ENCLOSURE

U.S. NUCLEAR REGULATORY COMMISSION
REGION IV

Inspection Report: 50-397/95-22

License: NPF-21

Licensee: Washington Public Power Supply System
3000 George Washington Way
P.O. Box 968, MD 1023
Richland, Washington

Facility Name: Washington Nuclear Project-2 (WNP-2)

Inspection At: Richland, Washington

Inspection Conducted: July 17-20, 1995

Inspector: J. B. Nicholas, Ph.D., Senior Radiation Specialist
Facilities Inspection Programs Branch

Approved: Dwight D. Chamberlain 8-10-95
for B. Murray, Chief, Facilities Inspection Programs Branch Date

Inspection Summary

Areas Inspected: Routine, announced inspection of the licensee's water chemistry and radiochemistry programs including water chemistry and radiochemistry confirmatory measurements.

Results:

- The organizational structure and staffing of the chemistry department met commitments and requirements. During the past 2 ½ years, the chemistry department had experienced some organizational changes and a low turnover of personnel. The chemistry department was fully staffed with qualified personnel (Section 1.1).

- A good chemistry department training program had been implemented. All chemistry technicians were properly qualified (Section 2.1).

- A review of Chemistry Technical Specification requirements were included in the 1994 Unit operation audit. The licensee's quality assurance audit program did not include a specific audit frequency for the chemistry program, but good performance based quality assurance

surveillances were performed and provided good program evaluation and management oversight and were considered a strength (Section 3.1).

- A good water chemistry program was being implemented. An improved consumable chemical material control program was developed and implemented. Plant water chemistry controls were included in the planned source term reduction program. Performance in the water chemistry confirmatory measurements program were above average (Section 4.1).

- A good radiological analytical measurement program was implemented. The licensee had properly calibrated and maintained state-of-the-art radiological counting instrumentation. Performance in the radiological confirmatory measurements area was good and consistent with the previous performance (Section 5.1).

Attachments:

- Attachment 1 - Persons Contacted and Exit Meeting
- Attachment 2 - Water Chemistry Confirmatory Measurements Results (Primary Chemistry Laboratory)
- Attachment 3 - Criteria for Comparing Water Chemistry Analytical Measurements
- Attachment 4 - Radiological Confirmatory Measurement Results
- Attachment 5 - Criteria for Comparing Radiological Analytical Measurements

DETAILS

1 ORGANIZATION AND MANAGEMENT CONTROLS (84750)

The inspector reviewed the organization and staffing of the chemistry department to determine agreement with commitments in the Updated Safety Analysis Report and compliance with the requirements in Technical Specification 6.2.

1.1 Discussion

The inspector reviewed the organizational structure and staffing changes in the chemistry department since the previous NRC inspection of this area conducted in November 1993. There had been several organizational changes in the chemistry department over the past 2 ½ years. During the past 2 ½ years, there had been only three chemistry technician personnel changes. This represented a low turnover of chemistry staff. These personnel changes had no negative effect on the performance of the chemistry program. The chemistry department personnel were directly responsible for performing their assigned duties which involved the monitoring and controlling of chemistry parameters in station water systems, effluent systems, and the environmental monitoring program by collecting and analyzing samples in accordance with the Technical Specifications and Offsite Dose Calculation Manual requirements. The inspector interviewed several chemistry personnel and determined that they were familiar with the requirements of the station's chemistry program and maintained a high level of responsibility. Staffing of the chemistry department was in accordance with the Updated Safety Analysis Report and Technical Specifications. Station administrative and chemistry departmental procedures were reviewed for the assignment of responsibilities for the management and implementation of the chemistry program. The inspector determined that the duties and responsibilities specified in the station procedures were being implemented, and the chemistry department activities were well managed.

The inspector attended the daily morning meetings held by the chemistry manager with the chemistry supervisors and lead technical specialists who were responsible for the five functional areas within the chemistry department. During these daily meetings, the chemistry supervisory staff briefed the chemistry manager on plant chemistry activities from the previous day and night and discussed the chemistry department activities for the remainder of the day. It was noted that the chemistry supervisors, lead technical specialists, and chemistry manager made frequent entries into the radiological controlled area in the plant and chemistry laboratory area. The inspector determined that chemistry department management was providing adequate supervisory oversight of the chemistry daily activities.

1.2 Conclusions

The organizational structure and staffing of the chemistry department met the commitments in the Updated Safety Analysis Report and the requirements in the Technical Specifications. During the past 2 ½ years, the chemistry department had experienced some organizational changes and a low turnover of personnel. The chemistry department was fully staffed with qualified personnel. Chemistry department management controls were being implemented in accordance with station procedures.

2 TRAINING AND QUALIFICATIONS (84750)

The inspector reviewed the training and qualification program for chemistry department personnel to determine agreement with commitments in the Updated Safety Analysis Report and compliance with the requirements in Technical Specifications 6.3 and 6.4.

2.1 Discussion

The inspector reviewed the qualifications of the present chemistry department staff. It was determined that all of the chemistry staff met the qualification requirements of ANSI/ANS 18.1-1971 and that all of the 15 chemistry journeyman technicians were shift qualified and had completed all of the routine training program requirements in accordance with station training procedures. It was determined that the chemistry department had an adequate qualified staff to meet the shift staffing requirements.

The inspector reviewed the training program for chemistry department personnel including a review of the chemistry technician training course catalog and training task matrix, the 1995 chemistry training schedule, selected chemistry training lesson plans, the chemistry training instructor's qualifications, and selected individual chemistry technician training records. The chemistry training program was being implemented and documented in accordance with station procedures. The licensee had developed a good chemistry training program which was being effectively implemented by an experienced training instructor.

