

APPENDIX

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

NRC Inspection Report: 50-498/87-29
50-499/87-29

Construction Permits: CPPR-128
CPPR-129

Dockets: 50-498
50-499

Licensee: Houston Lighting & Power Company (HL&P)
P. O. Box 1700
Houston, Texas 77001

Facility Name: South Texas Project Electric Generating Station, Units 1
and 2 (STP)

Inspection At: South Texas Project, Matagorda County, Texas

Inspection Conducted: May 18-22, 1987

Inspectors:

J. Blair Nicholas
J. B. Nicholas, Senior Radiation Specialist,
Facilities Radiological Protection Section

6/26/87
Date

for J. Blair Nicholas
for R. Wise, Radiation Specialist, Facilities
Radiological Protection Section

6/26/87
Date

Approved:

for J. Blair Nicholas
for B. Murray, Chief, Facilities Radiological
Protection Section

6/26/87
Date

Inspection Summary

Inspection Conducted May 18-22, 1987, (Report 50-498/87-29; 50-499/87-29)

Areas Inspected: Routine, announced preoperational inspection of the licensee's chemistry/radiochemistry program including the review of open items in the following areas: organization and management controls, staffing and staff qualifications, training program, primary chemistry program, secondary chemistry program, primary chemistry sampling, secondary chemistry sampling, postaccident sampling system (PASS), facilities and equipment, analytical

instrumentation, quality assurance (QA) program of chemistry/radiochemistry activities, and procedures. The inspection also included water chemistry and radiochemistry confirmatory measurements.

No inspection of Unit 2 was conducted.

Results: Within the areas inspected, no violations or deviations were identified. Nine of eleven previously identified open items were closed.

DETAILS

1. Persons Contacted

HL&P

*W. H. Kinsey, Jr., Plant Manager
 *J. E. Behm, Senior QA Specialist, Operations QA
 *E. L. Brown, Licensing Engineer
 S. E. Citzler, Lead Chemistry Technician
 J. C. Dierickx, Chemical Support Supervisor
 *R. A. Gangluff, Chemical Analysis Supervisor
 *S. M. Head, Lead Licensing Engineer, Project Compliance
 *W. G. Isereau, Operations QA Audits/Surveillance Supervisor
 *G. L. Jarvela, Health Physics Manager
 R. L. Meier, Senior Chemistry Training Instructor
 *W. C. Parish, Radiological Support Supervisor
 R. E. Schirmer, Chemical Analysis Technical Supervisor
 J. J. Woods, Nuclear Chemist
 *T. E. Underwood, Chemical Operations & Analysis (CO&A) Manager

Others

*D. R. Carpenter, Senior NRC Operations Resident Inspector
 T. Reis, NRC Operations Resident Inspector

*Denotes those present during the exit interview on May 22, 1987.

The NRC inspector also interviewed several other STP station personnel during the inspection.

2. Followup on Previous Inspection Findings

(Closed) Open Item (498/8624-01): Chemical Analysis Section Personnel Qualifications - This item was discussed in NRC Inspection Report 50-498/86-24 and involved the concern that the five lead chemistry technicians, the four senior chemistry technicians, and the six chemistry technicians that were onsite prior to August 1, 1986, had not completed phase III on-the-job (OJT) qualification training. The NRC inspectors reviewed the OJT qualification records of the above listed CO&A personnel onsite prior to August 1, 1986, and verified that they had completed all phases of qualification training. This item is considered closed.

(Closed) Open Item (498/8624-02): Chemical Analysis Section Training Program - This item was discussed in NRC Inspection Report 50-498/86-24 and involved the concern that not all the associate chemistry technicians onsite prior to August 1, 1986, had completed phase III of the chemical analysis technician training program (CATTP). The NRC inspectors reviewed the CO&A personnel training records and determined that all CO&A

associated chemistry technicians onsite prior to August 1, 1986, had completed all phases of the CATTP. This item is considered closed.

(Open) Open Item (498/8624-03): Primary Chemistry Program - (see comment in paragraph 5 for this open item).

