APPENDIX

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

NRC Inspection Report: 50-382/88-05 Operating License: NPF-38

Docket: 50-382

Licensee: Louisiana Power & Light Company (LP&L)
317 Baronne Street
New Orleans, Louisiana 70160

Facility Name: Waterford Steam Electric Station, Unit 3 (Wat-3)

Inspection At: Wat-3 Site, Taft, St. Charles Parish, Louisiana

Inspection Conducted: March 7-11, 1988

Inspectors: J. Blair Nicholas 4/7/88
J. B. Nicholas, Senior Radiation Specialist Date
Facilities Radiological Protection Section

R. Wise 3/31/88
R. Wise, Radiation Specialist, Facilities Date
Radiological Protection Section

Approved: Blaine Murray 4/7/88
B. Murray, Chief, Facilities Radiological Date
Protection Section

Inspection Summary

Inspection Conducted March 7-11, 1988 (Report 50-382/88-05)

Areas Inspected: Routine, unannounced inspection of the licensee's chemistry/radiochemistry program and water chemistry and radiochemistry confirmatory measurements.

Results: Within the areas inspected, no violations or deviations were identified. One previously identified violation and one unresolved item were closed. See paragraph 2.

DETAILS

1. Persons Contacted

LP&L

*R. P. Barkhurst, Vice President, Nuclear (Site Director)
*N. S. Carns, Plant Manager
*R. E. Allen, Senior Chemistry Engineer - Nuclear
K. P. Boudreaux, Senior Health Physics Technician
C. E. Brannon, Senior Chemistry Technician
M. J. Campo, Chemistry Technician
*G. L. Dolese, Radiochemistry Supervisor
B. P. Falqoust, Senior Chemistry Technician
*C. R. Gaines, Events Analysis Supervisor
W. L. Gilboy, Senior Chemistry Technician
*T. O. Gray, Quality Assurance (QA) Supervisor, Operations
M. L. Layton, Nuclear Operations and Support Assessment Engineer
*H. C. Lesan, Radiological Engineer
D. G. Marse, Senior Chemistry Technician
D. L. McBride, Senior Chemistry Technician
D. O. Medina, Chemistry Technician
J. V. Messina, QA Auditor, Operations
*B. G. Morrison, Licensing Engineer
*J. M. O'Hern, Technical Training Superintendent
P. V. Prasankumar, Assistant Plant Manager, Plant Technical Services
*S. Ramzy, Assistant Radiation Protection Superintendent
*D. A. Thorpe, Radiochemistry Engineer
E. V. Wright, Senior Chemistry Technician
*G. E. Wuller, Operational Licensing Supervisor

NRC

W. F. Smith, NRC Senior Resident Inspector, Wat-3
T. R. Staker, NRC Resident Inspector, Wat-3

*Denotes those present during the exit interview on March 11, 1988.

2. Followup On Previously Identified Inspection Findings (92701/92702)

(Closed) Violation 382/8706-01: Failure to Properly Store and Protect Quality Assurance Records - This violation was identified in NRC Inspection Report 50-382/87-06 and involved the failure to properly store original records of radioactive waste shipments performed during 1986 and 1987 and transmit these records in a timely manner to permanent plant records for final retention. The NRC inspectors reviewed the licensee's response and corrective actions to the violation. The licensee had purchased and placed in the Radwaste Supervisor's office in the reactor auxiliary building a lockable, one-hour rated fireproof file cabinet for

interim storage of radwaste shipping records. The NRC inspector verified the use of the fireproof file cabinet for interim storage and noted that all completed records of radioactive waste shipments had been transmitted to permanent plant records for final retention. The NRC inspectors reviewed the procedure change to Radwaste Departmental Procedure, RW-1-200, "Record Preparation, Filing, and Storage," Revision 1, June 26, 1987, and determined that the procedure requirements for record storage and retention were being met.

(Closed) Unresolved Item 382/8706-02: Procurement and Selection of Packaging - This item was identified in NRC Inspection Report 50-382/87-06 and involved the licensee possibly not applying to the Director, Office of Nuclear Material Safety and Safeguards, in writing, to use specific certified shipping packages prior the licensee's first use. The licensee was able to locate copies of the their application and the NRC approval letter licensing LP&L as a licensed user of specific certified shipping packages prior to their use by the licensee during 1986. The NRC inspectors reviewed the required documents and determined that the licensee had made application and received approval to use specific certified shipping packages prior to their use.

3. Followup On Licensee-Identified Problem (92705)

Contaminated Environmental Drinking/Surface Water Samples: Environmental drinking/surface water samples composited between January 18 and February 15, 1988, were found to be potentially contaminated with Cs-134 and Cs-137 by the licensee's environmental contractor laboratory. The licensee has investigated the problem and determined that the source of the contamination was a contaminated bottle of 6N hydrochloric acid used to acidify the environmental samples prior to shipping them to the offsite laboratory for analysis. The licensee self-identified the potential violation regarding the transfer of an unknown amount of licensed radioactive material to an offsite laboratory. The NRC inspectors have reviewed the results of the licensee's investigation of this self-identified problem and find the licensee's evaluation, immediate corrective actions, and actions initiated to prevent a recurrence of the incident satisfactory to meet the requirements of 10 CFR Part 2, Appendix C, and therefore, a Notice of Violation will not be issued.