During the review of individual chemistry technician training records to verify completion of semiannual post-accident system training, it was noted that one semiannual training record for two shift chemistry technicians had not been entered into the training record data base. This observation was brought to the attention of the chemistry training manager and chemistry training specialist. Documentation was provided to the inspector which indicated that the two shift chemistry technicians had completed their on-the-job training during the 6-month period in question, but the attendance information for the on-the-job training session had not been transmitted to the training record data base. The licensee immediately corrected the training record data base for the two chemistry technicians based on the on-the-job attendance roster.

2.2 Conclusions

The licensee had implemented a good chemistry department training program. All of the 15 chemistry technicians were fully qualified to perform routine independent chemistry sampling and analyses.

3 QUALITY ASSURANCE PROGRAM (79502, 84750)

The inspector reviewed the quality assurance audit and surveillance programs regarding the chemistry program activities to determine agreement with the commitments in the Updated Safety Analysis Report and compliance with the requirements in Technical Specification 6.5.2.8.

3.1 Discussion

The inspector reviewed the quality assurance audit schedules for 1994 and 1995. The audit schedules were in compliance with the Technical Specifications required audits and audit frequency requirements. However, the inspector noted that the schedules indicated no periodically scheduled audit of the chemistry program. The Technical Specifications did not require a specific audit of the chemistry program at a required frequency.

The inspector reviewed the 1994 annual quality assurance audit report for unit operation which contained a review of the chemistry program activities. The audit report indicated that no problems were noted with the implementation of the chemistry program Technical Specification requirements. The audit was performed by qualified personnel who were knowledgeable in nuclear chemistry program activities.

The inspector discussed with the licensee the frequency that the chemistry program would be audited using the annually required audit to review Technical Specification programs. The licensee indicated that there was no requirement or commitment to perform an audit of the chemistry program on a regular periodic frequency. During the inspection, the inspector discussed the performance of a periodic audit of the chemistry program with the licensee. The inspector also discussed the performance of a periodic audit of the chemistry program with the licensee during the exit meeting. The quality assurance manager stated that the audit frequency of the chemistry program would be evaluated.

The inspector reviewed 10 performance based quality assurance surveillances and assessments which were performed periodically to monitor selected chemistry department activities during the time period November 1993 through May 1995. The inspector reviewed the quality assurance surveillance and assessment reports of the chemistry program for scope, thoroughness of program evaluation, and timely followup of identified deficiencies and recommendations for program improvement. The inspector determined that the operational quality assurance surveillances and assessments of the chemistry program were thorough and technically comprehensive and were conducted in sufficient depth to provide good evaluation of the chemistry department's performance. The licensee's quality assurance surveillance and assessment program was considered a strength. The inspector reviewed the qualifications of the

quality assurance personnel and technical specialist who performed the surveillances and assessments of the chemistry program. The quality assurance auditors and technical specialist were well qualified and knowledgeable of chemistry program activities conducted at nuclear power generating facilities.

3.2 Conclusions

One quality assurance audit of the chemistry program had been performed. Good performance based quality assurance surveillances and assessments, which periodically monitored chemistry program activities, were performed. The quality assurance surveillances and assessments were technically comprehensive and provided good program evaluation and management oversight and were considered a strength.

4 WATER CHEMISTRY CONTROL, CHEMICAL ANALYSIS, AND CONFIRMATORY MEASUREMENTS (79502, 84750)

The inspector reviewed the water chemistry analysis program including facilities and equipment; implementation of the quality control program for chemical measurements, selected analytical procedures, and water chemistry confirmatory measurements to determine agreement with commitments in the Updated Safety Analysis Report and compliance with the requirements in Technical Specifications 3/4.4.4 and 6.8.1.

4.1 Discussion

Water Chemistry Controls

The inspector's review of the water chemistry program determined that the licensee had approved administrative procedures, surveillance procedures, chemical control procedures, sampling procedures, analytical instrument calibration and quality control procedures, and analytical procedures. A review of selected water chemistry procedures indicated that the licensee had established and implemented good water chemistry programmatic procedures to meet the commitments in the Updated Safety Analysis Report and the requirements in the Technical Specifications.

The inspector inspected the chemistry laboratory, laboratory analytical instrumentation, chemistry sample room, and in-line process instrumentation used by the chemistry staff for water chemistry analytical measurements and control. The chemistry laboratory was equipped with the necessary chemicals, reagents, and state-of-the-art analytical instrumentation to perform the required analyses to monitor the various water system chemical parameters. The inspector verified that analytical instrument quality control and calibration standards were prepared from independent standard stock solutions, which were specifically labeled with color coded labels and stored separately. It was noted that the licensee was operating a properly calibrated in-line ion chromatograph for routine analysis of anions and cations to help in monitoring chemical parameters in many of the plant water systems.

The inspector reviewed selected chemistry analytical procedures and procedures for the operation, calibration, and quality control of the analytical

instrumentation used for the analyses of the NRC water chemistry standards. It was verified, by direct observation, that the chemistry laboratories analytical instruments were properly calibrated, and an excellent instrument quality control program was being implemented in accordance with the licensee's procedures. Chemical standards and reagents were properly labeled, and none were found to be expired.

The inspector reviewed reactor water chemistry data for 1994 to determine compliance with Technical Specification requirements. It was verified that the Technical Specification required chemistry sampling and analyses had been performed. The review included recorded trends of the reactor water chemistry data. The licensee had implemented an excellent chemistry data management system. The licensee's chemical control limits were established according to the Electric Power Research Institute owner's group guidelines for boiling water reactor water chemistry and the reactor manufacturer's chemistry specifications. The licensee had established action levels and corrective actions for out-of-specification chemistry conditions.