(Closed) Open Item (498/8624-04): Secondary Chemistry Program - This item was discussed in NRC Inspection Report 50-498/86-24 and involved the lack of necessary procedures to implement a secondary chemistry program and that the licensee had not completed calibration of all in-line process instrumentation and laboratory instrumentation in the secondary chemistry laboratory. The NRC inspectors reviewed the licensee's secondary chemistry procedures and found that the licensee had completed and approved all planned secondary chemistry procedures. The licensee had written and approved analytical procedures for the determination of the secondary chemistry parameters to meet plant operating requirements. Secondary chemistry analytical procedures had been verified for correctness using known standards. The licensee had completed installation, preoperational testing, and calibration of all secondary chemistry in-line process analyzers. The licensee had completed calibration of all the secondary chemistry laboratory analytical instruments and a quality control program was being implemented according to procedures. This item is considered closed.

(Closed) Open Item (498/8624-05): Primary Chemistry Sampling System - This item was discussed in NRC Inspection Report 50-498/86-24 and involved the lack of a completed primary sampling system, sampling procedures, and determination of primary chemistry and radwaste tank volumes and tank recirculation times that are necessary to obtain representative samples. The NRC inspectors verified that the primary sample panel and the liquid waste processing sample panels have been installed and preoperational testing had been completed. The licensee had written and approved sampling procedures to operate the primary chemistry and radwaste processing sample panels. The NRC inspectors reviewed the licensee's test results for tank recirculation times. The tank recirculation times and sample line flush volumes had been incorporated into the licensee's sampling procedures to ensure representative sampling. This item is considered closed.

(Closed) Open Item (498/8624-06): Secondary Chemistry Sampling System - This item was discussed in NRC Inspection Report 50-498/86-24 and involved the concern that the secondary chemistry sampling panels had not been completed and tested. The NRC inspectors determined that all secondary chemistry sampling panels had been installed, tested, and demonstrated operational. The licensee had developed a sampling procedure to obtain representative grab samples from the secondary chemistry systems and had verified all sample points and sample line flush times. This item is considered closed.

(Open) Open Item (498/8624-07): Postaccident Sampling System - (see comments in paragraph 6 for this open item).

(Closed) Open Item (498/8624-08): Facilities and Equipment - This item was discussed in NRC Inspection Report 50-498/86-24 and involved the completion of construction and routine occupancy of all Chemistry Analysis Section (CAS) work areas. The NRC inspectors inspected the makeup demineralizer laboratory, secondary chemistry laboratory, radiochemistry laboratory, radiochemistry counting room, chemistry sampling panels, PASS control room and laboratory, training chemistry laboratory, training counting room, and CAS personnel study area. Construction was completed in all of the above listed areas and the laboratories were fully equipped with the necessary chemicals, labware, furniture, and analytical instrumentation. All chemistry areas were being occupied and in routine use. This item is considered closed.

(Closed) Open Item (498/8624-09): Chemistry/Radiochemistry Analytical Instrumentation - This item was discussed in NRC Inspection Report 50-498/86-24 and involved the procurement and final placement of laboratory analytical instrumentation in the respective laboratories, verification of operability and calibration of all analytical instrumentation in the laboratories and radiochemistry counting room, implementation of an instrument quality control program, and successful completion of water chemistry and radiochemistry confirmatory measurements. The NRC inspectors reviewed the licensee's inventory of analytical equipment and supplies to be used in the laboratories and radiochemistry counting room and verified the type and quantity of analytical instrumentation identified by the licensee had been tested and calibrated and a quality control program had been implemented and was being maintained on instrumentation in routine use. The NRC inspectors reviewed calibration data and quality control data for selected laboratory and counting room analytical instrumentation. Based on the results of this inspection, the licensee successfully completed the water chemistry and radiochemistry confirmatory measurements. This item is considered closed.

