion resistance and fuel integrity. The oxygen parameter is established to maintain oxygen

levels sufficiently low to prevent general and localized corrosion. The chloride parameter is established to provide protection from halide stress corrosion. The activity parameter is established to minimize personnel radiation exposure during operation and maintenance.

Pursuant to these requirements, the inspector reviewed tabular daily summaries which correlated reactor power output to chloride and DO concentrations of the reactor coolant for the five-week period referenced above. Additional summaries for specific activity for the period were reviewed. The inspector determined that the parameters were maintained well below TS limits. Typical values for DO and chloride were less than 0.001 ppm (the LLD (Lower Limit of Detection) for the "light tube" method of analysis) and less than 0.020 ppm (the LLD for the mercuric nitrate titration method of analysis), respectively. The inspector noted that chloride analysis using the ion chromatograph typically yielded concentrations of 0.004 ppm. Typical DEI values at steady-state conditions were 2.0E-4 $\mu$Ci/ml.

There had been no evidence of leaking fuel in calendar 1992 since the unit returned to service following the refueling outage. However, on January 1, 1993, a small tight leak apparently developed in the fuel. Evidence of this development was a rise in the concentrations of I-131 (from 5.84E-5 microcuries per milliliter ($\mu$Ci/ml) to 7.15E-4 $\mu$Ci/ml), DEI (from 4.18E-4 $\mu$Ci/ml to 1.36E-3 $\mu$Ci/ml), and Cs-138 (from 2.61E-3 $\mu$Ci/ml to 1.74E-2 $\mu$Ci/ml), and the I-131/I-133 ratio (from 0.080 to 0.463). These changes occurred between 0214 hours on December 31, 1992 and 0303 hours on January 1, 1993. Since that time, these parameters had exhibited steady to slightly declining behavior. At the time of this inspection, the licensee was continuing to gather information which would be sent to the corporate Nuclear Fuel Division and Siemens for evaluation and discussion about future actions to be taken.

The inspector concluded that the Plant Water Chemistry was being maintained well within the TS requirements.

No violations or deviations were identified.

5. Semiannual Radioactive Effluent Release Report (84750)

TS 6.9.d requires the licensee to submit a Semiannual Radiological Effluent Release Report within the time periods specified covering the operation of the facility during the previous six months of operation. The TS also states the requirements for the content and format of the report. The inspector reviewed the reports for 1991 and compared the results to those of 1989 and 1990 to verify compliance and to determine trends which might have occurred in liquid and gaseous effluent releases. These data are summarized on the following page.

Robinson Radioactive Effluent Release Summary

| | 1990 | 1991 | 1992* |
|---|---|---|---|
| Abnormal Releases | | | |
| Liquid | 0 | 0 | 0 |
| Gaseous | 0 | 0 | 0 |
| Activity Released (curies) | | | |
| a. Liquid | | | |
| 1. Fission and Activation Products | 3.60E-1 | 2.35E-1 | 1.83E-1 |
| 2. Tritium | 3.53E+2 | 1.88E+2 | 3.10E+2 |
| 3. Gross Alpha | 0.00E+0 | < LLD | < LLD |
| b. Gaseous | | | |
| 1. Fission and Activation Gases | 7.21E+0 | 2.26E+0 | 1.11E+0 |
| 2. Iodines | 1.09E-7 | < LLD | 8.43E-7 |
| 3. Particulates | 1.34E-4 | 1.73E-4 | 1.20E-4 |
| 4. Tritium | 4.44E+0 | 4.48E+0 | 1.56E+0 |

*First half of 1992 only.

No abnormal releases were reported in the second half of 1992 by the licensee.

A comparison of data from liquid and gaseous effluents 1990, 1991, and first half of 1992 showed no significant trends.

There were no changes to the Radiological Environmental Monitoring Program (REMP) (as a result of the Land Use Census), the Offsite Dose Calculation Manual (ODCM), or the Radioactive Waste System during the first half of 1992.

However, minor changes to the Process Control Program (PCP) had been made and included the correction of a typographical error, an editorial change (for consistency throughout the PCP), and the update of two position titles to reflect the current organization.