4. Open Items Identified During This Inspection

An open item is a matter that requires further review and evaluation by the NRC inspector. Open items are used to document, track, and ensure adequate followup on matters of concern to the NRC inspector. The following open item was identified:

Open Item	Title	Paragraph
382/8805-01	Post Accident Sampling System (PASS)	9

5. Inspector Observations

The following are observations the NRC inspectors discussed with the licensee during the exit interview on March 11, 1988. These observations are not violations, deviations, unresolved items, or open items. These observations were identified for licensee consideration for program improvement, but the observations have no specific regulatory requirements. The following observations are identified in paragraphs 8 and 11 of this report. The licensee stated that these observations would be evaluated.

a. Quality Control Charts - The licensee had not established criteria to identify and evaluate data biases in daily or periodic quality control analyses of water chemical parameters (see paragraph 8).

b. Quality Assurance of Contractor Laboratory - The licensee was not including in the audit of the licensee's contractor laboratory a detailed review of the laboratories quality control program for specific contract radioanalytical analyses (see paragraph 11).

6. Organization and Management Controls (83722/83522)

The NRC inspectors reviewed the licensee's organization, staffing, identification and correction of program weaknesses, audits and appraisals, communication to employees, and documentation and implementation of the chemistry/radiochemistry section (C/RS) to determine adherence to commitments in Chapter 13 of the Final Safety Analysis Report (FSAR) and the requirements in Section 6.2 of the Technical Specifications (TS).

The NRC inspectors verified that the organizational structures of the corporate nuclear operations and support assessment (NOSA) organization and the Wat-3 C/RS were as defined in the FSAR and TS. The NOSA and C/RS staff assignments and management controls were reviewed for the assignment of responsibiiities for the management and implementation of the corporate NOSA chemistry/radiochemistry group and the Wat-3 chemistry/radiochemistry programs. The NRC inspectors verified that the administrative control and program implementing responsibilities specified in the FSAR and Wat-3 procedures were being implemented.

The NRC inspectors reviewed the staffing of the corporate NOSA chemistry/radiochemistry group and the Wat-3 C/RS. It was noted that the staffing of the NOSA chemistry/radiochemistry group had been reduced to one position since the previous NRC inspection in this area in October 1986. The NOSA chmistry/radiochemistry group had lost both previous staff members and the Wat-3 C/RS had lost its secondary chemistry engineer, secondary chemistry supervisor, and six chemistry technicians. The one NOSA chemist position had been filled by the former secondary chemistry supervisor, the secondary chemistry engineer position was filled by one of the former NOSA chemists, and the secondary chemistry supervisor position had been filled by one of the senior chemistry technicians. The

six chemistry technician position vacancies had been filled with new personnel. Four of the six new chemistry technicians had no prior nuclear power plant chemistry experience. The NRC inspectors determined that the NOSA chemistry/radiochemistry group had experienced a 100 percent turnover in personnel and the C/RS personnel turnover had been approximately 50 percent in the past 16 months. The Wat-3 staffing of the NOSA chemistry/radiochemistry group and C/RS was determined to be in accordance with licensee commitments.

No violations or deviations were identified.

7. Training and Qualifications (83723/83523)

The NRC inspectors reviewed the licensee's training and qualification program for C/RS personnel including education and experience, adequacy and quality of training, employee knowledge, qualification requirements, new employees, Institute of Nuclear Power Operations (INPO) accreditation, and audits and appraisals to determine adherence to commitments in Chapter 13 of the FSAR and the requirements in Sections 6.3 and 6.4 of the TS.

The NRC inspector reviewed the education and experience of the present corporate NOSA chemistry/radiochemistry personnel and Wat-3 C/RS staff and determined that all but four recently hired chemistry technicians met the experience qualification requirements of ANSI N18.1-1971. The NRC inspectors also verified that all the C/RS personnel met the required qualifications specified in the FSAR, TS, and position descriptions. A review of shift staffing for the C/RS indicated that all shifts had a lead technician meeting the qualification requirements of ANSI N18.1-1971. It was determined that the licensee had an adequate, qualified staff to meet shift staffing requirements.

THe NRC inspectors reviewed the licensee's training program for C/RS personnel including a review of the chemistry training instructor's qualifications, training facilities, chemistry technician training procedure, chemistry technician training course descriptions, chemistry training schedules for 1987 and 1988, and C/RS personnel training records. The NRC inspectors found that the licensee's chemistry training program was being implemented and documented in accordance with Wat-3 procedures. It was determined that the Wat-3 nuclear training department had received INPO accreditation.

No violations or deviations were identified.

8. Light Water Reactor Water Chemistry Control and Chemical Analysis (79701/79501)

The NRC inspectors reviewed the licensee's water chemistry program including establishment and implementation of a water chemistry control program, sampling, facilities and equipment, establishment and implementation of a quality control program for chemical measurements, and

water chemistry confirmatory measurements to determine adherence to commitments in Chapters 5, 9, 10, and 11 of the FSAR and the requirements in Sections 3/4.4.6, 6.8.1, and 6.8.4 of the TS.