(Closed) Open Item (498/8624-10): Quality Assurance Program - This item was discussed in NRC Inspection Report 50-498/86-24 and involved the lack of an established and implemented approved comprehensive audit and surveillance program for chemistry/radiochemistry activities. The NRC inspectors reviewed the licensee's QA surveillance and audit program and found that the licensee had written and approved procedures and checklists for conducting audits and surveillances in the chemistry/radiochemistry area. The audit procedures indicated that the licensee will have a technical specialist with expertise in the areas being audited on the audit team. The licensee had conducted an audit of the chemistry/radiochemistry program in January 1987 and an audit of training and qualifications of chemistry personnel in April 1987. The NRC inspectors reviewed the audit plans, checklists, and reports for scope and depth to ensure thoroughness of program evaluation and timely followup of audit findings. The audit procedures and checklists appeared to be adequate and responses and corrective actions to audit findings were satisfactorily completed and documented in a timely manner. It was noted

that the audit team for the chemistry/radiochemistry program audit included a technical specialist knowledgeable in chemistry/radiochemistry activities at a nuclear power facility. This item is considered closed.

(Closed) Open Item (498/8624-11): Procedures - This item was discussed in NRC Inspection Report 50-498/86-24 and involved the completion and approval of all CO&A procedures for CAS activities in Unit 1. The licensee had written and approved all identified Unit 1 and applicable CAS procedures. The NRC inspectors reviewed selected CAS procedures and determined that they appeared to be sufficient to effectively implement the chemistry/radiochemistry program. This item is considered closed.

(Closed) Open Item (498/8409-01; 499/8409-01): Meteorological Monitoring Program (MMP) - This item was discussed in NRC Inspection Report 50-498/8409; 50-499/8409 and involved the need for the establishment of MMP calibration and maintenance procedures, implementation of a QA/QC program for the MMP, determination of a reliability factor for the meteorological monitoring system, and provide provisions for meteorological data readout in the plant control rooms. The licensee had completed all the necessary actions to resolve the NRC concerns. The NRC inspectors verified the licensee had established calibration and maintenance procedures for the meteorological monitoring system and had implemented a QA/QC program for the MMP. The licensee's reliability test data for the meteorological system was reviewed and the meteorological data readouts in the Unit 1 control room were confirmed to be operational. This item is considered closed.

(Closed) Open Item (498/8616-01; 499/8616-01): QA Audits - This item was discussed in NRC Inspection Report 50-498/8616; 50-499/8616 and involved the lack of a comprehensive audit and surveillance program for the radiological environmental monitoring program (REMP). The licensee had conducted an audit of the REMP in October 1986. The NRC inspectors reviewed the audit plan, checklist, and report for scope and thoroughness of program evaluation. The audit plan and checklist appeared to be adequate and corrective actions to audit findings were satisfactorily completed and documented in a timely manner. It was noted that the audit team included a technical specialist. This item is considered closed.

3. Inspector Observations

The following are observations the NRC inspectors discussed with the licensee during the exit interview on May 22, 1987. 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 licensee stated that the observations would be reviewed.

- a. Quality Control Procedures - The licensee was not using quality control charts to evaluate biases experienced in daily or periodic quality control analyses. The licensee had not included in the

quality control procedures information necessary to identify and evaluate data biases and notify the lead chemistry technicians when data trends and/or biases are observed.

- b. Liquid Scintillation Calibration and Quality Control - The licensee had not established a frequency for determining a quench curve calibration. The licensee had not included, on the daily quality control data sheets, acceptance criteria for background and tritium activities.
- c. Proportional Counter Calibration and Quality Control - The licensee had not established a frequency for determining operating voltage plateaus and counting efficiencies for gross alpha and gross beta analyses. The licensee had not included, on the daily quality control data sheets, acceptance criteria for alpha and beta source activities.
- d. Multichannel Analyzer Calibration - The licensee had not calibrated the multichannel analyzer germanium detectors located in the radiochemistry counting room for noble gas analysis geometries for energies greater than 514 KeV. The licensee had not used a recognized industry standard of mixed nuclides traceable to the National Bureau of Standards which would produce a range of gamma energies applicable for germanium detector energy and efficiency calibrations.

