APPENDIX

U. S. NUCLEAR REGULATORY COMMISSION
REGION IV

NRC Inspection Report: 50-285/82-21 License: DPR-40

Docket: 50-285

Licensee: Omaha Public Power District
1623 Harney Street
Omaha, Nebraska 68102

Facility Name: Fort Calhoun Station

Inspection At: Fort Calhoun Station, Blair, Nebraska

Inspection Conducted: October 11-15, 1982

Inspector: J. Blair Nicholas 1/10/83
J. Blair Nicholas, Radiation Specialist Date

Inspector: Russell Wise 1/10/83
Russell Wise, Radiation Specialist Date

Approved by: Blaine Murray 1/10/83
Blaine Murray, Chief, Facilities Radiation Protection Section Date

Inspection Summary

Inspection conducted October 11-15, 1982 (Report 50-285/82-21)

Areas Inspected: Routine, announced inspection of the licensee's radiochemistry program including organization, staffing, training program, sample collection, sample treatment and analysis, chemistry analytical procedures, laboratory instrument calibration and quality controls of analytical measurements, licensee audits of radiochemistry activities, and independent confirmatory measurements using the Region IV mobile counting laboratory for onsite comparisons of split sample results. The inspection involved a total of 88 hours onsite by two NRC inspectors.

Results: No violations or deviations were identified. One unresolved item and eleven open items are summarized in Section 4.

DETAILS

1. Persons Contacted

Omaha Public Power District (OPPD)

*W. C. Jones, Division Manager, Production Operations
*F. A. Thurtell, Division Manager, Quality Assurance and Regulatory Affairs
*K. J. Morris, Manager, Administrative Services
*W. G. Gates, Manager, Fort Calhoun Station
*J. K. Gasper, Manager, Reactor and Computer Technical Services
*M. C. Winter, Manager, Quality Assurance
*B. J. Hickle, Supervisor, Chemistry and Radiation Protection
B. Lisowyj, Supervisor, Quality Assurance
J. J. Fisicaro, Supervisor, Administrative Services and Security
J. F. Gass, Supervisor, Training
F. K. Smith, Plant Chemist
G. L. Roach, Plant Health Physicist
J. M. Hale, Chemistry/Radiation Protection Tech., Lead Chemist
C. C. Mallory, Chemistry/Radiation Protection Tech., Training Coordinator
C. J. Brunnert, Quality Assurance Inspector

Others Contacted

*L. A. Yandell, NRC Resident Inspector, Fort Calhoun Station

*Denotes those present during the exit briefing on October 15, 1982.

The NRC inspectors also interviewed several other Fort Calhoun Station personnel during the inspection.

2. Scope of Inspection

The purpose of this inspection was to review the licensee's radiochemistry instrument calibration and quality control program for the period July 1, 1981, through September 30, 1982, radiochemistry organization, staff training, licensee audits of radiochemistry activities, and perform confirmatory measurements on selected plant radioactive effluent samples. The previous quality control inspection of analytical measurements and confirmatory measurements was performed during May 4-7, 1981.

3. Licensee Action on Previous Inspection Findings

(Open) Open Item (285/7805-03): Containment Air Sampler - This item was discussed in NRC Inspection Report No. 50-285/78-05 and involved the installation and use of a remote containment air sampling system. The licensee decided to include the remote containment air sampling system as part of the post-accident sampling system (PASS). Installation and checkout of the post-accident sampling system was in its final stages.

The licensee indicated that the post-accident sampling system should be fully operational by November 30, 1982. This item remains open pending completion of the post-accident sampling system.

(Open) Open Item (285/8112-01): Quality Control of Chemistry Instrument Function Checks - This item was discussed in NRC Inspection Report No. 50-285/81-12 and involved the completing of the function check, Form FC-353, for nonradiological analytical chemistry instrumentation in the water plant, cold chemistry laboratory, and radiochemistry laboratory so as to thoroughly and accurately document the nonradiological analytical chemistry instrument quality control program. The NRC inspectors reviewed Form FC-353 for the first and second quarter of 1982 from the three laboratories and found deficiencies. This item remains open pending revision and NRC review of Form FC-353 and respective instrument functional check procedures following changes as detailed in Section 9.

(Closed) Violation (285/8112-02): Biannual Review of Chemistry and Radiation Protection Instrument Calibration Procedure - This item was discussed in NRC Inspection Report No. 50-285/81-12 and involved the requirement that all calibration procedures for chemistry analytical instruments and health physics radiation protection equipment be reviewed at least every 2 years. The NRC inspectors reviewed the master document index for these procedures and found that all calibration procedures mentioned in the violation had been reviewed or changed within the last 2 years. The licensee has initiated a computer system which controls the periodic review of all plant procedures so that each procedure is reviewed and updated on an appropriate frequency. This item is considered closed.

(Open) Open Item (285/8016-37): Relocation of Counting Area - This item was discussed in NRC Inspection Report No. 50-285/80-16 and involved the relocation or modification of the radiochemistry and health physics counting rooms to provide more working area and reduce potential for contamination and high background. The licensee has installed shielding in the wall of Room 59 between containment and the counting rooms to reduce radiation exposure in the case of an accident in containment. This was in conjunction with TMI-required modifications. The licensee has remodeled the radiochemistry counting room providing more efficient use of space. The health physics counting room is presently being remodeled to provide more working area and space for up-to-date counting instrumentation. The ultrasonic tank for tool decontamination had been moved to Room 59 behind a shielded wall and the area which it occupied had been incorporated into the health physics counting room. This will reduce the background radiation in the health physics counting room. This item remains open pending completion of the remodeling by the end of 1982.

(Open) Open Item (285/8016-38): Radiochemistry Laboratory Exhaust Blower - This item was discussed in NRC Inspection Report No. 50-285/80-16 and involved the fact that the exhaust hoods in the cold laboratory and radiochemistry laboratory did not have separate exhaust blowers and air movement across the face of the hoods was not sufficient to meet health and safety

requirements. During recent remodeling of the cold laboratory and radiochemistry counting room, the cold laboratory hood was relocated. At the time of the inspection, the cold laboratory fume hood exhaust had not been reconnected to the ventilation system. The licensee was in the process of developing plans to address this item. The NRC inspectors reviewed EEAR-FC-80-132 for content and found that development of modifications was very slow. This item remains open pending further action by the licensee.

4. Unresolved and Open Items this Inspection

(Open) Unresolved Item (285/8221-01): Chemical and Radiation Protection Personnel Qualifications - It was not determined if the plant chemist (radiochemistry supervisor) satisfied the qualifications in ANSI N18.1-1971. The licensee had not developed a selection and qualification criteria for radiochemistry personnel. See Section 6 for details.