The NRC inspectors' review of the water chemistry program found that the licensee had revised and approved administrative procedures, surveillance procedures, chemical control procedures, instrument calibration and quality control procedures, and analytical procedures. A review of selected procedures revised and written since the previous NRC inspection in October 1986 indicated that the C/RS had established sufficient programmatic procedures to meet the requirements of the FSAR and TS.

The NRC inspectors inspected the facilities and equipment used by the C/RS staff. The following facilities were inspected: water chemistry laboratory, radiochemistry laboratory, radiochemistry counting room, and health physics counting room. The laboratories and counting rooms were equipped with the necessary chemicals, reagents, labware, and analytical instrumentation to perform the required analyses.

The NRC inspectors reviewed selected chemistry department procedures for operation, calibration, and quality control of the instrumentation used for analysis of the NRC water chemistry standards to determine the adequacy and effectiveness of the licensee's chemistry measurement quality control program. It was observed that the licensee was using quality control charts to trend quality control data collected from daily or periodic quality control analyses of chemical parameters. However, the licensee had not established, in the water chemistry quality control program, criteria to identify and evaluate data biases in calibration and quality control data and changes or trends in instrument performance. This observation was discussed with the licensee during the inspection and at the exit interview. The licensee agreed to evaluate the NRC inspectors' observation and consider actions for program improvements.

During the inspection, standard chemical solutions were provided to the licensee for confirmatory measurements analyses. The standards were analyzed by the licensee using routine methods and equipment. The results of the measurement comparisons are summarized in Attachments 1, 2, and 3 to this report.

No violations or deviations were identified.

9. Quality Assurance and Confirmatory Measurements for In-plant Radiochemical Analysis (84725/84525)

The NRC inspectors reviewed the licensee's radiochemical analysis program including procedures, facilities and equipment, implementation of a quality control program, PASS sample analyses, and radioanalytical confirmatory measurements to determine adherence to commitments in Chapters 5, 9, and 11 of the FSAR and the requirements in Sections 3/4.4.6, 6.8.1, and 6.8.4 of the TS.

The NRC inspectors reviewed selected procedures and documents revised and approved since the previous NRC inspection in October 1986 and determined that the licensee had established and implemented sufficient programmatic procedures to meet the FSAR and TS requirements.

The NRC inspectors reviewed the licensee's records for the period January through December 1987 involving instrument calibration and quality control. It was verified that the radiochemistry counting room instruments had been calibrated according to procedures and an instrument quality control program had been implemented.

The NRC inspectors verified that the PASS equipment and associated procedures satisfied the requirements of NUREG-0737, Item II.B.3, for representative sampling and analysis of reactor coolant and containment atmosphere following a reactor incident. Since the previous NRC inspection of PASS in October 1986, the licensee has installed a newly designed PASS operating panel and has been performing a test program on the PASS modifications to demonstrate the proper functioning of all the PASS equipment. The licensee demonstrated PASS operability by collecting several diluted samples of reactor coolant. However, it was noted that the new modifications have not corrected the problem of being able to degas the reactor coolant sample and perform an accurate analysis of the reactor coolant dissolved hydrogen and radioactive gaseous isotopes. The root cause of this sampling problem has been determined to be gas sample leakage past the solenoid sampling valves due to design defects which do not allow the sampling valves to seat properly. The licensee is presently having a valve manufacturer design a different type of valve for this specific sampling application. The licensee has not been able to completely test and declare the PASS totally available for use. However, the NRC inspectors determined that the licensee had completed testing of all other functions of the PASS and could collect reactor coolant and containment atmosphere samples for analysis. This item is considered an open item pending licensee completion of the modifications to the PASS and successful testing of the reactor coolant degasification portion of the PASS. (382/8805-01)

During the inspection, radiological confirmatory measurements were performed on standards and split samples by the licensee and the NRC inspectors in the Region IV mobile laboratory. The standards and samples were analyzed by the licensee using routine methods and equipment. The results of the measurements comparisons are summarized in Attachments 1, 4, and 5.

No violations or deviations were identified.

10. Quality Assurance Program (79701/79501; 84725/84525)

The NRC inspectors reviewed the licensee's NOSA surveillance and QA surveillance and audit programs regarding C/RS activities to determine adherence with commitments in Chapter 13.4 of the FSAR and the requirements in Section 6.5.2.8 of the TS.

2. Radiological Confirmatory Measurements

Confirmatory measurements were performed on the following standards and samples in the Region IV mobile laboratory at Waterford-3 Steam Electric Station during the inspection:

(1) Reactor Coolant Liquid Sample (20 ml Scintillation Vial)

(2) Reactor Coolant Gas Sample (33 cc Gas Sphere)

(3) Particulate Filter Standard (47 mm Filter 24838-109)

(4) Scott Charcoal Cartridge Sample

(5) Liquid Waste Sample (1 liter Marinelli Beaker)

(6) Waste Gas Tank "C" Gas Sample (33 cc Gas Sphere)

(7) Waste Gas Tank "C" Gas Sample (33 cc Gas Sphere)

(8) Reactor Coolant Tritium Sample (20 ml Scintillation Vial)

(9) Charcoal Cartridge Sample F&J Type

The confirmatory measurements tests consisted of comparing measurements made by the licensee and the NRC mobile laboratory. The NRC's mobile laboratory measurements are referenced to the National Bureau of Standards (NBS) by laboratory intercomparisons. Confirmatory measurements are made only for those nuclides identified by the NRC as being present in concentrations greater than 10 percent of the respective isotopic values for liquid and gas concentrations as stated in 10 CFR Part 20, Appendix B, Table II. Attachment 5 contains the criteria used to compare results.