4. Program Areas Inspected

The following program areas were inspected. Unless otherwise noted, the inspection was completed and revealed no violations, deviations, unresolved items, or open items. Notations after a specific inspection item are used to identify the following: I = item not inspected or only partially inspected; V = violation; D = deviation; U = unresolved item; and O = open item.

<u>Procedure</u>	<u>Inspection Requirements</u>
83522	<u>Organization and Management Controls (Water Chemistry/ Radiochemistry)</u>
	02.01 Organization, Responsibilities, and Authorities
	02.02 Staffing
	02.03 Identification and Correction of Weaknesses
	02.04 Audits and Appraisals
	02.05 Communication to Employees
	02.06 Documentation and Implementation

83523 Training and Qualifications (Water Chemistry/Radiochemistry)

- 02.01 Training and Qualification Program
- 02.02 Education and Experience
- 02.03 Adequacy and Quality of Training

84525 Quality Assurance and Confirmatory Measurements For In-Plant Radiochemical Analysis

- 02.01 Facilities, Equipment, and Supplies
- 02.02 Procedures - 0 (see paragraph 5)
- 02.03 Confirmatory Measurements
- 02.04 Postaccident Sample Analysis - 0 (see paragraph 6)
- 02.05 Quality Assurance Program
- 02.06 Contractor Activities

79501 Light Water Reactor Water Chemistry Control and Chemical Analysis

- 02.01 Establishment of a Water Chemistry Control Program
- 02.02 Implementation of the Water Chemistry Control Program
- 02.03 Water Sampling
- 02.04 Chemistry Measurements: Facilities and Equipment
- 02.05 Establishment of a Quality Assurance Program for Chemical Measurements
- 02.06 Implementation of a Quality Assurance Program for Chemical Measurements
- 02.07 Laboratory Safety

79502 Plant Systems Affecting Plant Water Chemistry

- 02.01 Audits and Appraisals
- 02.02 Primary and Secondary Water Systems
- 02.03 Auxiliary Water Systems
- 02.04 Demineralizers

5. Primary Chemistry Program

The NRC inspectors reviewed the licensee's primary chemistry program to determine agreement with commitments in Section 5 in the Final Safety Analysis Report (FSAR) and Section 3 in the proposed Technical Specifications (TS).

The NRC inspectors reviewed the licensee's primary chemistry program and found that it appeared to agree with the FSAR and proposed TS. It was determined that all of the licensee identified administrative procedures, surveillance procedures, chemical control procedures, instrument calibration and quality control procedures, and analytical procedures were completed and approved. The NRC inspectors reviewed selected primary chemistry procedures.

The licensee had completed calibration of primary chemistry in-line process instrumentation and hot laboratory analytical instrumentation which are to be used to support the primary chemistry program and an approved instrument quality control program was being implemented.

The licensee had written a procedure PCP06-2M-001, "Preparation of Radioactive Sources," Revision 0, May 5, 1987, for preparing and documenting the activity on radioactive calibration standards to be used in calibration of the radiochemistry counting room instruments. The NRC inspectors determined that this procedure did not contain sufficient detail to systematically prepare reproducible radioactive standards which would be traceable to the National Bureau of Standards (NBS) for all counting geometries and matrixes utilized by the plant. The procedure did not address the preparation of charcoal cartridge standards, particulate filter standards, and liquid scintillation standards. However, it was noted that the preparation of these standard geometries were addressed, in general, in two plant radiation protection procedures, OPRP10-2L-0015, "Radiological Laboratory Preparation of Radioactive Standard Solutions and Calibration Sources," Revision 2, December 30, 1986, and OPRP10-2L-0021, "Preparation of Air Particulate Filter Source for Beta or Gamma Analysis," Revision 1, January 29, 1986.

The NRC inspectors determined that several primary chemistry and radiochemistry analytical procedures were still in the process of being tested and verified using known standards. The following analytical procedures are to be verified using known standards prior to initial criticality.