(Open) Open Item (285/8221-01): Chemical and Radiation Protection Organization - The licensee had not filled the chemist position vacancy in a timely manner and had not developed implementing procedures governing functional area assignments. See Section 5 for details.

(Open) Open Item (285/8221-02): Chemical and Radiation Protection Personnel Training - The licensee had not developed a formal training program for the technical supervisor or professionals in the chemical and radiation protection department. See Section 7 for details.

(Open) Open Item (285/8221-03): Licensee's Internal Audits - The licensee had not included, on the audit team for radiochemistry audits, a member knowledgeable in radiochemistry procedures and activities at nuclear power facilities. See Section 8 for details.

(Open) Open Item (285/8221-04): Quality Control of Chemistry Analytical Measurements - The licensee had not updated the list of chemistry instruments in Standing Order A-T-13 to include recently acquired instrumentation to match with the instrument calibration schedule posted in the chemistry laboratory area. See Section 9 for details.

(Open) Open Item (285/8221-05): Gas Partitioner Functional Check Procedure - The licensee had not replaced a functional check procedure for a new model instrument after deleting the previous functional check procedure for that instrument type. See Section 9 for details.

(Open) Open Item (285/8221-06): Instrument Calibration - The licensee had not written approved calibration procedures for recently acquired instrumentation. See Section 9 for details.

(Open) Open Item (285/8221-07): Instrument Functional Checks - The licensee had not written approved functional check procedures for recently acquired instrumentation. See Section 9 for details.

(Open) Open Item (285/8221-08): Radioactive Standard Preparation - The licensee had not developed procedures or acquired detailed procedures for preparation of radioactive standards. See Section 9 for details.

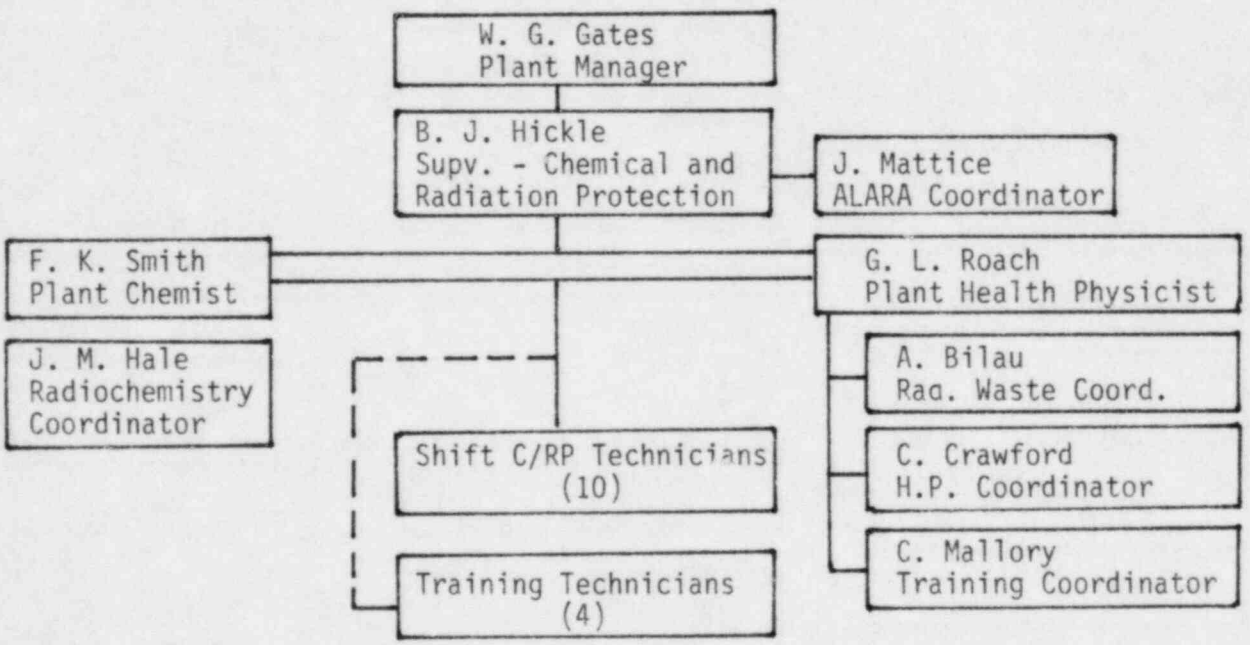
(Open) Open Item (285/8221-9): Quality Control Cross-Check Program - The licensee had not implemented an analytical spiked or split sample cross-check program inhouse or with an independent NRC-approved laboratory. See Section 9 for details.

(Open) Open Item (285/8221-10): Chemistry/Radiochemistry Sampling - The licensee had not developed detailed, written step-by-step sampling procedures for all chemistry/radiochemistry samples. See Section 10 for details.

(Open) Open Item (285/8221-11): Confirmatory Measurements - The licensee had a high percentage of disagreements in the confirmatory measurement samples analyses. See Section 11 for details.

5. Chemical and Radiation Protection

The NRC inspectors reviewed the Fort Calhoun Nuclear Station staff assignments in regard to radiochemistry and health physics responsibilities. The following diagram shows the present structure and assigned individuals:



The number of chemical and radiation protection personnel indicated on the staffing chart appears to be sufficient to meet staffing requirements for routine operation and backshift coverage. However, to facilitate adequate chemistry and health physics coverage during an outage, additional shift technicians may have to be considered.

The NRC inspectors reviewed the position descriptions which detailed the duties and responsibilities of the Supervisor - Chemical and Radiation Protection, Plant Chemist, Plant Health Physicist, Chemist, C/RP Senior Technician, C/RP Technician I, C/RP Technician II, and C/RP Junior Technician. The NRC inspectors were concerned regarding the present onsite management organization in that technician-rated positions had been given a great deal of responsibility and technicians were performing many functions at higher grade level other than those designated in their respective position description. However, it should be noted that the technicians assigned areas of responsibility have demonstrated their abilities in these areas and have completed the necessary training and experience to meet the demands of their assignments.

At the time of the inspection the chemist position remained vacant and that position's duties and responsibilities were being handled by a C/RP Technician I. Vacancies of responsible staff positions should be filled with qualified personnel as soon as possible to provide knowledge and expertise in giving guidance and training to the technician positions. Implementing procedures for functional area assignments such as hot laboratory, cold laboratory, and counting room had not been developed. This item is considered open (285/8221-01) pending:

. Filling the chemist position vacancy.

. Development and implementation of procedures governing functional area assignments.

No violations or deviations regarding the chemical and radiation protection organization were identified.