At the time of the inspection, the licensee had three detectors in the radiochemistry counting room and two detectors in the health physics counting room. One of the radiochemistry counting room detectors was out of service. All five detectors are used for routine isotopic analysis of radioactive samples to demonstrate compliance with TS and regulatory requirements. The detectors labeled (1) and (3) are located and maintained in the radiochemistry counting room and are primarily used for isotopic analysis of reactor coolant system samples. The detectors labeled (O) and (H) are located and maintained in the health physics counting room and are used primarily for isotopic analysis of radioactive waste samples and building atmosphere. The licensee performed the tritium analysis on their liquid scintillation counting system. The individual sample analyses and comparison of analytical results of the confirmatory measurements are tabulated in Attachment 4.

The licensee's chemistry section gamma isotopic results from the listed samples in Attachment 4 showed 100 percent agreement with the NRC's analysis results and the licensee's health physics section gamma isotopic results from the listed samples showed 94 percent agreement with the NRC's analysis results. The licensee's tritium result was in agreement with the NRC's analysis result.

ATTACHMENT 1

Analytical Measurements

1. Water Chemistry Confirmatory Measurements

During the inspection, standard chemical solutions were provided to the licensee for analysis. The standard solutions were prepared by the Brookhaven National Laboratory (BNL), Safety and Environmental Protection Division, for the NRC. The standards were analyzed by the licensee using routine methods and equipment. The analysis of chemical standards is used to verify the licensee's capability to monitor chemical parameters in various plant systems with respect to Technical Specification requirements and other industry standards. In addition, the analyses of standards are used to evaluate the licensee's analytical procedures with respect to accuracy and precision.

The results of the measurements comparison are listed in Attachment 2. Attachment 3 contains the criteria used to compare results. All standards were analyzed in triplicate. The licensee's original analytical results indicated that 21 of the 30 results were in agreement. Two chloride results and one sulfate result were originally found in disagreement. The licensee's chloride quality control standard read low and the sulfate quality control standard read high. The licensee recalibrated the ion chromatograph and reran the chloride and sulfate standards. The rerun result for the low chloride concentration remained in disagreement, but the rerun results for the sulfate concentrations were all in agreement. The licensee's original fluoride results were all in disagreement. The licensee reconditiond the selective ion electrode and reran the fluoride standards. The rerun result for the high fluoride concentration remained in disagreement. The licensee's original high concentration result for iron was biased low and in disagreement. There was not enough BNL standard to attempt a rerun. The licensee's original low concentration result for ammonia was biased high as was the ammonia quality control standard. The licensee prepared a new dilution of BNL standard 86M for the low concentration range and reran the ammonia analysis. The rerun result for ammonia was in agreement. The licensee's original mid-range concentration result for hydrazine was biased low as was the hydrazine quality control standard. The licensee recalibrated the spectrometer for hydrazine and reran the BNL hydrazine standards. The rerun results for hydrazine were all in agreement. The unresolved disagreements are not considered to indicate any significant programmatic problems. The licensee's final analysis results showed 90 percent agreement with the BNL results based on 27 agreement results out of 30 total results compared.

As part of the inspection, actual inplant samples were split between the licensee and the NRC in order to verify the licensee's measurement capabilities on actual plant water samples. The analyses will be performed by the licensee using their normal analytical methods and instrumentation and by BNL. Upon completion of the analyses by both laboratories, the results will be documented in a subsequent NRC inspection report.

The NRC inspectors reviewed the surveillance and audit schedules for 1987 and 1988, NOSA and QA surveillance and audit plans and checklists, and the qualifications of surveillance inspectors and auditors. Surveillances and audit reports of NOSA and QA activities performed during 1987 in the areas of secondary chemistry, radiochemistry, chemistry training, and PASS were reviewed for scope to ensure thoroughness of program evaluation. The NRC inspectors noted that the NOSA surveillances and QA surveillances and audits were designed to determine compliance with the FSAR, TS, and Wat-3 procedures. The NRC inspectors verified that surveillance and audit findings had been reviewed by licensee's management and that responses and corrective actions to findings had been documented in accordance with QA procedures. The NRC inspectors determined that the surveillances and audits were performed by qualified personnel knowledgeable in chemistry/radiochemistry activities at nuclear power facilities.

No violations or deviations were identified.

11. Contractor Activities (84725/84525)

The licensee uses a contractor laboratory to perform TS required radiochemistry analyses on several radioactive effluent composite samples. The licensee's program for oversight of contractor laboratory activities and the quality control of analytical measurements by the contractor laboratory were reviewed to verify adherence to the requirements in Sections 3/4.11 and 6.5.2.8 of the TS and agreement with the recommendations of Regulatory Guide (RG) 4.15.