- a. Determination of pH
- b. Determination of Conductivity
- c. Determination of Chloride
- d. Determination of Fluoride
- e. Determination of Dissolved Hydrogen
- f. Determination of Gamma Isotopes
- g. Determination of Tritium
- h. Determination of Gross Alpha and Gross Beta
- i. Determination of ^{55}Fe
- j. Determination of ^{88}Sr and ^{90}Sr

Open Item 498/8624-03, Primary Chemistry Program, will remain open pending the completion of the following items prior to initial criticality.

- . Completion of detailed preparation procedures for all nuclear instrument radioactive calibration standards and all counting geometries and matrixes to be utilized by the plant which would be traceable to the NBS.
- . Verification of the above listed primary chemistry and radiochemistry analytical procedures using known standards.

No violations or deviations were identified.

6. Postaccident Sampling System (PASS)

The NRC inspectors reviewed the licensee's PASS to determine agreement with commitments in Section 9.3.2 in the FSAR and the requirements in NUREG-0737, Item II.B.3.

The NRC inspectors inspected the area in STP Unit 1 where the PASS was installed. The liquid and gas sample panels, PASS laboratory fume hood, and PASS control panels were installed and sample lines connected and verified. The PASS was under startup control and underwent some preoperational testing during Unit 1 hot-functional testing. The PASS in-line instrumentation was installed in the various PASS panels and had been partially tested, but not calibrated. PASS operating procedures had been written and backup analytical procedures to the in-line analyzers had been written. The licensee had not completed operational training of CAS technicians on the PASS. The licensee had not established and implemented a PASS instrument preventative maintenance program and operational surveillance program.

Open Item 498/8624-07, Postaccident Sampling System, will remain open pending completion of the following matters prior to exceeding 5 percent power.

- . Testing and calibration of the in-line analytical instrumentation and the implementation of a maintenance and quality control program on the PASS.
- . Completion of theoretical and operational training of CAS technicians on the PASS.
- . Checkout of system operation by performing trial runs using the sample transport devices and sample preparation laboratory facilities.
- . Verification of system performance by collecting samples of reactor coolant and containment atmosphere under simulated accident conditions and performing required comparative analyses.
- . Implementation of an operational surveillance program.

No violations or deviations were identified.

7. Attachments

The licensee's confirmatory measurement results concerning water chemistry and radiochemistry samples are documented in Attachments 1, 2, 3, 4, and 5.

8. Exit Interview

The NRC inspectors met with the NRC senior resident inspector and the licensee representatives denoted in paragraph 1 at the conclusion of the inspection on May 22, 1987. The lead NRC inspector summarized the scope of the inspection and discussed the inspection findings, results of the confirmatory measurements, and the actions necessary to close the two remaining preoperational open items described in paragraphs 5 and 6.

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 analysis of standards is 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. Those analytical results which were found in disagreement after the first analysis were rerun by the licensee in an attempt to resolve any problems associated with the sample preparation or analysis. The licensee's final analytical results indicated that 31 of the 33 results were in agreement.

2. Radiological Confirmatory Measurements

Confirmatory measurements were performed on the following standards and samples in the Region IV mobile laboratory at South Texas Project Unit 1 during the inspection:

- a. CESCO Charcoal Cartridge Standard (21421-109)
- b. Air Particulate Filter Standard (21478-109)
- c. Liquid Marinelli Beaker Standard - 0.5 liter (21416-109)
- d. Liquid Scintillation Vial Standard - 20 milliliters (21414-109)
- e. Gas Marinelli Beaker - 1.0 liter
- f. Tritium Sample

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 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 utilized two detectors in radiochemistry for comparison with the NRC results. The licensee performed the tritium analysis on their liquid scintillation counting system. The individual sample analyses and comparison of analytical results of the radiological confirmatory measurements are tabulated in Attachment 4. The licensee's gamma isotopic results from the listed

samples in Attachment 4 showed 98 percent agreement with the NRC analysis results. The licensee's tritium result was in agreement with the NRC analysis result.