No outside liquid holdup tank or waste gas decay tank exceeded its regulatory limit of ten curies and 1.90E+4 curies, respectively.

Two monitors, FI-1064 and R-16, were reported to be out of service for greater than thirty days during this period. FI-1064, the liquid effluent flowrate measuring device, had originally been declared inoperable in July, 1990 due to erratic readings. The monitor had become obsolete and replacement parts were unavailable. Therefore, an engineering evaluation was initiated to procure a suitable replacement. The replacement was made during refueling outage #14 by plant

modification M-1118 and returned to service on May 30, 1992. R-16, which monitors service water from the containment vessel High Volume Heat (HVH) units, was declared to be inoperable on March 25, 1992 due to erratic readings and failure to respond to a source check. The monitor was returned to service on May 30, 1992. During the period of equipment inoperabilities, compensatory surveillances were initiated, as required by Table 3.5-6 of the TSs.

The following table summarizes solid radwaste shipments for burial or disposal for the previous two and a half years. These shipments typically include spent resins, filter sludges, dry compressible waste, and contaminated equipment.

Robinson Solid Radwaste Shipments

| | 1990 | 1991 | 1992* |
|---|---|---|---|
| Number of Waste Disposal Shipments | 61 | 90 | 48 |
| Volume (cubic meters) | 69.9 | 64.5 | 34.5 |
| Activity (curies) | 61.8 | 95.4 | 47.3 |

*First half of 1992 only.

Through the end of the year (1992), the licensee had made 112 radioactive material shipments, including nine to Scientific Ecology Group, Incorporated (SEG), six to the disposal facility, fifty-seven special, and forty laundry.

For solid radwaste, no significant changes were noted for the period reviewed.

The inspector concluded that the Semiannual Radioactive Effluent Release Report was complete and satisfied regulatory requirements.

No violations or deviations were identified.

6. Decommissioning Planning Records (84750)

10 CFR 50.75(g) requires, in part, that licensees maintain "records of information important to the safe and effective decommissioning of the facility in an identified location until the license is terminated by the Commission." Furthermore, information considered important by the Commission for decommissioning is identified as "records of spills or other unusual occurrences involving the spread of contamination in and around the facility, equipment, or site" and that the records "must include any known information on identification of involved nuclides, quantities, forms, and concentrations." Also identified are "as-built drawings and modifications of structures and equipment in restricted areas where radioactive materials are used and/or stored and of

locations of possible inaccessible contamination such as buried pipes which may be subject to contamination."

During Inspection 92-23, the inspector requested the licensee's decommissioning planning records to verify compliance with the regulations and held discussions with the licensee's Records Management Supervisor to determine program status/effectiveness. The inspector determined that while the subject information was in the licensee's document control vault, in the form of microfiche and drawings, it was not segregated into one readily identifiable area nor was a listing identifying pertinent information for decommissioning planning available. Timely retrieval and proper classification of documentation (both existing and future) could not be guaranteed. The licensee planned to evaluate and develop a system/program patterned after that in place at one of Carolina Power & Light's (CPL's) other nuclear power plants.

During the current inspection, the inspector interviewed the Records Management Supervisor to determine the status of the licensee's program. Per a memorandum sent from the supervisor to senior plant management dated December 21, 1992, a Records Task Force (RTF) was being established to review newly-created records to determine storage/retention requirements, establish the appropriate quality classification (Q or non-Q), and identify indexing parameters to facilitate record retrieval. The RTF was to consist of eight representatives, one from each of the following: Outage and Modifications; Records Management; Document Control; Operations; Technical Support; Maintenance; Regulatory Compliance; and E&RC. The activities of the RTF would encompass all plant records, not only those required for decommissioning planning. The licensee expected to implement the RTF by the end of January 1993. By mid-January, the licensee expected to begin a review of existing records to identify those related to decommissioning planning.

The inspector concluded that the licensee was making satisfactory progress in the implementation of a program to identify relevant decommissioning planning records (both existing and future).

No violations or deviations were identified.

7. Transportation (86750)

10 CFR 71.5(a) requires each licensee who transfers licensed material outside of the confines of its plant or other place of use, or who delivers licensed material to a carrier for transport, shall comply with the applicable requirements of the regulations appropriate to the mode of transport of the Department of Transportation (DOT) in 49 CFR, Parts 170 through 189.