The licensee performs vendor audits triannually with annual evaluations to retain current status on the qualified vendors list. The NRC inspectors reviewed the audit performed on the licensee's contractor laboratory in April 1987 and verified that the contractor had been approved for the required analyses and placed on the current qualified vendors list. It was observed that the area of quality control of radiological monitoring analyses was not addressed in sufficient detail to determine the scope and thoroughness of the audit in this area in regard to specific analyses requested in the contract by the licensee. The observation was discussed with the licensee's representatives at the exit interview. The licensee agreed to evaluate the NRC inspectors' observation.

No violations or deviations were identified.

12. Exit Interview

The NRC inspectors met with the licensee representatives denoted in paragraph 1 at the conclusion of the inspection on March 11, 1988. The NRC inspectors summarized the scope of the inspection and discussed the inspection findings, inspector observations, and the results of the water chemistry and radiochemistry confirmatory measurements as presented in this report.

Confirmatory measurements were performed by the licensee and a contractor laboratory on two liquid radiochemistry samples prepared by the Radiological Environmental Sciences Laboratory (RESL) in Idaho Falls, Idaho. The samples were provided to the licensee in July 1987. The analytical results were compared to the known sample activities and the results of the comparisons are presented in Attachment 4, sample 10. The licensee's results were in 100 percent agreement with the certified activities.

ATTACHMENT 2

Water Chemistry Confirmatory Measurements Results

Waterford-3 SES

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1. Chloride Analysis (5-25 ppb)

Sample	Method	WAT-3 Results (ppb)	NRC Results (ppb)	WAT-3/NRC Ratio	Comparison Decision
86A	IC	8.40±0.50	12.10±1.60	0.69±0.10	Disagreement
86B		18.20±0.30	18.70±0.60	0.97±0.04	Agreement
86C		4.90±0.20	4.03±0.11	1.22±0.06	Disagreement
Rerun					
86A		8.50±0.60	12.10±1.60	0.71±0.11	Disagreement
86B		18.90±0.20	18.70±0.60	1.01±0.03	Agreement
86C		14.80±0.30	16.10±0.40	0.92±0.04	Agreement

2. Fluoride Analysis (50-500 ppb)

Sample	Method	WAT-3 Results (ppb)	NRC Results (ppb)	WAT-3/NRC Ratio	Comparison Decision
86A	SIE	39.70±0.60	46.20±1.00	0.86±0.02	Disagreement
86B		149.30±0.60	174.00±8.00	0.86±0.04	Disagreement
86C		137.70±0.60	334.00±11.0	0.41±0.10	Disagreement
Rerun					
86A		49.30±1.20	46.20±1.00	1.07±0.04	Agreement
86B		171.70±2.90	174.00±8.00	0.99±0.05	Agreement
86C		420.00±0.00	334.00±11.0	1.26±0.10	Disagreement

3. Sulfate Analysis (5-25 ppb)

Sample	Method	WAT-3 Results (ppb)	NRC Results (ppb)	WAT-3/NRC Ratio	Comparison Decision
86A	IC	9.60±0.70	10.00±0.50	0.96±0.08	Agreement
86B		17.90±0.30	20.50±1.20	0.87±0.05	Disagreement
86C		4.80±0.40	4.04±0.15	1.19±0.11	Agreement
Rerun					
86A		10.20±0.70	10.00±0.50	1.02±0.09	Agreement
86B		19.70±0.50	20.50±1.20	0.97±0.06	Agreement
86C		15.60±0.30	16.20±0.60	0.97±0.04	Agreement

4. Boron Analysis (100-2000 ppm)

Sample	Method	WAT-3 Results (ppm)	NRC Results (ppm)	WAT-3/NRC Ratio	Comparison Decision
86F	MT	99.4±0.5	98.9±1.20	1.01±0.01	Agreement
86E		596.6±2.5	604.8±9.20	0.99±0.02	Agreement
86F		994.8±2.6	989.4±12.2	1.01±0.01	Agreement

5. Iron Analysis (0.5-20 ppm)

Sample	Method	WAT-3 Results (ppm)	NRC Results (ppm)	WAT-3/NRC Ratio	Comparison Decision
86G	AAF	5.13±0.02	4.89±0.35	1.05±0.08	Agreement
86H		9.47±0.02	9.55±0.34	0.99±0.04	Agreement
86I		13.31±0.01	14.70±0.42	0.91±0.02	Disagreement

6. Copper Analysis (0.5-20 ppm)

Sample	Method	WAT-3 Results (ppm)	NRC Results (ppm)	WAT-3/NRC Ratio	Comparison Decision
86G	AAF	4.60±0.01	4.68±0.24	0.98±0.05	Agreement
86H		9.43±0.01	9.66±0.49	0.98±0.05	Agreement
86I		14.22±0.03	14.50±0.60	0.98±0.05	Agreement

7. Sodium Analysis (0.5-5 ppm)

Sample	Method	WAT-3 Results (ppm)	NRC Results (ppm)	WAT-3/NRC Ratio	Comparison Decision
86J	AAF	5.06±0.02	4.58±0.50	1.10±0.12	Agreement
86K		2.59±0.01	2.31±0.20	1.12±0.09	Agreement
86L		1.55±0.01	1.44±0.08	1.08±0.06	Agreement