The inspector reviewed the chemistry monitoring program to measure and prevent the introduction of radioactivity into normally noncontaminated plant systems. Samples of the normally "clean" water systems were routinely collected and analyzed to ensure that no radioactivity had been introduced into them. The inspector also reviewed the chemical control program to prevent the introduction of chemical contaminates into the plant's water systems and reactor water system. The licensee was developing and implementing an improved consumable chemical material control program. The inspector verified that all chemicals brought on site must be classified, properly labelled, placed on the approved chemical list, and a chemical permit issued for each chemical prior to its use on site. A spot check of chemical containers throughout the plant was performed and all chemicals inspected were properly labeled and stored.

Source Term Reduction Program

The inspector discussed with the corporate chemist the licensee's plans for plant water chemistry control to implement the licensee's source term reduction program. Based on a study performed by the reactor manufacturer involving the analysis of WNP-2 fuel scraping and cobalt transport modeling, the following methods were recommended as means to accomplish the reduction of the existing cobalt-60 source term:

- Reduce cobalt input via the feedwater system
- Depleted zinc injection
- Iron injection
- Chemical decontamination of the reactor recirculation piping
- Add a seventh filter demineralizer to the condensate system

The licensee is presently developing a program to accomplish the above recommended actions and approve the necessary funding. According to the licensee, funding for the zinc and iron injection project has been approved, and the project will probably start in early 1996. The licensee has currently

placed a high priority on improving housekeeping during maintenance activities and especially during maintenance on Stellite components. A high priority has also been placed on fixing or replacing worn Stellite components to reduce the introduction of cobalt into the plant's reactor water system. Testing of special resin to remove metals (specifically cobalt) from the condensate system has been scheduled during Cycle 11. Chemical decontamination of the reactor recirculation piping has been scheduled during Refueling 11, which is scheduled to begin in April 1996.

Confirmatory Measurements

During the inspection, the inspector provided prepared standard chemical solutions to the licensee for confirmatory measurement analyses. The standard solutions were prepared by the Oak Ridge National Laboratory, Analytical Chemistry Division, for the NRC. The NRC standards were analyzed by the licensee in the chemistry laboratory using routine analytical methods and instrumentation. The analytical results of the chemical standards were used to verify the licensee's capability to monitor chemical parameters in the various station water systems with respect to Technical Specification requirements and industry standards. In addition, the chemical analyses of the NRC standards were used to evaluate the licensee's analytical procedures with respect to accuracy and precision.

The results of the water chemistry confirmatory measurement analyses and their comparison with the NRC's certified known analytical concentrations are listed for the chemistry laboratory in Attachment 2. Attachment 3 contains the criteria used to evaluate the analytical results.

The licensee's initial analytical results from the analyses performed in the chemistry laboratory indicated minor problems with the analyses for sulfate and silica. The initial water chemistry analytical results indicated that 25 of the 27 analytical results (93 percent) were in agreement or qualified agreement when compared with the NRC's certified analytical concentrations using the criteria presented in Attachment 3.

- The licensee's initial chloride midrange concentration analytical result was in qualified agreement, and the sulfate midrange concentration analytical result from the same NRC standard was in disagreement. The chloride analytical result and the corresponding sulfate analytical result from the same NRC standard dilution were biased high indicating a possible instrument calibration problem or standard preparation problem. The licensee prepared a new standard dilution and performed retest chloride and sulfate analyses on the midrange concentration diluted NRC standard. The retest chloride analytical result was in disagreement, and the sulfate analytical result was still in disagreement by approximately 12 percent. These biased high analytical results indicated a possible instrument calibration problem at the high concentration range.

- The licensee's initial silica high range concentration analytical result was in disagreement. The analytical result was biased high indicating a possible instrument calibration or standard preparation problem. The licensee prepared a new NRC standard dilution for the high range silica concentration and performed a retest silica analysis. The retest analytical result was still in disagreement by approximately 11 percent. This biased high analytical result indicated a possible instrument calibration problem at the high concentration range.

The licensee's final analytical results from the analyses performed in the chemistry laboratory, after the retest analyses in an attempt to resolve the initial disagreements, remained at 93 percent agreement or qualified agreement with the NRC's certified analytical concentrations based on 27 analytical results compared.

The licensee's initial performance in the area of water chemistry confirmatory measurements showed above average performance for their first participation in this inspection program. The two analytical disagreements were in the parts per million concentration range and were not considered to indicate any significant programmatic problems.

4.2 Conclusions

A good water chemistry program was being implemented. The chemistry laboratory and analytical instrumentation were being maintained satisfactorily. An improved consumable chemical material control program was being developed and implemented. Plans for plant water chemistry control to implement the licensee's source term reduction program were being developed. The licensee's initial performance in the water chemistry confirmatory measurements inspection program showed an above average performance in the water chemistry confirmatory measurements area.

5 RADIOLOGICAL CONFIRMATORY MEASUREMENTS (84750)

The inspector reviewed the radiochemistry program including facilities and equipment, implementation of a quality control program for radiochemistry measurements, and performed radiological confirmatory measurements to determine agreement with commitments in the Updated Safety Analysis Report and compliance with the requirements in Technical Specifications 3/4.4.5 and 6.8.1, and the Offsite Dose Calculation Manual.

5.1 Discussion

Radiochemistry Analytical Program

The inspector reviewed the radiochemistry analytical program and determined that the licensee had implemented satisfactory procedures to meet commitments in the Updated Safety Analysis Report and the Technical Specifications and Offsite Dose Calculation Manual requirements.