Pursuant to these requirements, the inspector reviewed the licensee's activities affiliated with these requirements, to determine whether the licensee effectively processes, packages, stores, and ships radioactive

solid materials. The licensee's program for the packaging and transportation of radioactive materials was conducted by the Radwaste Group within the E&RC Department. Radwaste was processed and packaged (including the preparation of shipping documentation) by the Radwaste Group.

a. Radioactive Materials Shipment Documentation Packages

Shipment of radioactive materials was the responsibility of the Radioactive Waste Group, which prepared all shipping documents and procured the necessary disposal containers and shipping casks. Radioactive materials shipments were classified into four categories: Casks (for disposal at a burial site); Low Specific Activity (LSA) sent to SEG for incineration and/or compaction prior to final disposal; Special Shipments (including virtually anything from spent fuel to samples containing Limited Quantities); and Laundry. The inspector reviewed two shipping documentation packages for radioactive materials shipments made since the last inspection (August 1992), including Shipment Nos. SEG-92-08 and SEG-92-09, LSA shipments to SEG. The documentation packages were thorough and included shipment information such as unique shipment and shipping container numbers, waste content and volume, total activity, analytical summary and breakdown of isotopes with a half-life greater than five years, a 24-hour emergency telephone number, emergency response information sheets, etc. The radiation and contamination survey results were within the limits specified by 49 CFR and the shipping documents were being maintained as required.

b. Information Notices (INs)

1. IN 92-62

The inspector discussed IN 92-62, "Emergency Response Information Requirements For Radioactive Material Shipments," with cognizant licensee personnel to be sure that the licensee had received it and that the staff was aware of it and its implications. The IN emphasizes that all emergency response information required by DOT regulations must be accurately provided on shipment papers or other documents and that the licensee must be prepared to respond immediately with the information, as needed. Furthermore, the IN indicated that response personnel would expect to be given emergency information within 15 minutes.

The licensee had modified its shipping procedures to ensure that the DOT regulations would be satisfied. Specifically, the licensee's Radwaste/Shipping Group is required to notify Operations when a shipment leaves the site and its destination. In the event of an accident involving the radioactive shipment, Operations will be contacted via the 24-hour emergency telephone number listed on the shipping

papers. Operations will record pertinent information on a newly-developed information sheet. At the bottom of the sheet, the names and beeper numbers of five Radiation Control Supervisors are provided and Operations has been instructed to contact one of them for specific guidance. Previously, the 24-hour number was answered by Security, but problems had arisen and the decision was made to give the responsibility to Operations.

2. IN 92-72

The inspector discussed IN 92-72, "Employee Training and Shipper Registration Requirements for Transporting Radioactive Materials," with cognizant licensee personnel to be sure that the licensee had received it and that the staff was aware of its implications in ensuring regulatory compliance when shipping packages containing radioactive materials. The corporate training department was reviewing the IN to assure that the issues raised were covered in future training.

The inspector concluded that the licensee had good programs in place for the handling and shipping of radioactive material and that they were effectively implemented.

8. Exit Interview

The inspection scope and results were summarized on January 8, 1993, with those persons indicated in Paragraph 1. The inspector described the areas inspected and discussed the inspection results, including likely informational content of the inspection report with regard to documents and/or processes reviewed during the inspection. The licensee did not identify any such documents or processes as proprietary. Dissenting comments were not received from the licensee.

9. Acronyms and Initialisms

APTEC - Applied Physical Technology, Inc.
CFR - Code of Federal Regulations
Ci - curie
CP - Chemistry Procedure
CPL - Carolina Power and Light
DEI - Dose Equivalent Iodine
DO - Dissolved Oxygen
DOT - Department of Transportation
E&RC - Environmental and Radiation Control
EMP - Environmental Monitoring Procedure
F - Fahrenheit
g - gram
GeLi - Germanium-Lithium
HVH - High Volume Heat
IN - Information Notice

l - liter
LLD - Lower Limit of Detection
LSA - Low Specific Activity
$\mu$Ci - micro-Curie (1.0E-6 Ci)
ml - milli-liter
NIST - National Institute of Standards and Technology
No. - Number
NRC - Nuclear Regulatory Commission
ODCM - Off-site Dose Calculation Manual
PCP - Process Control Program
ppm - parts per million
RCS - Reactor Coolant System
REMP - Radiological Environmental Monitoring Program
Rev - Revision
RTF - Records Task Force
SEG - Scientific Ecology Group, Incorporated
TS - Technical Specification