8. Ammonia Analysis (0.5-5 ppm)

Sample	Method	WAT-3 Results (ppm)	NRC Results (ppm)	WAT-3/NRC Ratio	Comparison Decision
86M	SPEC	2.13±0.01	1.75±0.11	1.22±0.08	Disagreement
86N		3.03±0.01	3.14±0.26	0.96±0.08	Agreement
86O		5.03±0.01	4.69±0.43	1.07±0.10	Agreement
Rerun					
86M		1.94±0.02	1.75±0.11	1.11±0.07	Agreement

9. Hydrazine Analysis (5-250 ppb)

Sample	Method	WAT-3 Results (ppb)	NRC Results (ppb)	WAT-3/NRC Ratio	Comparison Decision
86P	SPEC	21.0±0.0	22.3±1.4	0.94±0.06	Agreement
86Q		52.3±0.6	56.9±0.7	0.92±0.02	Disagreement
86R		100.0±1.0	104.0±1.0	0.96±0.02	Agreement
Rerun					
86P		21.7±0.6	22.3±1.4	0.97±0.07	Agreement
86Q		54.0±1.0	56.9±0.7	0.95±0.03	Agreement
86R		108.0±0.0	104.0±1.0	1.04±0.02	Agreement

10. Silica Analysis (10-500 ppb)

Sample	Method	WAT-3 Results (ppb)	NRC Results (ppb)	WAT-3/NRC Ratio	Comparison Decision
86S	SPEC	53.3±0.60	54.3± 5.6	0.98±0.10	Agreement
86T		109.0±0.00	109.0± 7.0	1.00±0.06	Agreement
86U		328.0±1.00	320.0±10.0	1.03±0.03	Agreement

Analysis Method Definitions:

Ion Chromatograph - IC
Plazma Emission Spectroscopy - PES
Atomic Absorption Graphite Furnace - AAGF
Atomic Absorption Flame - AAF
Selective Ion Electrode - SIE
Manitol Titration - MT
Spectroscopy - SPEC

ATTACHMENT 3

CRITERIA FOR COMPARING ANALYTICAL MEASUREMENTS

This attachment provides criteria for comparing results of capability tests. In these criteria the judgement limits are based on the uncertainty of the ratio of the licensee's value to the NRC value. The following steps are performed:

(1) The ratio of the licensee's value to the NRC value is computed

$$\left(\text{ratio} = \frac{\text{Licensee's Value}}{\text{NRC VALUE}}\right); \text{ and}$$

(2) the uncertainty of the ratio is propagated.[1]

If the absolute value of one minus the ratio is less than or equal to twice the ratio uncertainty, the results are in agreement.

$$(|1-\text{ratio}| \leq 2 \times \text{uncertainty})$$

$$Z = \frac{X}{Y}, \text{ then } \frac{S_z^2}{Z^2} = \frac{S_x^2}{X^2} + \frac{S_y^2}{Y^2}$$

[1] (From: Bevington, P. R., Data Reduction and Error Analysis for the Physical Sciences, McGraw-Hill, New York, 1969)

ATTACHMENT 4

Radiological Confirmatory Measuresment Results

Waterford-3 SES

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1. Reactor Coolant Liquid (20cc Scintillation Vial)
(Sampled: 08:05, CST, March 9, 1988)

Sample analyzed by radiochemistry on detector (1).

Nuclide	WAT-3 Results (uCi/ml)	NRC Results (uCi/ml)	WAT-3/NRC Ratio	Comparison Decision
I-131	4.428±0.042E-2	4.917±0.029E-2	0.90	Agreement
	4.545±0.022E-2		0.92	Agreement
I-132	1.322±0.007E-1	1.397±0.006E-1	0.95	Agreement
	1.253±0.006E-1		0.90	Agreement
I-133	1.239±0.005E-1	1.386±0.004E-1	0.89	Agreement
	1.284±0.003E-1		0.93	Agreement
I-134	1.893±0.025E-1	2.067±0.019E-1	0.92	Agreement
	1.717±0.049E-1		0.83	Agreement
I-135	1.633±0.021E-1	1.750±0.015E-1	0.93	Agreement
	1.653±0.014E-1		0.94	Agreement
Cs-134	9.193±0.351E-3	1.089±0.027E-2	0.84	Agreement
	9.449±0.197E-3		0.87	Agreement
Cs-137	1.108±0.036E-2	1.138±0.026E-2	0.97	Agreement
	1.096±0.018E-2		0.96	Agreement
Cs-138	1.721±0.039E-1	1.884±0.026E-1	0.91	Agreement
	1.752±0.181E-1		0.93	Agreement

2. Reactor Coolant Gas Sample (33cc Gas Sphere)
(Sampled: 10:15, CST, March 9, 1988)

Sample analyzed by radiochemistry on detector (1).