The inspector inspected the chemistry laboratory and the radiochemistry counting facility and determined that the licensee had sufficient state-of-the-art analytical instrumentation to perform the required radiochemistry analytical measurements. The inspector verified that the radiochemistry counting facility's instrumentation was properly calibrated, and that an excellent quality control program was being implemented. The inspector verified that the licensee was using calibration standards traceable to the National Institute of Standards and Technology.

The inspector accompanied and observed a chemistry technician collect and prepare for analysis of the radioactive gas sample from the steam jet air ejector system, the radioactive waste liquid sample from the Equipment Drain Tank 4B, and the reactor water sample. The inspector also observed a chemistry technician prepare the charcoal cartridge sample and air particulate filter sample by spiking the two sample types with reactor water, since the main stack vent charcoal cartridge and air particulate samples did not contain sufficient radioactivity to measure. The sampling and preparation of the samples for analyses were performed in accordance with approved procedures. The inspector noted that the chemistry technicians observed were familiar with the various sample collection, preparation, and analysis procedures used during the inspection.

The steam jet air ejector off-gas sample was collected in accordance with Sampling Procedure 12.5.23A, "Recombiner Sampling and Analysis," Revision 1, dated January 18, 1994. To facilitate the use of a calibrated flow-through glass sample bulb for collection of the steam jet air ejector off-gas sample, the alternate sample method described in the procedure was used to collect the off-gas sample. The glass sample bulb was installed in the sample line using quick-disconnect couplings and tygon tubing as described in the procedure. During the collection of the sample, moisture vapor droplets formed in the tygon tubing and the glass sample bulb. When the chemistry technician removed the tygon tubing from the glass sample bulb, two of his finger tips became contaminated from the moisture vapor droplets trapped in the tygon tubing. This method of sample collection is not routinely used, and the off-gas sample is usually not handled directly at the collection point nor contaminated on the outside of the sample collection container. Surgeons gloves were available in an area nearby to the sample point but were not used when performing the sampling. The inspector noted that the sampling procedure did not contain any radiological precautions for handling the alternate sampling apparatus. This observation was discussed with the licensee during the inspection. The licensee stated that they would add a note and radiological precautions for using the alternate sampling method in the procedure.

Health physics personnel were contacted when the contamination was discovered on the chemistry technician's finger tips during a hand frisk survey performed prior to exiting the sampling area. The health physics technician who responded to the request for help effectively controlled the contamination, surveyed the area, and assisted in the decontamination of the chemistry technician's fingers. The appropriate personnel contamination report was completed.

Confirmatory Measurements

During the inspection, radiological analytical measurements were performed in the licensee's radiochemistry counting facility on five samples collected by the chemistry department staff. The samples were analyzed by the licensee using routine methods and instrumentation. Following the inspection conducted on site, the licensee shipped either the identical or split samples to the Region IV office for analyses by the inspector in the Region IV laboratory.

Radiological confirmatory measurements were performed on the following samples:

- Equipment Drain Tank 4B Sample
- Air Particulate Filter Sample Spiked with Reactor Water
- Charcoal Cartridge Sample Spiked with Reactor Water
- Steam Jet Air Ejector Off-Gas Sample
- Reactor Water System Sample
- 1994 Capability Test Sample

The radiological confirmatory measurement tests consisted of comparing the analytical results from the licensee's radiochemistry counting facility with the NRC Region IV laboratory's analytical results. The NRC Region IV laboratory's measurements were referenced to the National Institute of Standards and Technology by laboratory intercomparisons.

The licensee was maintaining four high purity germanium detectors in the radiochemistry counting facility. At the time of the inspection, Detectors ORT-1, ORT-2, and ORT-3 were being used routinely for isotopic analysis of radioactive samples to demonstrate compliance with Technical Specifications and Offsite Dose Calculation Manual requirements. Detector TEN-1 was being reserved for analyses of only very low environmental activity level samples and, therefore, was not used during the inspection for performing confirmatory measurements.

Individual sample analytical results and their comparison with the NRC analytical results are tabulated in Attachment 4. The tabulated analytical results from the individual licensee's detectors are listed in the order indicated in the heading of each data table. A summary of the analytical results is as follows:

(1) Equipment Drain Tank 4B Sample

Of the five radionuclides originally identified by the licensee, only four radionuclides were identified by the NRC Region IV laboratory due to the low original radionuclide activity in the sample and radioactive decay during shipment. The fifth radionuclide (Cr-51) had decayed to below the NRC Region IV laboratory's minimum detectable activity prior to analysis of the sample and; therefore, no comparison was made between the analytical results for Cr-51.

The licensee's radionuclide analytical results obtained from analyses using Detectors ORT-2 and ORT-3 were in agreement with each other. Only one radionuclide identified by both the NRC and the licensee was in agreement with only one detector used by the licensee. The seven disagreements between the licensee's and the NRC's analytical results were due to possible plate-out of the radionuclides on the sample container walls during shipment even though the sample was acidified after collection to help prevent deposition from happening. This plate-out of the radionuclides in the sample reduced their concentration in the shipped sample to measurable quantities not equivalent or in agreement with the licensee's analytical results.

(2) Air Particulate Filter Sample Spiked with Reactor Water

Of the nine radionuclides identified by the licensee and the NRC, two radionuclides were originally below the licensee's minimum detectable activity and not identified, and four radionuclides were not identified by the NRC Region IV laboratory due to radioactive decay during shipment to below the NRC Region IV laboratory's minimum detectable activity prior to analysis of the sample. Therefore, no comparison of analytical results was performed on six of the nine radionuclides originally identified in the sample by either the licensee or the NRC.