6. Chemical and Radiation Protection Personnel Qualifications

The NRC inspectors reviewed the qualifications of the chemical and radiation protection personnel to determine agreement with commitments in the FSAR, management-approved position descriptions, and the recommendations of Regulatory Guide 1.8 and ANSI N18.1-1971.

Documents Reviewed

. Chemical and radiation protection staff position descriptions

. Chemical and radiation protection staff ANSI N18.1-1971 qualification letters

The NRC inspectors noted that the plant chemist did not appear to meet the experience and training qualification criteria for radiochemistry supervisor

as outlined in Section 4.4 of ANSI N18.1-1971. The NRC inspectors also noted that the licensee had not developed procedures which would provide definitive guidance for the determination of acceptable radiochemistry and radiation protection experience for station personnel. This item is considered unresolved (285/8221-01) pending further review of resumes and documentation indicating experience and training in accordance with ANSI N18.1-1971 for the radiochemistry supervisor and the development of selection and qualification criteria for radiochemistry personnel.

No violations or deviations regarding chemical and radiation protection staff qualifications were identified.

7. Chemical and Radiation Protection Personnel Training

The NRC inspectors reviewed the licensee's chemical and radiation protection staff training program to determine compliance with FSAR commitments, 10 CFR 19.12 requirements, and the recommendations of ANSI N18.1-1971 and Regulatory Guide 1.8.

Documents Reviewed

- FSAR
- Fort Calhoun Station Training Manual, Section 6, Revision 4, January 4, 1982
- Study Guide for Shift Qualification
- Shift Chemist Requirements
- Shift Health Physics Requirements
- Study Guide and Record for C/RP Junior Technician
- Study Guide and Record for C/RP Technician II
- Study Guide and Record for C/RP Technician I
- Study Guide and Record for C/RP Senior Technician
- Computer printout summary of training received by each chemical and radiation protection staff member

The NRC inspectors reviewed the Fort Calhoun Station Training Manual and found a written training program which included defined objectives, schedules, training requirements for each chemical and radiation protection position classification, study guides, topical lesson plans, instruction materials, and methods of evaluating the effectiveness of the training.

The NRC inspectors reviewed the computer summary of training received by each chemical and radiation protection staff member as compiled from individual staff member's on-job-training (OJT) record books. The summary record indicated that all of the staff, except for the most recently hired trainees, had completed initial site training, general employee training, site emergency plan training, radiation protection training, emergency monitor team training, and shift qualification training for chemical and radiation protection technicians. Each member of the staff receives training every sixth week on rotation. The computer summary of each staff member's progress is updated and kept current during that member's training week. Specific topical training is conducted by the training department supplemented by vendor schools on specialized topics. The Babcock and Wilcox radiochemistry course has been attended by the plant chemist. The Canberra School on operation of the Jupiter Multi-Channel Analyzer System has been attended by the lead chemistry technician responsible for radiochemistry and counting room activities.

The NRC inspectors noted that the training manual did not address specific training requirements of professional or supervisor staff positions. If a person filling such position had not been plant specifically trained in the station's technician program, he would not be required to receive training which would enable him to be qualified to perform functions required by his subordinates. A formal training program for technical supervisors and professionals which defines objectives, scope, and training and retraining schedules had not been developed by the licensee. This item is considered open (285/8221-02) pending development of a formal training program for chemical and radiation protection supervisors and professionals.

No violations or deviations regarding the chemical and radiation protection training program were identified.

8. Licensee's Internal Audits

The NRC inspectors reviewed the quality assurance organization and audit program to determine compliance with FSAR commitments, 10 CFR 50 Appendix B requirements, and the recommendations of ANSI N18.7-1976 and Regulatory Guide 1.33. Reports of audits conducted in the area of chemistry/radiochemistry during the period from July 1981 through September 1982 were reviewed for scope and followup action of problem areas identified during the audit.

Documents Reviewed

- Fort Calhoun Station Quality Assurance Manual, Revision 3, June 18, 1982
- List of annual internal audit subject/area
- QA Surveillance Checklist for Waste Liquid Release, monthly check
- QA Surveillance Checklist for Waste Gas Release, semiannual check

- QA Surveillance Checklist for Containment Purge Releases, quarterly check
- QA Surveillance Checklist for Primary/Secondary Chemistry, monthly check
- "Surveillance Testing and Technical Specifications for Fort Calhoun Station," Audit Report No. 16-82, April 27, 1982
- "Training," Audit Report No. 28-82, June 28, 1982
- "Calibration Control," Audit Report No. 14-82, April 2, 1982

The NRC inspectors reviewed the above-listed audit reports and QA surveillance checklists performed as scheduled during the period July 1981 through September 1982. The QA audits were scheduled and published for distribution on a quarterly basis by the QA Manager. All QA audits were performed on an annual frequency. QA surveillance checklists (mini-audits) were performed according to their respective monthly, quarterly, or semiannual frequency. All audits and mini-audits were performed as scheduled and only minor deficiencies were identified and subsequently corrected in a timely manner and documented.

The audits and QA surveillance checklists were designed to determine compliance with existing procedures. The audit scope did not include evaluations regarding the effectiveness of the chemistry/radiochemistry group, facilities, equipment, or recommended improvements to the existing chemistry/radiochemistry program. The audits were designed to cover general topics and not areas of a technical discipline such as chemistry, health physics, or radwaste in a complete and technical manner. Therefore, several audits must be performed in order to encompass all aspects of a department.

The NRC inspectors noted that the audit teams did not include a member who had radiochemistry experience and was technically knowledgeable in radiochemistry procedures and activities at nuclear power facilities. This item is considered open (285/8221-03) pending followup action by the licensee on audit team member selection in the future.

No violations or deviations regarding the licensee's audit program of chemistry/radiochemistry were identified.

9. Quality Control of Chemistry and Health Physics Radiological Analytical Measurements

The NRC inspectors visited the radiochemistry counting room and health physics counting room and reviewed the program for quality control of radiological analytical measurements to determine compliance with Technical Specifications and recommendations of Regulatory Guide 4.15.