Nuclide	WAT-3 Results (uCi/cc)	NRC Results (uCi/cc)	WAT-3/NRC Ratio	Comparison Decision
Ar-41	1.315±0.084E-2	1.123±0.044E-2	1.17	Agreement
Xe-133	1.982±0.002E+0	1.737±0.001E+0	1.14	Agreement
Xe-133m	4.787±0.239E-2	4.420±0.094E-2	1.08	Agreement

RCS Gas Sample Cont'd

Nuclide	WAT-3 Results (uCi/cc)	NRC Results (uCi/cc)	WAT-3/NRC Ratio	Comparison Decision
Xe-135	4.964±0.009E-1	4.679±0.005E-1	1.06	Agreement
Xe-135m	7.572±0.169E-2	6.533±0.495E-2	1.16	Agreement
Kr-85m	1.115±0.004E-1	1.026±0.002E-1	1.09	Agreement
Kr-87	1.269±0.012E-1	1.154±0.007E-1	1.10	Agreement
Kr-88	2.215±0.014E-1	2.020±0.007E-1	1.10	Agreement

3. Particulate Filter Standard (47 mm Filter 24838-109)
(Standardized: 02:00, CST, March 10, 1988)

Standard analyzed by health physics on detectors (O) and (H).

Nuclide	WAT-3 Results (uCi/Sample)	NRC Results (uCi/Sample)	WAT-3/NRC Ratio	Comparison Decision
Cd-109	1.206±0.002E+0	1.029±0.002E+0	1.17	Agreement
	1.178±0.002E+0		1.14	Agreement
Co-57	2.768±0.007E-2	2.329±0.006E-2	1.19	Disagreement
	2.694±0.009E-2		1.16	Agreement
Ce-139	1.731±0.007E-2	1.482±0.005E-2	1.17	Agreement
	1.678±0.008E-2		1.13	Agreement
Hg-203	9.106±0.071E-3	7.994±0.057E-3	1.14	Agreement
	8.893±0.076E-3		1.11	Agreement
Sn-113	2.626±0.015E-2	2.212±0.011E-2	1.19	Disagreement
	2.536±0.016E-2		1.15	Agreement
Cs-137	5.675±0.023E-2	4.574±0.017E-2	1.24	Disagreement
	5.415±0.023E-2		1.18	Agreement
Y-88	3.059±0.022E-2	2.535±0.016E-2	1.21	Agreement
	2.927±0.021E-2		1.15	Agreement
Co-60	4.510±0.025E-2	3.937±0.021E-2	1.15	Agreement
	4.300±0.024E-2		1.09	Agreement

4. Scott Charcoal Cartridge Sample
(Sampled: 08:20, CST, March 10, 1988)

Sample analyzed by health physics on detectors (D) and (H).

Nuclide	WAT-3 Results (uCi/Sample)	NRC Results (uCi/Sample)	WAT-3/NRC Ratio	Comparison Decision
I-131	2.717±0.037E-3	2.527±0.031E-3	1.08	Agreement
	2.780±0.043E-3		1.10	Agreement
I-133	1.522±0.034E-3	1.329±0.029E-3	1.15	Agreement
	1.484±0.035E-3		1.12	Agreement

5. Liquid Waste Sample (1 liter Marinelli)
(Sampled: 10:35, CST, March 10, 1988)

Sample analyzed by radiochemistry and health physics on detectors (1), (D), and (H).

Nuclide	WAT-3 Results (uCi/ml)	NRC Results (uCi/ml)	WAT-3/NRC Ratio	Comparison Decision
Na-24	1.032±0.107E-6	1.397±0.119E-6	0.74	Agreement
	1.503±0.139E-6		1.08	Agreement
	1.649±0.156E-6		1.18	Agreement
Mn-54	1.680±0.170E-6	1.625±0.113E-6	1.03	Agreement
	1.731±0.127E-6		1.07	Agreement
	1.639±0.155E-6		1.01	Agreement
Co-58	3.123±0.035E-5	2.993±0.028E-5	1.04	Agreement
	3.231±0.035E-5		1.08	Agreement
	3.599±0.037E-5		1.20	Agreement
Co-60	4.157±0.179E-6	4.307±0.133E-6	0.97	Agreement
	4.478±0.164E-6		1.04	Agreement
	5.240±0.166E-6		1.22	Agreement
I-131	3.175±0.031E-5	3.314±0.028E-5	0.96	Agreement
	3.296±0.035E-5		0.99	Agreement
	3.348±0.035E-5		1.01	Agreement
I-133	1.411±0.025E-5	1.448±0.025E-5	0.97	Agreement
	1.509±0.041E-5		1.04	Agreement
	1.502±0.042E-5		1.04	Agreement
Cs-134	2.492±0.036E-5	2.526±0.028E-5	0.99	Agreement
	2.509±0.032E-5		0.99	Agreement
	2.528±0.032E-5		1.00	Agreement
Cs-137	3.190±0.040E-5	3.319±0.032E-5	0.96	Agreement
	3.251±0.037E-5		0.98	Agreement
	3.345±0.038E-5		1.01	Agreement

6. Waste Gas Tank "C" Gas Sample (33cc Gas Bulb)
(Sampled: 13:05, CST, March 9, 1988)

Sample analyzed by radiochemistry on detectors (1) and (3).