ATTACHMENT 1

COMPARISON OF NRC AND ROBINSON ANALYTICAL RESULTS
JANUARY 4-8, 1993

Type of Sample: Unit 2 Reactor Coolant System (RCS)
Sample Container: NRC 50 ml bottle
Robinson 125 ml bottle

| Radio-nuclide | Licensee's Value ($\mu$Ci/ml) | NRC Value ($\mu$Ci/ml) | Reso-lution | Ratio | Compar-ison |
|---|---|---|---|---|---|
| APTEC 1299 Detector | | | | | |
| Ar-41 | 3.12E-3 | (3.38 +/- 0.12)E-3 | 28 | 0.92 | Agree |
| Ce-139 | 3.44E-5 | (6.69 +/- 1.65)E-5 | 4 | 0.51 | Agree |
| Co-58 | 1.74E-4 | (1.69 +/- 0.15)E-4 | 11 | 1.03 | Agree |
| I-131 | 3.05E-4 | (2.32 +/- 0.29)E-4 | 8 | 1.31 | Agree |
| I-132 | 1.45E-3 | (1.18 +/- 0.06)E-3 | 20 | 1.23 | Agree |
| I-133 | 9.27E-4 | (6.90 +/- 0.55)E-4 | 13 | 1.34 | Agree |
| I-135 | 1.17E-3 | (1.26 +/- 0.08)E-3 | 16 | 0.92 | Agree |
| Kr-85m | 1.79E-3 | (1.74 +/- 0.07)E-3 | 25 | 1.03 | Agree |
| Kr-87 | 2.20E-3 | (2.28 +/- 0.16)E-3 | 14 | 0.96 | Agree |
| Na-24 | 1.31E-3 | (1.15 +/- 0.04)E-3 | 29 | 1.14 | Agree |
| ORTEC 1602A Detector | | | | | |
| Ar-41 | 3.06E-3 | (3.38 +/- 0.12)E-3 | 28 | 0.91 | Agree |
| Ce-139 | 1.10E-4 | (6.69 +/- 1.65)E-5 | 4 | 1.64 | Agree |
| Co-58 | 1.91E-4 | (1.69 +/- 0.15)E-4 | 11 | 1.13 | Agree |
| I-131 | 3.07E-4 | (2.32 +/- 0.29)E-4 | 8 | 1.32 | Agree |
| I-132 | 1.40E-3 | (1.18 +/- 0.06)E-3 | 20 | 1.19 | Agree |
| I-133 | 9.75E-4 | (6.90 +/- 0.55)E-4 | 13 | 1.41 | Agree |
| I-135 | 1.11E-3 | (1.26 +/- 0.08)E-3 | 16 | 0.88 | Agree |
| Kr-85m | 1.73E-3 | (1.74 +/- 0.07)E-3 | 25 | 0.99 | Agree |
| Kr-87 | 2.30E-3 | (2.28 +/- 0.16)E-3 | 14 | 1.01 | Agree |
| Na-24 | 1.30E-3 | (1.15 +/- 0.04)E-3 | 29 | 1.13 | Agree |
| PGT 1452 Detector | | | | | |
| Ar-41 | 2.95E-3 | (3.38 +/- 0.12)E-3 | 28 | 0.87 | Agree |
| Ce-139 | 7.10E-5 | (6.69 +/- 1.65)E-5 | 4 | 1.06 | Agree |
| Co-58 | 2.03E-4 | (1.69 +/- 0.15)E-4 | 11 | 1.20 | Agree |
| I-131 | 3.18E-4 | (2.32 +/- 0.29)E-4 | 8 | 1.37 | Agree |
| I-132 | 1.47E-3 | (1.18 +/- 0.06)E-3 | 20 | 1.25 | Agree |
| I-133 | 9.68E-4 | (6.90 +/- 0.55)E-4 | 13 | 1.40 | Agree |
| I-135 | 1.14E-3 | (1.26 +/- 0.08)E-3 | 16 | 0.90 | Agree |
| Kr-85m | 1.79E-3 | (1.74 +/- 0.07)E-3 | 25 | 1.03 | Agree |
| Kr-87 | 2.54E-3 | (2.28 +/- 0.16)E-3 | 14 | 1.11 | Agree |
| Na-24 | 1.34E-3 | (1.15 +/- 0.04)E-3 | 29 | 1.16 | Agree |