Documents Reviewed

- Standing Order A-T-13, "Quality Control Program for Chemistry and Radiation Protection Equipment," Revision 14, August 24, 1982
- Master index for chemistry instrument calibration procedures
- Master index for chemistry instrument functional check procedures
- Master index for health physics instrument calibration procedures
- Master index for health physics instrument functional check procedures
- CP-LAB-6, "G.M.," Revision 6, September 3, 1981
- CP-LAB-7, "I.P.C.," Revision 8, December 12, 1981
- CP-LAB-8, "Liquid Scintillation Spectrometer, Packard Model 3002," Revision 2, September 20, 1979
- CP-LAB-15, "TN-11, GeLi," Revision 2, June 22, 1982
- CP-LAB-19, "Canberra Jupiter GeLi System," Revision 1, October 7, 1982
- CP-Tennelec-1, "Radiation Monitoring Equipment," Revision 1, August 10, 1982
- FCP-LAB-6, "G.M.," Revision 3, December 29, 1981
- FCP-LAB-7, "Internal Proportional Counter (IPC)," Revision 3, December 22, 1981
- FCP-LAB-8, "Liquid Scintillation Spectrometer, Packard Model 3002," Revision 3, November 3, 1981
- FCP-LAB-15, "TN-11, GeLi," Revision 2, November 3, 1978
- FCP-LAB-19, "Canberra Jupiter GeLi System," Revision 1, October 16, 1979
- FCP-HP-1, "Radiation Detection Equipment Performance Testing," Revision 5, December 4, 1981
- Form FC-200, "Canberra Jupiter GeLi System Quality Control Function Test Data Sheet," Revision 1, November 24, 1981
- Form FC-264, "G. M. Quality Control Function Test Data Sheet," Revision 1, December 29, 1981

- Form FC-265, "I.P.C. Quality Control Function Test Data Sheet," Revision 1, January 14, 1982

- Form FC-266, "TN-11 GeLi System Quality Control Function Test Data Sheet," Revision 1, November 24, 1981

- Form FC-272, "Wide Beta II Quality Control Function Test Data Sheet," Revision 0, July 15, 1981

- Form FC-274, "Liquid Scintillator Quality Control Function Test Data Sheet," Revision 2, November 16, 1978

- Form FC-353, "Chemistry Laboratory Instrument Quality Control Function Test Data Sheet," Revision 1, November 24, 1981

The NRC inspectors examined the licensee's radiochemistry counting room and health physics counting room quality control procedures, counting instrument calibration data, counting instrument functional check data, and other documentation of instrument performance. Data for the period July 1981 through September 1982 were reviewed for the following: radiochemistry instruments including the Beckman Wide Beta II, Packard Model 3002 Liquid Scintillation Spectrometer, NMC Geiger-Mueller Counting System, NMC Internal Proportional Gas Flow Counting System, Tracor Northern TN-11 Gamma Spectrometer System, and Canberra Jupiter Gamma Spectrometer System; the health physics Tennelec Smear Counting System; and the non-radiological analytical instruments in the water plant, cold chemistry laboratory, and the radiochemistry laboratory. The licensee's records were in order and indicated that an adequate quality control program was being maintained.

The NRC inspectors reviewed Standing Order A-T-13, "Quality Control Program for Chemistry and Radiation Protection Equipment," Revision 14, August 24, 1982, for any revisions since the last inspection and for compliance with established requirements of the quality control procedures. It was noted that revisions had been made in response to deficiencies identified in QA audit "Calibration Control" No. 14-82 conducted in April 1982. The quality control schedule for chemistry instrument calibration and functional check had not been updated to include recently acquired instrumentation including the Orbisphere oxygen meter, atomic absorption spectrometer model 2380, post-accident sampling system pH meter, sodium sled, and hydrazine analyzer as per instrument calibration schedule mounted on the wall of the chemistry counting room.

This item is considered open (285/8221-04) pending revision and NRC review of Standing Order A-T-13 to include the above-listed instruments.

The NRC inspectors reviewed the above-listed instrument calibration procedures, instrument function check procedures, and instrument quality control function test data sheets for the following items: instrument operation, preparation of standards, specific sample geometries to be calibrated, analytical measurements, calculations for determination of

instrument parameters from analytical data, methods of recording or reporting the data, frequency of calibration or functional check, and acceptance criteria. In general, all the procedures reviewed included these items. However, the NRC inspectors have the following items of concern:

a. Procedure FCP-LAB-5, "Gas Partitioner Model 25," Revision 3, November 16, 1978, had been cancelled on September 8, 1981, and not replaced with a function check procedure for the current gas partitioner, Fisher Model 1200.

This item is considered open (285/8221-05) pending the licensee developing a function check procedure for the Fisher Gas Partitioner Model 1200.

b. Calibration procedures had not been written and approved in accordance with established plant policy for the following recently acquired instruments: sodium sled, hydrazine analyzer, Orbisphere oxygen meter, atomic absorption spectrometer model 2380, post-accident sampling system pH meter, and PYE Unicom spectrometer. These calibration procedures must be written and approved prior to use of the instrumentation for analytical measurements influencing plant systems.

This item is considered open (285/8221-06) pending review of approved procedures for the above-listed instruments.

c. Functional check procedures had not been written and approved in accordance with established plant policy for the following instruments: Orion Model 601A Digital Analyzer, Orion Model 901 Digital Analyzer, sodium sled, hydrazine analyzer, Orbisphere oxygen meter, atomic absorption spectrometer model 2380, post-accident sampling system pH meter, and PYE Unicom spectrometer. These function check procedures must be written and approved prior to use of the instrumentation for analytical measurements influencing plant systems.

This item is considered open (285/8221-07) pending review of approved procedures for the above-listed instruments.

d. Review of Form FC-353 for the cold chemistry laboratory and radiochemistry laboratory revealed that all instruments indicated on that form were not either indicated as not being used on the form or the proper completion of the form was not being performed in accordance with the respective instrument functional check procedures. In the radiochemistry laboratory only the conductivity bridge, pH meter, and Coleman Model 139 spectrometer were being initialed as function checked as per functional check procedures. In the cold chemistry laboratory only the conductivity bridge, Klett-Summerson Colorimeter, pH meter, and analytical balance were being initialed as function checked as per functional check procedures.

This item remains open (285/8112-01) pending revision and NRC review of Form FC-353 to indicate only the appropriate instruments and the respective instrument functional check procedures to indicate how the functional check information is to be documented.

e. The NRC inspectors were unable to determine precisely how the licensee prepared "homemade" radioactive standards or how the commercially prepared radioactive standards were prepared which were used in calibration or functional checks of the radiochemistry Tracor Northern TN-11 Gamma Spectrometer System, Canberra Jupiter Gamma Spectrometer System, Packard Model 3002 Liquid Scintillation Spectrometer, Beckman Wide Beta II, NMC Geiger-Mueller Counting System, NMC Internal Proportional Gas Flow Counting System, and the health physics Tennelec Smear Counting System.

This item is considered open (285/8221-08) pending development of detailed procedures for preparation of radioactive standards for all types of counting configurations which are NBS traceable and acquire detailed preparation procedures from the commercial supplier of radioactive standards used.

f. The NRC inspectors noted that an internal quality control cross-check program had not been implemented requiring chemical and radiation protection technicians and chemists to periodically analyze spiked or split samples and compare results with an independent laboratory other than the annual split samples used for confirmatory measurements with the NRC to evaluate both equipment performance and technician proficiency on a regular basis.