The licensee's radionuclide analytical results obtained from analyses using Detectors ORT-1 and ORT-2 for six radionuclides were in agreement with each other. Only the analytical results of three radionuclides identified by both the NRC and the licensee were in agreement with both detectors used by the licensee.

(3) Charcoal Cartridge Sample Spiked with Reactor Water

Of the 10 radionuclides identified by the licensee and the NRC, three radionuclides were originally below the licensee's minimum detectable activity and not identified, and four radionuclides were not identified by the NRC Region IV laboratory due to radioactive decay during shipment to below the NRC Region IV laboratory's minimum detectable activity prior to analysis of the sample. Therefore, no comparison of analytical results was performed on seven of the ten radionuclides originally identified in the sample by either the licensee or the NRC.

The licensee's radionuclide analytical results obtained from analyses using Detectors ORT-1 and ORT-2 for seven radionuclides were in agreement with each other. Only the analytical results of three radionuclides identified by both the NRC and the licensee were compared and were in agreement with both detectors used by the licensee.

(4) Steam Jet Air Ejector Off-Gas Sample

Of the six radionuclides identified by the licensee and the NRC, five radionuclides were not identified by the NRC Region IV laboratory due to radioactive decay during shipment to below the NRC Region IV laboratory's minimum detectable activity prior to analysis of the

sample. Therefore, no comparison of analytical results was performed on five of the six radionuclides originally identified in the sample by either the licensee or the NRC.

The licensee's radionuclide analytical results obtained from analyses using Detectors ORT-1, ORT-2, and ORT-3 for five radionuclides were in agreement with each other. Only the analytical results of one radionuclide identified by both the NRC and the licensee were compared and were in agreement with the three detectors used by the licensee.

(5) Reactor Water System Sample

Of the 12 radionuclides identified by the licensee, 6 radionuclides were not identified by the NRC Region IV laboratory due to radioactive decay during shipment to below the NRC Region IV laboratory's minimum detectable activity prior to analysis of the sample. Therefore, no comparison of analytical results was performed on 6 of the 12 radionuclides originally identified in the sample by the licensee.

The licensee's radionuclide analytical results obtained from analyses using Detectors ORT-1 and ORT-2 for the 12 radionuclides were in agreement with each other. Only the analytical results of 6 radionuclides identified by both the NRC and the licensee were compared. The analytical results of five radionuclides identified by both the NRC and the licensee were in agreement with both detectors used by the licensee, and the analytical results of one radionuclide were in disagreement with both detectors used by the licensee.

The licensee's radiochemistry counting facility's isotopic analytical results from the samples listed in Attachment 4 which were compared showed 92 percent agreement with the NRC's isotopic analytical results based on 24 agreement results out of 26 total analytical results compared exempting the analytical results from the equipment drain tank sample due to plate-out and circumstances beyond the licensee's or the inspector's control. The criteria used to compare the analytical results is presented in Attachment 5. The licensee's performance in the area of radiological confirmatory measurements was consistent with the performance achieved during the previous NRC inspection of this area in November 1993.

The licensee performed radiological confirmatory measurements during the fall of 1994 on a quality assurance liquid capability test sample prepared by the NRC's reference laboratory, the Department of Energy's Radiological and Environmental Sciences Laboratory, in Idaho Falls, Idaho. The licensee's analytical results were compared to the sample's certified radionuclide activities, and the results of the analytical results comparisons are presented in Attachment 4, Sample 6. The analytical results for tritium, iron-55, strontium-89, and strontium-90 were in agreement.

5.2 Conclusions

A good radiological analytical measurement program was being implemented. The licensee had properly calibrated and maintained state-of-the-art radiological

counting instrumentation. The licensee's performance in the area of radiological confirmatory measurements was good and consistent with the performance achieved during the previous NRC inspection of this area in November 1993.

Attachment 2

WATER CHEMISTRY CONFIRMATORY MEASUREMENTS RESULTS

Chemistry Laboratory

WASHINGTON NUCLEAR PROJECT -2

NRC INSPECTION REPORT: 50-397/95-22

1 Chloride Analysis (Ion Chromatography)				
Sample	WNP-2 Results (ppm)	NRC Results (ppm)	WNP-2/NRC Ratio	Comparison Decision
92A-8	20.69±0.08	19.42±0.54	1.06	Agreement
92B-42	39.97±2.41	36.49±1.12	1.09	Qualified Agreement
Retest - prepared a new chloride standard dilution and performed retest analysis				
92B-87	40.93±1.52	36.49±1.12	1.12	Disagreement
92C-81	72.06±0.13	77.01±2.59	0.94	Agreement

2 Sulfate Analysis (Ion Chromatography)				
Sample	WNP-2 Results (ppm)	NRC Results (ppm)	WNP-2/NRC Ratio	Comparison Decision
92A-8	21.44±0.81	19.42±0.26	1.10	Qualified Agreement

Attachment 2 (cont'd)

2 Sulfate Analysis (Ion Chromatography)				
Sample	WNP-2 Results (ppm)	NRC Results (ppm)	WNP-2/NRC Ratio	Comparison Decision
92B-42	43.39±1.37	38.83±0.60	1.12	**Disagreement**
Retest - prepared a new sulfate standard dilution and performed retest analysis				
92B-87	43.73±2.41	38.83±0.60	1.13	**Disagreement**
92C-81	82.90±1.14	79.34±1.73	1.04	Agreement