Type of Sample: Unit 2 Reactor Coolant System (RCS) (48-hour decay)
Sample Container: one-liter Marinelli container

| Radio-nuclide | Licensee's Value (μCi/ml) | NRC Value (μCi/ml) | Reso-lution | Ratio | Compar-ison |
|---|---|---|---|---|---|
| APTEC 1299 Detector | | | | | |
| Ce-144 | 2.84E-5 | (2.69 +/- 0.31)E-5 | 9 | 1.06 | Agree |
| Co-58 | 3.85E-6 | (3.82 +/- 0.48)E-6 | 8 | 1.01 | Agree |
| Co-60 | 5.17E-6 | (3.80 +/- 0.61)E-6 | 6 | 1.36 | Agree |
| Cs-134 | 2.60E-5 | (2.49 +/- 0.14)E-5 | 18 | 1.04 | Agree |
| Cs-136 | 7.30E-6 | (7.04 +/- 0.62)E-6 | 11 | 1.03 | Agree |
| Cs-137 | 2.01E-5 | (2.00 +/- 0.11)E-5 | 18 | 1.01 | Agree |
| I-131 | 4.66E-4 | (4.89 +/- 0.36)E-4 | 14 | 0.95 | Agree |
| I-133 | 1.14E-3 | (1.10 +/- 0.05)E-3 | 22 | 1.03 | Agree |
| Mn-54 | 1.13E-5 | (1.08 +/- 0.06)E-5 | 18 | 1.05 | Agree |
| Mo-99 | 3.47E-5 | (5.33 +/- 0.56)E-5 | 10 | 0.65 | Agree |
| Na-24 | 1.27E-3 | (1.24 +/- 0.05)E-3 | 25 | 1.02 | Agree |
| ORTEC 1602A Detector | | | | | |
| Ce-144 | 2.15E-5 | (2.69 +/- 0.31)E-5 | 9 | 0.80 | Agree |
| Co-58 | 3.87E-6 | (3.82 +/- 0.48)E-6 | 8 | 1.01 | Agree |
| Co-60 | 6.11E-6 | (3.80 +/- 0.61)E-6 | 6 | 1.60 | Agree |
| Cs-134 | 2.60E-5 | (2.49 +/- 0.14)E-5 | 18 | 1.04 | Agree |
| Cs-136 | 7.75E-6 | (7.04 +/- 0.62)E-6 | 11 | 1.10 | Agree |
| Cs-137 | 2.05E-5 | (2.00 +/- 0.11)E-5 | 18 | 1.03 | Agree |
| I-131 | 4.74E-4 | (4.89 +/- 0.36)E-4 | 14 | 0.97 | Agree |
| I-133 | 1.15E-3 | (1.10 +/- 0.05)E-3 | 22 | 1.05 | Agree |
| Mn-54 | 1.12E-5 | (1.08 +/- 0.06)E-5 | 18 | 1.04 | Agree |
| Mo-99 | 3.89E-5 | (5.33 +/- 0.56)E-5 | 10 | 0.73 | Agree |
| Na-24 | 1.20E-3 | (1.24 +/- 0.05)E-3 | 25 | 0.97 | Agree |
| PGT 1452 Detector | | | | | |
| Ce-144 | 2.41E-5 | (2.69 +/- 0.31)E-5 | 9 | 0.90 | Agree |
| Co-58 | 3.86E-6 | (3.82 +/- 0.48)E-6 | 8 | 1.01 | Agree |
| Co-60 | 5.12E-6 | (3.80 +/- 0.61)E-6 | 6 | 1.35 | Agree |
| Cs-134 | 2.71E-5 | (2.49 +/- 0.14)E-5 | 18 | 1.09 | Agree |
| Cs-136 | 6.65E-6 | (7.04 +/- 0.62)E-6 | 11 | 0.94 | Agree |
| Cs-137 | 1.96E-5 | (2.00 +/- 0.11)E-5 | 18 | 0.98 | Agree |
| I-131 | 4.57E-4 | (4.89 +/- 0.36)E-4 | 14 | 0.93 | Agree |
| I-133 | 1.13E-3 | (1.10 +/- 0.05)E-3 | 22 | 1.03 | Agree |
| Mn-54 | 1.03E-5 | (1.08 +/- 0.06)E-5 | 18 | 0.95 | Agree |
| Mo-99 | 3.66E-5 | (5.33 +/- 0.56)E-5 | 10 | 0.69 | Agree |
| Na-24 | 1.24E-3 | (1.24 +/- 0.05)E-3 | 25 | 1.00 | Agree |