This item is considered open (285/8221-09) pending development of a program to analyze spiked or split samples on a routine basis as part of the quality control program.

No violations or deviations regarding the licensee's chemistry/radiochemistry and health physics quality control program were identified.

10. Chemistry/Radiochemistry Sampling

The NRC inspectors reviewed the licensee's routine chemistry/radiochemistry sampling procedures to determine compliance with FSAR and Technical Specification commitments.

Documents Reviewed

. CMP-2, "Sample Collection," Revision 7, September 16, 1982

. OI-WDL-1, "Collection and Transfer of Liquid Waste," Revision 14, December 4, 1981

The NRC inspectors reviewed CMP-2, "Sample Collection," Revision 7, September 16, 1982. This section of the chemistry manual covers general

philosophy and techniques for taking liquid and gaseous samples and sampling schedule for routine plant samples indicating sample description, sample point location, sample valve, frequency of collection, and analyses. Appendixes A-F to this section of the chemistry manual include step-by-step procedures for the gas analysis sampling system, plant maps for sample point locations, sampling procedures to comply with 40 CFR 190 requirements, primary sampling system, secondary sampling system, and gaseous effluent sampling. However, it was noted that detailed step-by-step sampling procedures were not developed to provide guidance in the proper techniques for collection of specific routine samples such as monitor tanks, hotel tanks, waste holdup tanks, radwaste evaporator concentrate and distillate, component cooling water, safety injection tanks, spent fuel storage pool, and water plant demineralizer acid and caustic tanks. Detailed sampling procedures for all manually taken samples should be written to include such items as sampling frequency, sample point valve identification, valve lineups, tank recirculation times, health physics handling precautions, safety considerations, sample line flush time to provide a representative sample, sample quantity, and sample container labeling.

This item is considered open (285/8221-10) pending development of detailed sampling procedures for all chemistry/radiochemistry samples.

No violations or deviations regarding the licensee's chemistry sampling program were identified.

11. Analytical Measurements

a. Confirmatory Measurements

Confirmatory measurements were performed on the following samples in the Region IV mobile laboratory at Fort Calhoun Nuclear Station during the inspection:

(1) Stack Particulate Filter

(2) RESL Particulate Filter Standard

(3) Stack Charcoal Cartridge

(4) Gaseous Radwaste Effluent

(5) Reactor Coolant Gas

(6) Reactor Coolant Degassed Liquid

(7) Liquid Radwaste Effluent

(8) Monitor Tank Composite

The confirmatory measurements test consists of comparing measurements made by the licensee, NRC's mobile laboratory, and NRC's reference laboratory, Radiological and Environmental Sciences Laboratory (RESL) in Idaho Falls, Idaho. RESL's and 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 mobile laboratory or RESL 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, and above the Lower Limit of Detection (LLD) for stack samples. Stack charcoal cartridge and stack particulate filter comparisons are based on established LLD's for total activity per sample.

Attachment No. 1 contains the criteria used to compare results.

Attachment No. 2 lists the LLD's for stack samples.

b. Results

The licensee maintains two separate gamma spectroscopy systems which are used for routine isotopic analysis of radioactive effluent samples and Technical Specification requirements. Either and/or both systems are used to demonstrate compliance with regulatory requirements. For this reason both systems were cross-checked during this inspection.

The following tables show the various sample comparison results. All samples were analyzed on both the TN-11 Gamma Spectrometer System (TN-11) and the Canberra Jupiter Gamma Spectrometer System (Canb.) located in the radiochemistry counting room. The analytical results from both systems were compared with the NRC results, as well as between themselves.

(1) Stack Particulate Filter from RM-060
(Sampled 10:00 CDT, October 12, 1982)

No significant nuclide concentrations greater than the lower level of detectability were identified by the licensee or by the Region IV mobile laboratory. No comparison was made.

(2) RESL Particulate Filter Standard No. 80-8
(Standardized 09:00 CST, March 19, 1980)

Nuclide	OPPD System	OPPD Result (uCi/gm)	TN-11/Canb. Ratio	Decision	NRC Result[1/] (uCi/gm)	OPPD/NRC Ratio	Decision
^{57}Co	TN-11	2.28±0.06E-02	0.88	Agreement	2.28±0.09E-02	1.00	Agreement
	Canb.	2.58±0.11E-03				1.13	Agreement
^{60}Co	TN-11	1.63±0.01E-01	1.27	Possible Agreement	1.73±0.07E-01	0.94	Agreement
	Canb.	1.28±0.01E-01				0.74	Poss.Agreement

^{137}Cs	TN-11	1.22±0.01E-01	0.94	Agreement	1.29±0.05E-01	0.95	Agreement
	Canb.	1.30±0.01E-01				1.01	Agreement

1/ NRC results were taken from the standard certificate supplied with the standard as prepared by RESL and traceable to the National Bureau of Standards.

(3) Stack Charcoal Cartridge from RM-060
(Sampled 10:00 CDT, October 12, 1982)

Nuclide	OPPD System	OPPD Result (uCi/sample)	TN-11/Canb. Ratio	Decision	NRC Result (uCi/sample)	OPPD/NRC Ratio	Decision
^{131}I	TN-11	2.54±0.15E-04	1.12	Agreement	2.76±0.09E-04	0.92	Agreement
	Canb.	2.26±0.16E-04				0.82	Agreement
^{133}I	TN-11	4.17±0.83E-04	-	Disagreement	3.32±0.76E-05	12.6	Disagreement
	Canb.	<2.53E-04					

The same identical charcoal cartridge was analyzed on all three gamma spectrometer systems.

(4a) Gaseous Radwaste Effluent from Gas Decay Tank "A"
(Sampled 16:32 CDT, October 12, 1982)

Nuclide	OPPD System	OPPD Result (uCi/cc)	TN-11/Canb. Ratio	Decision	NRC Result (uCi/cc)	OPPD/NRC Ratio	Decision
^{133}Xe	TN-11	9.44±0.01E-03	1.02	Agreement	1.26±0.01E-02	0.75	Disagreement
	Canb.	9.30±0.57E-03				0.74	Disagreement
^{133m}Xe	TN-11	<6.21E-06	-	No Comparison	3.44±0.07E-04	-	Disagreement
	Canb.	7.13±1.32E-04				2.07	Disagreement
^{133m}Xe	TN-11	1.77±0.04E-07	0.002	Disagreement	9.12±0.12E-05	0.002	Disagreement
	Canb.	1.02±0.01E-04				1.11	Agreement
^{85}Kr	TN-11	4.98±0.04E-03	1.89	Disagreement	1.84±0.03E-03	2.71	Disagreement
	Canb.	2.64±0.04E-03				1.43	Disagreement

The three samples analyzed were taken simultaneously by connecting the three sample containers in series with tubing and purging them with the gas sample flowing. The sample analyzed by OPPD on the TN-11 System was a 4000cc Marinelli beaker; the sample analyzed by OPPD on the Canberra Jupiter System was a 1000cc Marinelli beaker, and the sample analyzed by the NRC on the ND-6620 System was a 1000cc Marinelli beaker. Due to the high percentage of

disagreements among the analyses results, a resampling of the gas decay tank was performed for a second analysis. The results of the resampling are recorded in the following table.