4 Boron Analysis (Potentiometric Titration)				
Sample	WNP-2 Results (ppm)	NRC Results (ppm)	WNP-2/NRC Ratio	Comparison Decision
92D-13	1036±9	1049±11	0.98	Agreement
92E-20	3058±13	3038±36	1.01	Agreement
92F-14	4979±23	5062±80	0.98	Agreement

5 Chromium Analysis (Inductively Coupled Plasma)				
Sample	WNP-2 Results (ppm)	NRC Results (ppm)	WNP-2/NRC Ratio	Comparison Decision
92G-80	19.5±0.1	20.0±0.2	0.98	Agreement
92H-32	39.0±0.4	40.2±0.4	0.97	Agreement
92I-43	77.5±0.5	80.4±0.7	0.96	Agreement

Attachment 2 (cont'd)

6 Copper Analysis (Inductively Coupled Plasma)				
Sample	WNP-2 Results (ppm)	NRC Results (ppm)	WNP-2/NRC Ratio	Comparison Decision
92G-80	21.1±0.5	20.2±0.2	1.04	Agreement
92H-32	42.6±0.1	40.3±0.4	1.06	Agreement
92I-43	84.4±0.9	81.0±1.0	1.04	Agreement

7 Iron Analysis (Inductively Coupled Plasma)				
Sample	WNP-2 Results (ppm)	NRC Results (ppm)	WNP-2/NRC Ratio	Comparison Decision
92G-80	20.3±0.2	19.9±0.2	1.02	Agreement
92H-32	40.2±0.2	39.8±0.4	1.01	Agreement
92I-43	79.2±0.7	79.5±0.7	0.99	Agreement

8 Nickel Analysis (Inductively Coupled Plasma)				
Sample	WNP-2 Results (ppm)	NRC Results (ppm)	WNP-2/NRC Ratio	Comparison Decision
92G-80	20.1±0.2	19.9±0.2	1.01	Agreement
92H-32	40.2±0.3	40.0±0.4	1.00	Agreement
92I-43	79.8±0.6	80.0±0.8	0.99	Agreement

Attachment 2 (cont'd)

9 Sodium Analysis (Inductively Coupled Plasma)				
Sample	WNP-2 Results (ppm)	NRC Results (ppm)	WNP-2/NRC Ratio	Comparison Decision
92J-31	4.5±1.2	5.32±0.18	0.85	Agreement
92K-84	10.2±0.2	10.20±0.30	1.00	Agreement
92L-159	16.5±0.6	15.50±0.40	1.06	Agreement

10 Silica Analysis (UV-VIS Spectroscopy)				
Sample	WNP-2 Results (ppm)	NRC Results (ppm)	WNP-2/NRC Ratio	Comparison Decision
92S-91	12.7±0.4	12.17±0.13	1.04	Agreement
92T-45	26.8±1.2	28.36±0.36	0.94	Agreement
92U-156	65.9±0.4	60.14±0.99	1.09	Disagreement
Retest - prepared new silica standard dilution and performed retest analysis				
92U-135	66.6±0.5	60.14±0.99	1.11	Disagreement

Attachment 3

CRITERIA FOR COMPARING WATER CHEMISTRY ANALYTICAL MEASUREMENTS

The following are the criteria used in comparing the results of the capability tests and verification measurements. The criteria for the judgement limits was based on the data from Table 2.1 of NUREG/CR-5244, "Evaluation of Non-Radiological Water Chemistry at Power Reactors," applied to Oak Ridge National Laboratory data. Licensee values within the plus or minus two standard deviations range of the known values are considered to be in agreement. Licensee values outside the plus or minus two standard deviations range but within the plus or minus three standard deviations range of the know values are considered to be in qualified agreement. Licensee values greater than the plus or minus three standard deviations range of the known values are in disagreement. The standard deviations were computed using the average percent standard deviation values of each analyte in Table 2.1 of NUREG/CR-5244.

Analyte	Sample	Agreement Range	Qualified Agreement Range
Ammonia	92M	99.02 - 120.54	93.64 - 125.92
	92N	275.70 - 334.26	261.06 - 348.90
	92O	436.48 - 527.08	413.85 - 549.71
Boron	92D	1028 - 1070	1018 - 1080
	92E	2977 - 3099	2947 - 3129
	92F	4941 - 5183	4880 - 5244
Chloride	92A	18.0 - 20.8	17.3 - 21.5
	92B	34.2 - 38.8	32.9 - 40.0
	92C	70.7 - 83.4	66.0 - 84.6

Attachment 3 (cont'd)

Analyte	Sample	Agreement Range	Qualified Agreement Range
Chromium	92G	18.0 - 22.0	17.0 - 23.0
	92H	35.9 - 44.5	33.8 - 46.6
	92I	73.5 - 87.3	70.0 - 90.8
Copper	92G	18.3 - 22.1	17.3 - 23.1
	92H	36.0 - 44.6	33.9 - 46.7
	92I	74.2 - 87.8	70.8 - 91.2
Fluoride	92A	16.5 - 23.9	14.6 - 25.8
	92B	36.8 - 43.6	35.1 - 45.3
	92C	77.9 - 92.3	74.4 - 95.8
Hydrazine	92P	12.83 - 13.63	12.63 - 13.83
	92Q	29.96 - 38.28	27.88 - 40.36
	92R	52.00 - 61.04	49.74 - 63.3
Iron	92G	18.6 - 21.2	17.9 - 21.9
	92H	35.9 - 43.7	33.9 - 45.7
	92I	69.6 - 89.4	64.7 - 94.3
Lithium	92JJ	4.05 - 5.81	3.61 - 6.25
	92KK	10.9 - 13.9	10.1 - 14.7
	92LL	21.4 - 27.2	20.0 - 28.6