ATTACHMENT 2

Water Chemistry Confirmatory Measurements Results

South Texas Project Unit 1

<u>Chemical Parameter</u>	<u>Analytical Procedure</u>	<u>Sample ID</u>	<u>STP Results</u>	<u>NRC Results</u>	<u>STP/NRC Ratio</u>	<u>Comparison Decision</u>
Results in parts per billion (ppb)						
Sodium	Atomic Absorption Flame Emission	86J	6.0±4.4	9.2±1.0	0.65±0.48	Agreement
		86K	85.0±2.0	92.3±8.0	0.92±0.08	Agreement
		86L	270.0±1.5	288.0±1.6	0.94±0.01	Disagreement
		86Lrerun	273.0±16.6	288.0±1.6	0.94±0.06	Agreement
Iron	Atomic Absorption Flame Emission	86G	60.0±8.2	48.9±3.5	1.23±0.19	Agreement
		86Grerun	50.0±2.0	48.9±3.5	1.02±0.08	Agreement
		86H	106.7±7.6	95.5±3.4	1.12±0.09	Agreement
		86Hrerun	101.0±4.6	95.5±3.4	1.06±0.06	Agreement
		86I	311.0±9.8	294.0±8.4	1.06±0.05	Agreement
		86Irerun	300.7±1.2	294.0±8.4	1.02±0.03	Agreement
Copper	Atomic Absorption Flame Emission	86G	72.3±4.5	46.8±2.4	1.50±0.12	Disagreement
		86Grerun	52.0±1.0	46.8±2.4	1.11±0.04	Disagreement
		86H	127.0±4.4	96.6±4.9	1.31±0.08	Disagreement
		86Hrerun	104.7±2.3	96.6±4.9	1.08±0.06	Agreement
		86I	320.0±6.4	290.0±12.0	1.10±0.05	Agreement
		86Irerun	316.7±2.1	290.0±12.0	1.09±0.05	Agreement
Fluoride	Ion Chromatograph	86A	24.3±0.6	23.1±0.5	1.05±0.03	Agreement
		86B	86.7±2.9	87.0±3.8	0.99±0.05	Agreement
		86C	165.0±1.0	167.0±5.6	0.99±0.03	Agreement
Chloride	Ion Chromatograph	86A	19.7±2.9	24.1±3.1	0.82±0.16	Agreement
		86B	81.7±1.2	74.8±2.4	1.09±0.04	Disagreement
		86Brerun	77.7±0.6	74.8±2.4	1.04±0.03	Agreement
		86C	159.7±1.2	161.0±4.0	0.99±0.03	Agreement
Sulfate	Ion Chromatograph	86A	19.0±0.0	20.0±0.9	0.95±0.04	Agreement
		86B	81.3±1.5	82.0±4.0	0.99±0.05	Agreement
		86C	164.7±1.5	161.6±6.0	1.02±0.04	Agreement
Silica	Spectro- photometry	86S	25.0±4.6	27.2±2.8	0.92±0.19	Agreement
		86T	50.3±0.6	54.5±3.5	0.92±0.06	Agreement
		86U	78.3±0.6	80.0±2.5	0.98±0.03	Agreement

Hydrazine	Spectro- photometry	86P	15.7±0.6	22.3±1.4	0.70±0.05	Disagreement
		86Prerun	21.7±0.6	22.3±1.4	0.97±0.07	Agreement
		86Q	47.7±1.2	56.9±0.1	0.83±0.02	Disagreement
		86Qrerun	57.3±0.6	56.9±0.1	1.01±0.02	Agreement
		86R	103.0±1.0	104.0±1.0	0.99±0.01	Agreement

Results in parts per million (ppm)