(4b) Gaseous Radwaste Effluent from Gas Decay Tank "A" (Resample)
(Sampled 12:27 CDT, October 14, 1982)

Nuclide	OPPD System	OPPD Result (uCi/cc)	TN-11/Canb. Ratio	Decision	NRC Result (uCi/cc)	OPPD/NRC Ratio	Decision
^{133}Xe	TN-11	8.29±0.01E-04	0.97	Agreement	3.84±0.01E-04	2.15	Disagreement
	Canb.	8.50±0.01E-04				2.21	Disagreement
^{131m}Xe	TN-11	8.91±0.16E-05	1.12	Agreement	3.64±0.12E-05	2.45	Disagreement
	Canb.	7.98±0.15E-05				2.19	Disagreement
^{85}Kr	TN-11	1.30±0.02E-03	0.90	Agreement	5.11±0.14E-04	2.54	Disagreement
	Canb.	1.45±0.02E-03				2.84	Disagreement

The two samples analyzed were taken simultaneously and connected in series with tubing. The sample analyzed by OPPD on both systems was a 4000cc Marinelli beaker and the sample analyzed by the NRC was a 1000cc Marinelli beaker. The results indicated that the licensee's results could agree between their two systems when analyzing the same sample; however, the results were not in agreement when compared with a second sample analyzed by NRC. The data would indicate that the reason for the disagreements in the results was due to not obtaining representative samples. It should be noted that the licensee's analytical results were of a conservative value for reporting effluent release concentrations. Therefore, gas decay tank isotopic analyses performed by the licensee would cause the licensee to require a more restrictive release rate to the environment of a gaseous effluent so as to meet 10 CFR Part 20, Appendix B requirements.

(5a) Reactor Coolant Gas
(Sampled 10:46 CDT, October 13, 1982)

Nuclide	OPPD System	OPPD Result (uCi/cc)	TN-11/Canb. Ratio	Decision	NRC Result (uCi/cc)	OPPD/NRC Ratio	Decision
^{41}Ar	TN-11	1.34±0.06E-02	0.14	Disagreement	1.40±0.10E-02	0.96	Agreement
	Canb.	9.25±0.40E-02				6.61	Disagreement
^{85m}Kr	TN-11	9.06±0.04E-02	0.85	Agreement	9.62±0.10E-02	0.94	Agreement
	Canb.	1.06±0.01E-01				1.10	Agreement

Nuclide	OPPD System	OPPD Result (uCi/cc)	TN-11/Canb. Ratio	Decision	NRC Result (uCi/cc)	OPPD/NRC Ratio	Decision
^{87}Kr	TN-11	1.10±0.01E-01	1.00	Agreement	1.52±0.02E-01	0.72	Disagreement
	Canb.	1.10±0.01E-01				0.72	Disagreement
^{88}Kr	TN-11	1.42±0.01E-01	0.92	Agreement	2.61±0.03E-01	0.54	Disagreement
	Canb.	1.55±0.01E-01				0.59	Disagreement
^{133}Xe	TN-11	2.00±0.01E+00	1.01	Agreement	2.16±0.01E+00	0.93	Agreement
	Canb.	1.98±0.02E+00				0.92	Agreement
^{133m}Xe	TN-11	2.57±0.15E-02	-	Disagreement	4.67±0.50E-02	0.55	Possible Agreement[1/]
	Canb.	<5.53E-03				-	Disagreement[1/]
^{135}Xe	TN-11	5.16±0.01E-01	1.06	Agreement	6.57±0.02E-01	0.78	Disagreement
	Canb.	4.86±0.01E-01				0.74	Disagreement
^{135m}Xe	TN-11	6.22±0.40E-02	0.85	Agreement	1.04±0.04E-01	0.60	Possible Agreement
	Canb.	7.28±0.10E-02				0.70	Possible Agreement
^{138}Xe	TN-11	4.78±0.40E-02	0.34	Disagreement	3.05±0.20E-01	0.16	Disagreement
	Canb.	1.41±0.03E-01				0.46	Disagreement

[1/] Nuclide was not identified by the licensee due to analysis sensitivity parameters which had been established for isotopic peak identification.

The two aliquot samples analyzed were taken from the same gas sample using the same gas syringe. The same sample volume (1cc) was analyzed by both the licensee and the NRC. The sample analyzed by OPPD on both the TN-11 System and the Canberra Jupiter System was 1cc injected into a 5cc vial. The sample analyzed by the NRC on the ND-6620 System was 1cc injected into a 15cc serum vial. Due to the high percentage of disagreements among the analyses results, a resampling of the reactor coolant and degassing of the sample was performed for a second analysis. The results of the resampling are recorded in the following table.

(5b) Reactor Coolant Gas (Resample)
(Sampled 13:11 CDT, October 14, 1982)

Nuclide	OPPD System	OPPD Result (uCi/cc)	TN-11/Canb. Ratio	Decision	NRC Result (uCi/cc)	OPPD/NRC Ratio	Decision
^{41}Ar	TN-11	1.84±0.06E-02	0.12	Disagreement	2.30±0.05E-02	0.80	Agreement
	Canb.	1.49±0.05E-01				6.48	Disagreement

Nuclide	OPPD System	OPPD Result (uCi/cc)	TN-11/Canb. Ratio	Decision	NRC Result (uCi/cc)	OPPD/NRC Ratio	Decision
^{85m}Kr	TN-11	1.29±0.01E-01	0.75	Poss. Agreement	1.57±0.01E-01	0.82	Agreement
	Canb.	1.73±0.01E-01				1.10	Agreement
^{87}Kr	TN-11	1.72±0.01E-01	0.85	Agreement	2.43±0.01E-01	0.71	Disagreement
				Possible			
	Canb.	2.03±0.02E-01				0.84	Agreement
^{88}Kr	TN-11	2.02±0.01E-01	0.81	Agreement	4.10±0.02E-01	0.49	Disagreement
	Canb.	2.50±0.01E-01				0.61	Disagreement
				Possible			
^{133}Xe	TN-11	2.77±0.01E+00	0.81	Agreement	3.67±0.01E+00	0.76	Disagreement
	Canb.	3.40±0.01E+00				0.93	Agreement
				Possible			
^{133m}Xe	TN-11	3.17±0.02E-02	0.71	Agreement	7.62±0.31E-02	0.42	Disagreement
	Canb.	4.48±0.14E-02				0.59	Disagreement
^{135}Xe	TN-11	7.44±0.01E-01	0.88	Agreement	1.12±0.001E+0	0.66	Disagreement
	Canb.	8.43±0.01E-01				0.75	Disagreement
^{135m}Xe	TN-11	9.91±0.13E-02	0.81	Agreement	1.34±0.02E-01	0.74	Disagreement
	Canb.	1.23±0.13E-01				0.92	Agreement
^{138}Xe	TN-11	9.19±0.20E-02	-	Disagreement	3.90±0.07E-01	0.24	Disagreement
	Canb.	< 7.71E-02				-	No Comparison 1/