Attachment 3 (cont'd)

Analyte	Sample	Agreement Range	Qualified Agreement Range
Nickel	92G	18.6 - 21.2	17.9 - 21.9
	92H	36.6 - 43.4	35.0 - 45.0
	92I	77.1 - 82.9	75.7 - 84.3
Silica	92S	10.40 - 13.97	9.43 - 14.87
	92T	26.32 - 30.40	25.30 - 31.42
	92U	56.53 - 63.75	54.73 - 65.55
Sodium	92J	4.37 - 6.27	3.90 - 6.74
	92K	9.00 - 11.4	8.30 - 12.1
	92L	13.7 - 17.3	12.8 - 18.2
Sulfate	92A	17.5 - 21.3	16.5 - 22.3
	92B	35.8 - 41.8	34.4 - 43.2
	92C	70.9 - 87.7	66.7 - 91.9
Zinc	92X	----------	----------
	92Y	----------	----------
	92Z	----------	----------

Attachment 4

RADIOLOGICAL CONFIRMATORY MEASUREMENT RESULTS
WASHINGTON NUCLEAR PROJECT-2
NRC INSPECTION REPORT: 50-397/95-22

1 EQUIPMENT DRAIN TANK 4B SAMPLE - 1000 ml (1 liter Marinelli beaker)
Sampled: 13:30, PDT, July 18, 1995
Radiochemistry Detectors: ORT-2 and ORT-3

Nuclide	WNP-2 Results (μCi/ml)	NRC Results (μCi/ml)	WNP-2/NRC Ratio	Comparison Decision
Cr-51	<7.40E-7	<5.23E-7	----	No Comparison
	7.12±3.20E-7		----	No Comparison
Mn-54	3.95±0.90E-7	1.85±0.29E-7	2.13	Disagreement
	3.02±0.90E-7		1.63	Agreement
Co-58	3.07±1.00E-7	1.03±0.26E-7	2.98	Disagreement
	3.42±0.90E-7		3.32	Disagreement
Co-60	7.59±0.50E-6	2.09±0.08E-6	3.63	Disagreement
	8.48±0.50E-6		4.06	Disagreement
Zn-65	2.04±0.30E-6	5.99±0.71E-7	3.41	Disagreement
	2.07±0.30E-6		3.46	Disagreement

Attachment 4 (cont'd)

2 AIR PARTICULATE FILTER SAMPLE SPIKED WITH REACTOR WATER
Sampled: 15:45, PDT, July 18, 1995
Radiochemistry Detectors: ORT-1 and ORT-2

Nuclide	WNP-2 Results (μCi/Sample)	NRC Results (μCi/Sample)	WNP-2/NRC Ratio	Comparison Decision
Na-24	1.87±0.49E-4	<3.28E-2	----	No Comparison
	1.88±0.37E-4		----	No Comparison
Cr-51	<6.60E-4	4.71±3.44E-5	----	No Comparison
	<5.80E-4		----	No Comparison
Mn-54	<5.70E-5	2.04±5.23E-6	----	No Comparison
	<3.90E-5		----	No Comparison
Co-58	<8.4E-5	5.66±1.05E-5	----	No Comparison
	7.07±1.94E-5		1.25	Agreement
Co-60	1.30±0.22E-4	9.52±1.04E-5	1.37	Agreement
	1.45±0.26E-4		1.52	Agreement
Cu-64	4.91±1.21E-2	<2.54E+1	----	No Comparison
	5.15±0.93E-2		----	No Comparison
Zn-65	1.06±0.37E-4	9.98±2.39E-5	1.06	Agreement
	1.30±0.27E-4		1.30	Agreement

Attachment 4 (cont'd)

2 AIR PARTICULATE FILTER SAMPLE SPIKED WITH REACTOR WATER (cont'd)
Sampled: 15:45, PDT, July 18, 1995
Radiochemistry Detectors: ORT-1 and ORT-2

Nuclide	WNP-2 Results (μCi/Sample)	NRC Results (μCi/Sample)	WNP-2/NRC Ratio	Comparison Decision
Tc-99m	2.08±0.17E-3	<1.56E+3	----	No Comparison
	1.74±0.15E-3		----	No Comparison
I-133	2.04±0.42E-4	<2.92E-3	----	No Comparison
	2.06±0.41E-4		----	No Comparison

3 CHARCOAL CARTRIDGE SAMPLE SPIKED WITH REACTOR WATER
Sampled: 15:45, PDT, July 18, 1995
Radiochemistry Detectors: ORT-1 and ORT-2

Nuclide	WNP-2 Results (μCi/Sample)	NRC Results (μCi/Sample)	WNP-2/NRC Ratio	Comparison Decision
Na-24	3.47±0.72E-4	<3.33E-2	----	No Comparison
	3.51±0.55E-4		----	No Comparison
Cr-51	<1.03E-3	1.15±0.26E-4	----	No Comparison
	<7.70E-4		----	No Comparison
Mn-54	<7.90E-5	1.06±0.36E-5	----	No Comparison
	<4.80E-5		----	No Comparison
Co-58	1.36±0.34E-4	1.05±0.07E-4	1.30	Agreement
	1.37±0.27E-4		1.30	Agreement
Co-60	2.59±0.34E-4	1.77±0.11E-4	1.46	Agreement
	2.19±0.31E-4		1.24	Agreement

Attachment 4 (cont'd)