Type of Sample: Waste Condensate Tank "D" Liquid
Sample Container: one-liter Marinelli container

| Radio-nuclide | Licensee's Value (μCi/ml) | NRC Value (μCi/ml) | Reso-lution | Ratio | Compar-ison |
|---|---|---|---|---|---|
| APTEC 1299 Detector | | | | | |
| Ag-110m | 1.28E-6 | (1.22 +/- 0.12)E-6 | 10 | 1.05 | Agree |
| Co-58 | 4.74E-7 | (2.85 +/- 0.93)E-7 | 3 | 1.66 | Agree |
| Co-60 | 2.55E-6 | (1.94 +/- 0.23)E-6 | 8 | 1.31 | Agree |
| ORTEC 1602A Detector | | | | | |
| Ag-110m | 1.13E-6 | (1.22 +/- 0.12)E-6 | 10 | 0.93 | Agree |
| Co-58 | 3.47E-7 | (2.85 +/- 0.93)E-7 | 3 | 1.22 | Agree |
| Co-60 | 2.68E-6 | (1.94 +/- 0.23)E-6 | 8 | 1.38 | Agree |
| PGT 1452 Detector | | | | | |
| Ag-110m | 1.29E-6 | (1.22 +/- 0.12)E-6 | 10 | 1.06 | Agree |
| Co-58 | 4.12E-7 | (2.85 +/- 0.93)E-7 | 3 | 1.45 | Agree |
| Co-60 | 2.68E-6 | (1.94 +/- 0.23)E-6 | 8 | 1.38 | Agree |

Type of Sample: Charcoal Cartridge (NRC spike)

| Radio-nuclide | Licensee's Value (μCi) | NRC Value (μCi) | Reso-lution | Ratio | Compar-ison |
|---|---|---|---|---|---|
| APTEC 1299 Detector | | | | | |
| Cd-109 | 2.33E-1 | (2.93 +/- 0.09)E-1 | 33 | 0.80 | Agree |
| Ce-139 | 7.64E-4 | (7.15 +/- 0.62)E-4 | 12 | 1.07 | Agree |
| Co-57 | 3.13E-3 | (3.37 +/- 0.13)E-3 | 26 | 0.93 | Agree |
| Co-60 | 3.77E-2 | (4.09 +/- 0.14)E-2 | 29 | 0.92 | Agree |
| Cs-137 | 4.53E-2 | (4.58 +/- 0.20)E-2 | 23 | 0.99 | Agree |
| ORTEC 1602A Detector | | | | | |
| Cd-109 | 2.25E-1 | (2.93 +/- 0.09)E-1 | 33 | 0.77 | Agree |
| Ce-139 | 7.20E-4 | (7.15 +/- 0.62)E-4 | 12 | 1.01 | Agree |
| Co-57 | 2.95E-3 | (3.37 +/- 0.13)E-3 | 26 | 0.88 | Agree |
| Co-60 | 3.72E-2 | (4.09 +/- 0.14)E-2 | 29 | 0.91 | Agree |
| Cs-137 | 4.44E-2 | (4.58 +/- 0.20)E-2 | 23 | 0.97 | Agree |
| PGT 1452 Detector | | | | | |
| Cd-109 | 2.23E-1 | (2.93 +/- 0.09)E-1 | 33 | 0.76 | Agree |
| Ce-139 | 7.40E-4 | (7.15 +/- 0.62)E-4 | 12 | 1.03 | Agree |
| Co-57 | 2.98E-3 | (3.37 +/- 0.13)E-3 | 26 | 0.88 | Agree |
| Co-60 | 3.75E-2 | (4.09 +/- 0.14)E-2 | 29 | 0.92 | Agree |
| Cs-137 | 4.37E-2 | (4.58 +/- 0.20)E-2 | 23 | 0.95 | Agree |