1/ Nuclide was not identified because the activity had decayed to below the lower level of detectability at the time of sample analysis by the licensee on the Canberra Jupiter System; therefore, no comparison was made.

The two aliquot samples analyzed were taken from the same gas sample using the same gas syringe as before. The gas results from the resampling of the reactor coolant show a higher percentage of disagreements among the analysis results than was found with the first sample. It should be noted that the licensee's analytical results were not always in agreement between the licensee's two gamma spectroscopy systems and the results, for all isotopes, were of a nonconservative value (less than the NRC isotopic analytical results).

The NRC inspectors were concerned with the high percentage of disagreements in the confirmatory measurements analyses of especially the gas samples. The above data indicates that 68 percent of the gaseous isotopic analyses were classified as disagreements. The NRC inspectors find this percentage of analysis disagreements unacceptable. Corrective action is necessary

regarding the present sampling and analysis procedures in order to reduce the number of disagreements to an acceptable level. An acceptable level is considered to be greater than 90 percent agreements. This item is considered open (285/8221-11) pending an evaluation by the licensee as to the plants gaseous sampling techniques and procedures and a subsequent sampling and analysis of gaseous radwaste effluent and reactor coolant gas giving comparitive results which are in agreement with the NRC.

(6a) Reactor Coolant Degassed Liquid
(Sampled 10:46 CDT, October 13, 1982)

Nuclide	OPPD System	OPPD Result (uCi/ml)	TN-11/Canb. Ratio	Decision	NRC Result (uCi/ml)	OPPD/NRC Ratio	Decision
^{54}Mn	TN-11	1.15±0.04E-02	-	Disagreement	1.26±0.04E-02	0.91	Agreement
	Canb.	<1.37E-03				-	Disagreement
^{58}Co	TN-11	5.61±0.40E-03	-	Disagreement	2.23±0.20E-03	2.52	Disagreement
	Canb.	<1.37E-03				-	Disagreement
^{131}I	TN-11	3.37±0.04E-02	0.97	Agreement	3.37±0.05E-02	1.00	Agreement
	Canb.	3.47±0.06E-02				1.03	Agreement
^{132}I	TN-11	1.00±0.04E-01	0.91	Agreement	1.03±0.01E-01	0.97	Agreement
	Canb.	1.10±0.07E-01				1.07	Agreement
^{133}I	TN-11	8.06±0.06E-02	0.33	Disagreement	7.68±0.06E-02	1.05	Agreement
	Canb.	2.44±0.02E-01				3.18	Disagreement
^{134}I	TN-11	1.29±0.02E-01	1.04	Agreement	1.56±0.03E-01	0.83	Agreement Possible
	Canb.	1.24±0.02E-01				0.79	Agreement
^{135}I	TN-11	9.07±0.20E-02	0.83	Agreement	1.06±0.02E-01	0.86	Agreement
	Canb.	1.09±0.02E-01				1.03	Agreement
^{138}Cs	TN-11	1.94±0.05E-01	0.53	Disagreement	4.15±0.07E-01	0.47	Disagreement
	Canb.	3.64±0.10E-01				0.88	Agreement

The two aliquot samples analyzed were taken from the same liquid sample. The sample analyzed by OPPD on both the TN-11 System and the Canberra Jupiter System was 1 ml pipetted into an 8 ml bottle. The sample analyzed by the NRC on the ND-6620 System was 3 ml pipetted into a 50 ml bottle. Due to the high percentage of disagreements among the analysis results, a resampling of the reactor coolant was performed for a second analysis. The results of the resampling are recorded in the following table.

(6b) Reactor Coolant Degassed Liquid (Resample)
(Sampled 13:11 CDT, October 14, 1982)

Nuclide	OPPD System	OPPD Result (uCi/ml)	TN-11/Canb. Ratio	Decision	NRC Result (uCi/ml)	OPPD/NRC Ratio	Decision
^{58}Co	TN-11	8.22±0.43E-03	2.74	Disagreement	2.46±0.15E-03	3.34	Disagreement
	Canb.	3.00±0.27E-03				1.22	Agreement
^{131}I	TN-11	2.99±0.04E-02	0.90	Agreement	3.10±0.04E-02	0.96	Agreement
	Canb.	3.32±0.04E-02				1.07	Agreement
^{132}I	TN-11	8.95±0.35E-02	0.95	Agreement	9.91±0.08E-02	0.90	Agreement
	Canb.	9.43±0.43E-02				0.95	Agreement
^{133}I	TN-11	7.25±0.06E-02	0.92	Agreement	7.38±0.05E-02	0.98	Agreement
	Canb.	7.87±0.07E-02				1.07	Agreement
^{134}I	TN-11	1.29±0.02E-01	0.96	Agreement	1.51±0.02E-01	0.85	Agreement
	Canb.	1.35±0.03E-01				0.89	Agreement
^{135}I	TN-11	8.43±0.18E-02	0.73	Disagreement	1.02±0.02E-01	0.83	Agreement
	Canb.	1.16±0.02E-01				1.14	Agreement
^{138}Cs	TN-11	1.61±0.03E-01	0.50	Disagreement	3.05±0.03E-01	0.53	Disagreement
	Canb.	3.20±0.07E-01				1.05	Agreement

The two aliquot samples were taken from the same liquid sample. The sample analyzed by OPPD on both the TN-11 System and the Canberra Jupiter System was 1 ml.pipetted into an 8 ml bottle. The sample analyzed by the NRC on the ND-6620 System was 10 ml pipetted into a 500 ml bottle. The degassed liquid results from the resampling of the reactor coolant show about the same percentage of agreements as found in the first sample. The results indicated that liquid samples were much easier to duplicate than gaseous samples using OPPD's present technique for gas sampling.