Ammonia	Specific Ion Electrode	86M	0.95±0.03	0.88±0.05	1.08±0.07	Agreement
		86N	2.88±0.07	3.14±0.26	0.92±0.08	Agreement
		86O	10.06±0.22	9.38±0.85	1.07±0.10	Agreement
Boron	Manitol Titration	86D	1007±9.0	985±10.0	1.02±0.01	Agreement
		86D	103.3±0.6	98.5±1.0	1.05±0.01	Disagreement
		86Drerun	100.1±1.1	98.5±1.0	1.02±0.02	Agreement
		86E	298.0±5.0	298.0±5.0	1.00±0.00	Agreement
		86F	511.0±2.0	487.0±6.0	1.05±0.01	Disagreement
		86Frerun	500.3±2.4	487.0±6.0	1.03±0.01	Disagreement
		86F	1000±13.0	974±12.0	1.03±0.02	Agreement
		86E	1495±5.0	1490±25.0	1.00±0.02	Agreement

NOTE: Licensee analyses were run in triplicate and were separate analyses and/or dilutions. The uncertainty associated with these analyses is an estimate of the total uncertainty of the measurement process.

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

$$(\text{ratio} = \frac{\text{Licensee Value}}{\text{NRC Value}});$$

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

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

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

ATTACHMENT 4

RADIOLOGICAL CONFIRMATORY MEASUREMENTS RESULTS

South Texas Project Unit 1

1. CESCO Charcoal Cartridge Standard (21421-109) (Standardized 11:00, CST, October 1, 1986)

Nuclide	STP Results (uCi/Sample)	NRC Results (uCi/Sample)	STP/NRC Ratio	Comparison Decision
¹⁰⁹ Cd	1.459±0.015E+0	1.321±0.004E+0	1.10	Agreement
	1.438±0.014E+0		1.09	Agreement
⁵⁷ Co	3.887±0.052E-2	3.567±0.016E-2	1.09	Agreement
	3.904±0.049E-2		1.09	Agreement
¹³⁹ Ce	3.390±0.067E-2	3.263±0.024E-2	1.04	Agreement
	3.305±0.064E-2		1.01	Agreement
²⁰³ Hg	1.003±0.062E-1	8.538±0.198E-2	1.17	Agreement
	9.228±0.052E-2		1.08	Agreement
¹¹³ Sn	7.091±0.180E-2	6.287±0.63E-2	1.13	Agreement
	6.852±0.160E-2		1.09	Agreement
¹³⁷ Cs	4.930±0.070E-2	4.708±0.029E-2	1.05	Agreement
	4.943±0.067E-2		1.05	Agreement
⁸⁸ y	8.543±0.220E-2	8.649±0.097E-2	0.99	Agreement
	8.629±0.210E-2		1.00	Agreement
⁶⁰ Co	3.025±0.045E-2	3.106±0.029E-2	0.97	Agreement
	3.006±0.044E-2		0.97	Agreement

2. Air Particulate Filter Standard (21478-109) (Standardized 11:00, CST, October 1, 1986)

Nuclide	STP Results (uCi/Sample)	NRC Results (uCi/Sample)	STP/NRC Ratio	Comparison Decision
¹⁰⁹ Cd	1.352±0.026E+0	1.370±0.004E+0	0.99	Agreement
	1.189±0.016E+0		0.87	Agreement
⁵⁷ Co	3.989±0.040E-2	3.726±0.017E-2	1.07	Agreement
	3.451±0.062E-2		0.93	Agreement
¹³⁹ Ce	3.415±0.130E-2	3.435±0.026E-2	0.99	Agreement
	3.016±0.083E-2		0.88	Agreement
²⁰³ Hg	9.949±0.540E-2	1.017±0.022E-1	0.98	Agreement
	9.135±0.720E-2		0.90	Agreement

^{113}Sn	7.230±0.290E-2	6.445±0.066E-2	1.12	Agreement
	6.664±0.210E-2		1.03	Agreement
^{137}Cs	5.052±0.120E-2	4.718±0.030E-2	1.07	Agreement
	4.714±0.085E-2		1.00	Agreement
^{88}y	9.282±0.420E-2	8.960±0.104E-2	1.04	Agreement
	8.558±0.270E-2		0.96	Agreement
^{60}Co	3.555±0.130E-2	3.168±0.031E-2	1.12	Agreement
	3.153±0.059E-2		1.00	Agreement