Type of Sample: Stripped Gas Sample
Sample Container: One-liter gas Marinelli container

| Radio-nuclide | Licensee's Value (μCi/cc) | NRC Value (μCi/cc) | Reso-lution | Ratio | Compar-ison |
|---|---|---|---|---|---|
| APTEC 1299 Detector | | | | | |
| Ar-41 | 1.14E-2 | (1.18 +/- 0.04)E-2 | 30 | 0.97 | Agree |
| Kr-85m | 5.41E-3 | (5.18 +/- 0.18)E-3 | 29 | 1.04 | Agree |
| Kr-87 | 7.30E-3 | (6.74 +/- 0.37)E-3 | 18 | 1.08 | Agree |
| Kr-88 | 1.17E-2 | (9.51 +/- 0.35)E-3 | 27 | 1.23 | Agree |
| Xe-133 | 1.11E-1 | (1.29 +/- 0.04)E-1 | 32 | 0.86 | Agree |
| Xe-133m | 2.91E-3 | (2.36 +/- 0.26)E-3 | 9 | 1.23 | Agree |
| Xe-135 | 3.28E-2 | (2.65 +/- 0.09)E-2 | 29 | 1.24 | Agree |
| ORTEC 1602A Detector | | | | | |
| Ar-41 | 1.15E-2 | (1.18 +/- 0.04)E-2 | 30 | 0.97 | Agree |
| Kr-85m | 5.29E-3 | (5.18 +/- 0.18)E-3 | 29 | 1.02 | Agree |
| Kr-87 | 7.57E-3 | (6.74 +/- 0.37)E-3 | 18 | 1.12 | Agree |
| Kr-88 | 1.14E-2 | (9.51 +/- 0.35)E-3 | 27 | 1.20 | Agree |
| Xe-133 | 1.14E-1 | (1.29 +/- 0.04)E-1 | 32 | 0.88 | Agree |
| Xe-133m | 2.73E-3 | (2.36 +/- 0.26)E-3 | 9 | 1.16 | Agree |
| Xe-135 | 3.33E-2 | (2.65 +/- 0.09)E-2 | 29 | 1.26 | Agree |
| PGT 1452 Detector | | | | | |
| Ar-41 | 1.14E-2 | (1.18 +/- 0.04)E-2 | 30 | 0.97 | Agree |
| Kr-85m | 5.54E-3 | (5.18 +/- 0.18)E-3 | 29 | 1.07 | Agree |
| Kr-87 | 7.20E-3 | (6.74 +/- 0.37)E-3 | 18 | 1.07 | Agree |
| Kr-88 | 1.17E-2 | (9.51 +/- 0.35)E-3 | 27 | 1.23 | Agree |
| Xe-133 | 1.11E-1 | (1.29 +/- 0.04)E-1 | 32 | 0.86 | Agree |
| Xe-133m | 3.02E-3 | (2.36 +/- 0.26)E-3 | 9 | 1.28 | Agree |
| Xe-135 | 3.32E-2 | (2.65 +/- 0.09)E-2 | 29 | 1.25 | Agree |