(7) Liquid Radwaste Effluent from Waste Holdup Tank "B"
(Sampled 14:26 CDT, October 13, 1982)

Nuclide	OPPD System	OPPD Result (uCi/ml)	TN-11/Canb. Ratio	Decision	NRC Result (uCi/ml)	OPPD/NRC Ratio	Decision
tritium	-	7.19±0.006E-02	-	-	1/	-	2/
gross beta							
on (10/13/82)		3.01E-02	-	-	3.29±0.01E-02	0.91	Agreement
on (11/3/82)		6.57±0.17E-03	-	-	3.00±0.10E-02 3/	0.22	Disagreement

^{60}Co	TN-11	1.57±0.05E-04	1.47	Possible Agreement	2.81±0.20E-04	0.56	Possible Agreement
	Canb.	1.07±0.03E-04				0.38	Disagreement
^{131}I	TN-11	<1.24E-05	-	-	6.66±3.23E-05	-	Disagreement 4/
	Canb.	<3.78E-05	-	-		-	Disagreement 4/
^{134}Cs	TN-11	7.68±0.03E-03	1.05	Agreement	8.56±0.09E-03	0.90	Agreement
	Canb.	7.32±0.02E-03				0.86	Agreement
^{137}Cs	TN-11	2.19±0.0004E-02	1.02	Agreement	2.49±0.01E-02	0.88	Agreement
	Canb.	2.14±0.0030E-02				0.86	Agreement

1/ Analytical results were not available at the time of the report. Formal documentation of these analyses will appear in the next confirmatory measurements inspection report.

2/ Analytical results were not available at the time of the report; therefore, no comparison was made.

3/ Analytical results as reported by the Radiological and Environmental Science Laboratory (RESL), Idaho Falls, Idaho.

4/ Licensee's peak confidence level for peak identification along with other analysis parameters have been established so as not to allow analysis of nuclides at sensitivity levels recommended for principal gamma emitters in liquid effluent samples as presented in the draft standard technical specifications for pressurized water reactors or at activity levels equal to or less than 10 percent of the isotopic values stated in 10 CFR Part 20, Appendix B, Table II, Column 2.

(8) Monitor Tank Composite
(Sampled 16:00 CDT, October 14, 1982)

Nuclide	OPPD Result (uCi/ml)	NRC Result 2/ (uCi/ml)	OPPD/NRC Ratio	Decision
^{89}Sr	1/	1.16±0.98E-08	-	3/
^{90}Sr	1/	8.0±4.0E-09	-	3/

1/ Analytical results were not available at the time of the report. Formal documentation of these analyses will appear in the next confirmatory measurements inspection report.

2/ Analytical results as reported by the Radiological and Environmental Science Laboratory (RESL), Idaho Falls, Idaho.

3/ Analytical results were not available at the time of the report; therefore, no comparison was made.

c. Previous Confirmatory Measurements

Confirmatory measurements were performed on a sample of liquid radwaste effluent taken during an inspection (Report No. 50-285/8112) conducted in May 1981. The results were reported to the licensee in a letter dated September 11, 1981, to W. C. Jones from G. D. Brown. In that letter the comparison decision was stated in error as possible agreement. The following table shows the correct result comparisons:

(1) Liquid (Waste Holdup Tank "B")
(Sampled 16:40 CDT, May 6, 1981)

Nuclide	OPPD Result (uCi/ml)	NRC Result[1/] (uCi/ml)	OPPD/NRC Ratio	Decision
^{89}Sr	5.81±0.07E-06	2.0±0.20E-05	0.29	Disagreement
^{90}Sr	2.28±0.07E-06	8.0±2.0E-07	2.85	Disagreement

1/ Analytical results as reported by the Radiological and Environmental Science Laboratory, Idaho Falls, Idaho.

No items of violation or deviation in regard to confirmatory measurements were identified.

12. Facilities and Equipment

The NRC inspectors visited the licensee's laboratory area and health physics counting room. The laboratories, counting facilities, and instrumentation were found acceptable and adequate. New computer support equipment had been added to the Canberra Jupiter System since the last confirmatory measurements inspection. New spectroscopy equipment and other items of analytical equipment have been added to both the secondary chemistry laboratory and the radiochemistry laboratory to upgrade the laboratory capability and replace retired equipment. The health physics counting room now has two new Tennelec smear counting systems controlled by microprocessors.

The licensee has remodeled the radiochemistry counting room and secondary chemistry laboratory providing more efficient use of the available space. The health physics counting room was in the process of remodeling which will provide more working space for health physics technicians and space to install all counting instrumentation in one controlled location and not in an auxiliary building corridor.

No violations or deviations were identified.

13. Unresolved Items

Unresolved items are matters about which more information is required in order to ascertain whether they are acceptable items, violations, or deviations. An unresolved item disclosed during the inspection is discussed in Section 6.

14. Exit Briefing

The lead NRC inspector met with the licensee representatives identified in Section 1 of this report at the conclusion of the inspection on October 15, 1982. The lead NRC inspector summarized the scope of the inspection findings and informed the licensee of the results of the confirmatory measurements performed on various intercomparison samples.

ATTACHMENT NO. 1

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 judgment 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	RATIO		
	Agreement	Possible Agreement A	Possible Agreement B
3	0.4 - 2.5	0.3 - 3.0	No Comparison
4 - 7	0.5 - 2.0	0.4 - 2.5	0.3 - 3.0
8 - 15	0.6 - 1.66	0.5 - 2.0	0.4 - 2.5
16 - 50	0.75 - 1.33	0.6 - 1.66	0.5 - 2.0
51 - 200	0.80 - 1.25	0.75 - 1.33	0.6 - 1.66
>200	0.85 - 1.18	0.80 - 1.25	0.75 - 1.33

"A" criteria are applied to the following analyses:

Gamma Spectrometry where principal gamma energy used for identification is greater than 250 keV.

Tritium analyses of liquid samples.

Iodine on adsorbers.

"B" criteria are applied to the following analyses:

Gamma Spectrometry where principal gamma energy used for identification is less than 250 keV.

^{89}Sr and ^{90}Sr determinations.

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

ATTACHMENT NO. 2

LLD's for Nuclides on Particulate and Charcoal Filters

Nuclide	LLD (uCi/sample)
^{51}Cr	1.0E-04
^{54}Mn	1.5E-05
^{58}Co	1.5E-05
^{59}Fe	3.0E-05
^{57}Co	2.0E-05
^{60}Co	3.0E-05
^{65}Zn	3.0E-05
^{89}Sr	1.0E-05
^{90}Sr	2.0E-07
^{131}I	2.0E-05
^{134}Cs	2.0E-05
^{137}Cs	2.0E-05
^{140}Ba	2.0E-05
^{140}La	4.0E-05
^{141}Ce	2.0E-05
^{144}Ce	1.0E-04