3. Liquid Marinelli Beaker Standard - 0.5 liter (21416-109)
(Standardized 11:00, CST, October 1, 1986)

Nuclide	STP Results (uCi/Sample)	NRC Results (uCi/Sample)	STP/NRC Ratio	Comparison Decision
^{109}Cd	1.481±0.011E+0	1.515±0.007E+0	0.98	Agreement
	1.505±0.011E+0		0.99	Agreement
^{57}Co	4.477±0.041E-2	3.930±0.025E-2	1.14	Agreement
	4.397±0.039E-2		1.12	Agreement
^{139}Ce	3.854±0.053E-2	3.746±0.031E-2	1.03	Agreement
	3.870±0.052E-2		1.03	Agreement
^{203}Hg	1.037±0.043E-1	9.726±0.253E-2	1.07	Agreement
	1.037±0.042E-1		1.07	Agreement
^{113}Sn	7.597±0.120E-2	6.919±0.074E-2	1.10	Agreement
	7.457±0.012E-2		1.08	Agreement
^{137}Cs	5.535±0.049E-2	5.166±0.031E-2	1.07	Agreement
	5.450±0.049E-2		1.06	Agreement
^{88}y	1.002±0.019E-1	9.606±0.111E-2	1.04	Agreement
	1.039±0.020E-1		1.08	Agreement
^{60}Co	3.564±0.049E-2	3.509±0.033E-2	1.02	Agreement
	3.529±0.051E-2		1.01	Agreement

4. Liquid Scintillation Vial Standard - 20 milliliters (21414-109)
(Standardized 11:00, CST, October 1, 1986)

Nuclide	STP Results (uCi/Sample)	NRC Results (uCi/Sample)	STP/NRC Ratio	Comparison Decision
^{109}Cd	1.072±0.016E+0	1.338±0.006E+0	0.80	Disagreement
	1.156±0.019E+0		0.86	Agreement

^{57}Co	3.121±0.064E-2	3.500±0.022E-2	0.89	Agreement
	3.278±0.070E-2		0.94	Agreement
^{139}Ce	2.709±0.086E-2	3.197±0.031E-2	0.85	Agreement
	2.805±0.091E-2		0.88	Agreement
^{203}Hg	7.043±0.690E-2	7.649±0.256E-2	0.92	Agreement
	7.280±0.710E-2		0.95	Agreement
^{113}Sn	5.587±0.200E-2	6.301±0.085E-2	0.89	Agreement
	5.743±0.210E-2		0.91	Agreement
^{137}Cs	4.061±0.077E-2	4.577±0.036E-2	0.89	Agreement
	4.315±0.086E-2		0.94	Agreement
^{88}Y	8.428±0.320E-2	8.299±0.125E-2	1.02	Agreement
	8.767±0.340E-2		1.06	Agreement
^{60}Co	2.913±0.082E-2	3.017±0.037E-2	0.97	Agreement
	2.974±0.060E-2		0.99	Agreement

5. Gas Marinelli Beaker - 1.0 liter
(Standardized 08:00, CDT, May 20, 1987)

Nuclide	STP Results (uCi/Sample)	NRC Results (uCi/Sample)	STP/NRC Ratio	Comparison Decision
^{133}Xe	4.651±0.097E-2	4.229±0.032E-2	1.10	Agreement
^{127}Xe	1.662±0.010E-1	1.526±0.004E-1	1.06	Agreement
^{85}Kr	9.482±0.120E+0	7.933±0.049E+0	1.20	Agreement

6. Tritium Sample
(Sampled February 11, 1987)

Nuclide	STP Results (uCi/g)	NRC Results (uCi/g)	STP/NRC Ratio	Comparison Decision
^3H	5.09±0.11E-4	5.57±0.59E-4	0.91	Agreement

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	0.4 - 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

The above criteria are applied to the following analyses:

- (1) Gamma Spectrometry.
- (2) Tritium analyses of 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.