Type of Sample: Particulate Filter (RCS 48-hour filtrate)

| Radio-nuclide | Licensee's Value (μCi) | NRC Value (μCi) | Reso-lution | Ratio | Compar-ison |
|---|---|---|---|---|---|
| APTEC 1299 Detector | | | | | |
| Co-58 | 1.08E-4 | (9.62 +/- 0.32)E-5 | 30 | 1.12 | Agree |
| Co-60 | 7.65E-6 | (6.50 +/- 0.32)E-6 | 20 | 1.17 | Agree |
| Cr-51 | 1.13E-4 | (1.04 +/- 0.13)E-4 | 8 | 1.09 | Agree |
| Mn-54 | 1.14E-6 | (8.72 +/- 1.02)E-7 | 9 | 1.31 | Agree |
| Nb-95 | 1.70E-5 | (1.50 +/- 0.06)E-5 | 25 | 1.13 | Agree |
| Zr-95 | 1.95E-5 | (1.73 +/- 0.08)E-5 | 22 | 1.13 | Agree |
| Zr-97 | 2.85E-5 | (2.20 +/- 0.21)E-5 | 10 | 1.30 | Agree |

ORTEC 1602A Detector

| | | | | | |
|---|---|---|---|---|---|
| Co-58 | 1.08E-4 | (9.62 +/- 0.32)E-5 | 30 | 1.12 | Agree |
| Co-60 | 7.55E-6 | (6.50 +/- 0.32)E-6 | 20 | 1.16 | Agree |
| Cr-51 | 1.12E-4 | (1.04 +/- 0.13)E-4 | 8 | 1.08 | Agree |
| Mn-54 | 9.70E-7 | (8.72 +/- 1.02)E-7 | 9 | 1.11 | Agree |
| Nb-95 | 1.74E-5 | (1.50 +/- 0.06)E-5 | 25 | 1.16 | Agree |
| Zr-95 | 1.95E-5 | (1.73 +/- 0.08)E-5 | 22 | 1.13 | Agree |
| Zr-97 | 2.82E-5 | (2.20 +/- 0.21)E-5 | 10 | 1.28 | Agree |

PGT 1452 Detector

| | | | | | |
|---|---|---|---|---|---|
| Co-58 | 1.09E-4 | (9.62 +/- 0.32)E-5 | 30 | 1.13 | Agree |
| Co-60 | 8.15E-6 | (6.50 +/- 0.32)E-6 | 20 | 1.25 | Agree |
| Cr-51 | 1.16E-4 | (1.04 +/- 0.13)E-4 | 8 | 1.12 | Agree |
| Mn-54 | 1.04E-6 | (8.72 +/- 1.02)E-7 | 9 | 1.19 | Agree |
| Nb-95 | 1.75E-5 | (1.50 +/- 0.06)E-5 | 25 | 1.17 | Agree |
| Zr-95 | 1.97E-5 | (1.73 +/- 0.08)E-5 | 22 | 1.14 | Agree |
| Zr-97 | 2.99E-5 | (2.20 +/- 0.21)E-5 | 10 | 1.36 | Agree |

ATTACHMENT 2

# CRITERIA FOR COMPARISONS OF ANALYTICAL MEASUREMENTS

This attachment provides criteria for the comparison of results of analytical radioactivity measurements. These criteria are based on empirical relationships which combine prior experience in comparing radioactivity emission, and the accuracy needs of this program.

In these criteria, the "Comparison Ratio Limits"[1] denoting agreement or disagreement between licensee and NRC results are variable. This variability is a function of the ratio of the NRC's analytical value relative to its associated statistical and analytical uncertainty, referred to in this program as "Resolution".[2]

For comparison purposes, a ratio between the licensee's analytical value and the NRC's analytical value is computed for each radionuclide present in a given sample. The computed ratios are then evaluated for agreement of disagreement bases on "Resolution." The corresponding values for "Resolution" and the "Comparison Ratio Limits" are listed in the Table below. Ratio values which are either above or below the "Comparison Ratio Limits" are considered to be in disagreement, while ratio values within or encompassed by the "Comparison Ratio Limits" are considered to be in agreement.

TABLE

NRC Confirmatory Measurements Acceptance Criteria
Resolution vs.Comparison Ratio Limits

| Resolution | Comparison Ratio Limits for Agreement |
|---|---|
| < 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 |

[1]Comparison Rario = $\frac{\text{Licensee Value}}{\text{NRC Reference Value}}$

[2]Resolution = $\frac{\text{NRC Reference Value}}{\text{Associated Uncertainty}}$