3 CHARCOAL CARTRIDGE SAMPLE SPIKED WITH REACTOR WATER (cont'd)
Sampled: 15:45, PDT, July 18, 1995
Radiochemistry Detectors: ORT-1 and ORT-2

Nuclide	WNP-2 Results (μCi/Sample)	NRC Results (μCi/Sample)	WNP-2/NRC Ratio	Comparison Decision
Cu-64	8.98±1.86E-2	<3.00E+1	----	No Comparison
	7.35±1.21E-2		----	No Comparison
Zn-65	2.32±0.81E-4	1.56±0.15E-4	1.49	Agreement
	2.40±0.52E-4		1.54	Agreement
I-131	<1.10E-4	1.39±0.46E-5	----	No Comparison
	<8.60E-5		----	No Comparison
I-133	3.61±0.61E-4	<3.61E-3	----	No Comparison
	3.68±0.54E-4		----	No Comparison
I-135	1.05±0.37E-3	<2.48E+3	----	No Comparison
	9.74±2.54E-4		----	No Comparison

Attachment 4 (cont'd)

4 STEAM JET AIR EJECTOR OFF-GAS SAMPLE - 14.58 cc (15 cc Off-Gas Vial)
Sampled: 09:32, PDT, July 18, 1995
Radiochemistry Detectors: ORT-1, ORT-2, and ORT-3

Nuclide	WNP-2 Results (μCi/cc)	NRC Results (μCi/cc)	WNP-2/NRC Ratio	Comparison Decision
Xe-133	1.01±0.14E-4	1.01±0.15E-4	0.99	Agreement
	1.20±0.28E-4		1.18	Agreement
	9.67±1.57E-5		0.95	Agreement
Xe-135	1.66±0.10E-3	<9.59E-1	----	No Comparison
	1.62±0.09E-3		----	No Comparison
	1.53±0.09E-3		----	No Comparison
Xe-138	<1.00E-1	<1.00E+20	----	No Comparison
	4.03±0.94E-2		----	No Comparison
	<0.00E+0		----	No Comparison
Kr-85m	3.13±0.22E-4	<4.18E+5	----	No Comparison
	2.88±0.20E-4		----	No Comparison
	3.09±0.25E-4		----	No Comparison
Kr-87	2.05±0.15E-3	<1.00E+20	----	No Comparison
	2.00±0.14E-3		----	No Comparison
	1.75±0.15E-3		----	No Comparison
Kr-88	1.09±0.09E-3	<6.03E+12	----	No Comparison
	1.02±0.11E-3		----	No Comparison
	1.05±0.11E-3		----	No Comparison

Attachment 4 (cont'd)

5 REACTOR WATER SYSTEM SAMPLE - 20 ml (20 ml scintillation vial)
Sampled: 15:45, PDT, July 18, 1995
Radiochemistry Detectors: ORT-1 and ORT-2

Nuclide	WNP-2 Results (μCi/ml)	NRC Results (μCi/ml)	WNP-2/NRC Ratio	Comparison Decision
Na-24	2.28±0.15E-4	<1.27E-2	----	No Comparison
	2.22±0.14E-4		----	No Comparison
Mn-54	1.84±0.35E-5	8.07±1.05E-6	2.28	Disagreement
	1.89±0.35E-5		2.34	Disagreement
Co-58	7.93±0.56E-5	7.80±0.24E-5	1.02	Agreement
	7.73±0.54E-5		0.99	Agreement
Co-60	1.40±0.08E-4	1.26±0.03E-4	1.11	Agreement
	1.35±0.08E-4		1.07	Agreement
Cu-64	4.64±0.31E-2	<1.20E+1	----	No Comparison
	4.64±0.30E-2		----	No Comparison
Zn-65	1.14±0.10E-4	1.12±0.04E-4	1.02	Agreement
	1.16±0.10E-4		1.04	Agreement
Sr-91	1.90±0.19E-4	<7.21E+00	----	No Comparison
	1.73±0.16E-4		----	No Comparison
Mo-99	1.35±0.26E-4	1.56±0.05E-4	0.87	Agreement
	1.43±0.19E-4		0.92	Agreement

Attachment 4 (cont'd)

5 REACTOR WATER SYSTEM SAMPLE (cont'd) Sampled: 15:45, PDT, July 18, 1995 Radiochemistry Detectors: ORT-1 and ORT-2				
Nuclide	WNP-2 Results (μCi/ml)	NRC Results (μCi/ml)	WNP-2/NRC Ratio	Comparison Decision
Tc-99m	2.42±0.15E-3	<4.04E+03	----	No Comparison
	2.33±0.14E-3		----	No Comparison
I-131	1.83±0.64E-5	1.41±0.13E-5	1.29	Agreement
	1.93±0.52E-5		1.37	Agreement
I-133	2.41±0.16E-4	<1.52E-3	----	No Comparison
	2.31±0.15E-4		----	No Comparison
I-135	5.39±0.54E-4	<2.21E+3	----	No Comparison
	5.46±0.44E-4		----	No Comparison

6 1994 CAPABILITY TEST SAMPLE (9407-NRC-23)				
Nuclide	WNP-2 Results (μCi/gm)	NRC Results (μCi/gm)	WNP-2/NRC Ratio	Comparison Decision
H-3	3.65E-05	3.550E-05	1.03	Agreement
Fe-55	3.26E-05	3.273E-05	0.99	Agreement
Sr-89	2.05E-05	1.942E-05	1.06	Agreement
Sr-90	3.15E-06	4.192E-06	0.75	Agreement

All test analyses were performed by the licensee's plant radiochemistry laboratory.

Attachment 5

CRITERIA FOR COMPARING RADIOCHEMISTRY 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.