Nuclide	WAT-3 Results (uCi/cc)	NRC Results (uCi/cc)	WAT-3/NRC Ratio	Comparison Decision
Kr-85m	9.746±1.211E-5	9.502±0.681E-5	1.03	Agreement
	1.060±0.138E-4		1.12	Agreement
Kr-85	8.019±1.334E-3	9.157±0.430E-3	0.88	Agreement
	1.082±0.121E-2		1.18	Agreement
Xe-131m	5.474±0.381E-3	6.336±0.167E-3	0.86	Agreement
	7.113±0.371E-3		1.12	Agreement
Xe-133m	2.156±0.057E-3	2.191±0.032E-3	0.98	Agreement
	2.369±0.086E-3		1.08	Agreement
Xe-133	3.602±0.003E-1	3.311±0.001E-1	1.09	Agreement
	3.759±0.003E-1		1.14	Agreement
Xe-135	3.255±0.020E-3	3.241±0.010E-3	1.00	Agreement
	3.318±0.024E-3		1.02	Agreement

7. Waste Gas Tank "C" Gas Sample (33cc Gas Bulb)
(Sampled: 17:24, CST, March 10, 1988)

Sample analyzed by health physics on detectors (D) and (H).

Nuclide	WAT-3 Results (uCi/cc)	NRC Results (uCi/cc)	WAT-3/NRC Ratio	Comparison Decision
Kr-85	1.149±0.102E-2	9.263±0.531E-3	1.24	Agreement
	9.433±1.129E-3		1.02	Agreement
Xe-131m	5.930±0.454E-3	6.866±0.230E-3	0.86	Agreement
	7.642±0.524E-3		1.11	Agreement
Xe-133m	1.755±0.070E-3	1.579±0.034E-3	1.11	Agreement
	1.825±0.079E-3		1.16	Agreement
Xe-133	3.484±0.005E-1	2.998±0.002E-1	1.16	Agreement
	3.493±0.006E-1		1.17	Agreement
Xe-135	4.207±0.112E-4	4.116±0.053E-4	1.02	Agreement
	4.528±0.153E-4		1.10	Agreement

8. Reactor Coolant Tritium Sample (20 ml Scintillation Vial)
(Sampled: 08:08, CST, March 9, 1988)

Nuclide	WAT-3 Results (uCi/ml)	NRC Results (uCi/ml)	WAT-3/NRC Ratio	Comparison Decision
H-3	4.789E-2	5.599±0.106E-2	0.86	Agreement

9. Charcoal Cartridge Sample F&J Type
(Sampled: 14:05, CST, March 10, 1988)

Sample analyzed by health physics on detectors (D) and (H).

Nuclide	WAT-3 Results (uCi/Sample)	NRC Results (uCi/Sample)	WAT-3/NRC Ratio	Comparison Decision
I-131	2.101±0.034E-3	1.744±0.059E-3	1.20	Agreement
	2.083±0.037E-3		1.19	Agreement
I-133	1.591±0.038E-3	1.331±0.068E-3	1.20	Agreement
	1.707±0.042E-3		1.28	Agreement

10. RESL Unknown Liquid Sample
(Standardized: 12:00, MST, January 11, 1987)

Nuclide	WAT-3 Results (uCi/ml)	NRC Results (uCi/ml)	WAT-3/NRC Ratio	Comparison Decision
Mn-54	2.60E-5	2.37±0.05E-5	1.10	Agreement
Co-60	2.08E-5	2.27±0.05E-5	0.92	Agreement
Cs-137	3.55E-5	3.34±0.10E-5	1.06	Agreement
Fe-55	7.00±0.50E-5	8.16±0.16E-5	0.85	Agreement
Sr-89	1.70±0.10E-4	1.83±0.05E-4	0.93	Agreement
Sr-90	1.70±0.10E-5	1.65±0.07E-5	1.03	Agreement
H-3	1.22E-4	1.34±0.03E-4	0.91	Agreement
Fe-59		5.66±0.23E-6		

NRC results were taken from the standard certification supplied to the NRC Region IV office as prepared by RESL and traceable to the National Bureau of Standards.

ATTACHMENT 5

CRITERIA FOR COMPARING ANALYTICAL MEASUREMENTS

The following are the criteria used in comparing the results of capability tests and verification measurements. The criteria are based on an empirical relationship established through prior experience and this program's analytical requirements.

In these criteria, the judgement limits vary in relation to the comparison of the resolution.

$$\text{Resolution} = \frac{\text{NRC VALUE}}{\text{NRC UNCERTAINTY}}$$

$$\text{Ratio} = \frac{\text{LICENSEE VALUE}}{\text{NRC VALUE}}$$

Comparisons are made by first determining the resolution and then reading across the same line to the corresponding ratio. The following table shows the acceptance values.

RESOLUTION	AGREEMENT RATIO
<4	0.40 - 2.50
4 - 7	0.50 - 2.00
8 - 15	0.60 - 1.66
16 - 50	0.75 - 1.33
51 - 200	0.80 - 1.25
>200	0.85 - 1.18

The above criteria are applied to the following analyses:

(1) Gamma Spectrometry

(2) Tritium in liquid samples

(3) Iodine on adsorbers

(4) ^{89}Sr and ^{90}Sr determinations

(5) Gross Beta where samples are counted on the same date using the same reference nuclide.