U. S. NUCLEAR REGULATORY COMMISSION

REGION V

Report No. 50-397/89-15

License Nos. NPF-21

Licensee: Washington Public Power Supply System
P. O. Box 968
3000 George Washington Way
Richland, Washington 99352

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

Inspection at: WNP-2 Site, Benton County, Washington

Inspection Conducted: May 15-19, 1989

Inspected by: ______________________ 6/8/89
W. K. TenBrook, Radiation Specialist — Date Signed

Approved by: ______________________ 6/8/89
E. M. Garcia, Acting Chief — Date Signed
Facilities Radiological Protection Section

Summary:

Areas Inspected: Routine unannounced inspection of inspector followup items, plant water chemistry control and chemical analysis, radiochemical analysis and quality assurance of plant chemistry activities. Inspection procedures 92701 and 84750 were used.

Results: Program strengths included superior control of RCS chemistry and a superior inventory of in-line and laboratory instruments.

Program weaknesses included inconsistent use of measurement control charts, and declining oversight of process water chemistry by Corporate and Plant Quality Assurance.

Overall program status was superior in accomplishing chemistry safety functions for radiological control, protection of the fuel, and protection of the reactor coolant system.

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DETAILS

1. Persons Contacted

Licensee

*A. Alexander, Chemistry Supervisor
J. Arbuckle, Compliance Engineer, Plant Technical
*J. Baker, Assistant Plant Manager
D. Bennett, Senior Radiochemist, Chemistry
D. Beecher, Chemistry Foreman
*T. Brun, Quality Assurance Engineer, Plant Quality Assurance
*R. Graybeal, Manager, Health Physics and Chemistry
L. Morrison, Supervisor, Chemistry Support
B. Nowack, Quality Assurance Engineer, Plant Quality Assurance

State of Washington

*J. Erickson, Department of Social and Health Services

USNRC

*C. Bosted, Senior Resident Inspector, WNP-2

*Indicates attendance at Exit Meeting, May 19, 1989.

2. Followup (92701)

(Open) 50-397/89-13-01: This item concerned a lack of established calibration frequencies for laboratory radioanalytical instruments. At the time of the inspection, Plant Procedures Manual 12.8 did not include frequency of performance for calibrations. However, radioanalytical instruments had been calibrated during the preceding year following repairs and maintenance. The licensee will issue preventive maintenance cards through Scheduled Maintenance System (SMS) tracking to assure that calibrations are verified and redone as necessary. This item is open pending confirmation of the licensee's corrective action.

(Closed) 50-397/88-13-02 This item concerned evaluation of improved split sampling methods for condenser offgas and liquid wastes. The offgas system was in outage during the inspection. The inspector obtained several standard 15 cc septum vials routinely used by the licensee to sample the offgas system, and stated that the NRC laboratory would independently calibrate their detectors for the licensee's geometry for a more direct comparison. Intercomparison of treated liquid waste (see section 3.A) did not exhibit the sedimentation biases observed during the previous inspection. This item is closed.

3. Water Chemistry and Confirmatory Measurements (84750)

A. In-Plant Radiochemical Analysis and Confirmatory Measurements

The regional mobile laboratory trailer was brought onsite for gamma isotopic intercomparisons with the licensee's counting laboratories. Sample types commonly analyzed for compliance with regulatory requirements were analyzed by the licensee and the NRC, and the results were compared using the NRC verification test criteria (see enclosure).

The first sample obtained was a charcoal cartridge removed from the plant vent monitor REA-1. The NRC measurements were compared with measurements by licensee detectors designated Tennelec 1 (Tenn1), Ortec 1 (Ort1) and Ortec 3 (Ort3). The intercomparison data are given in Table 1.

Table 1

Charcoal Cartridge from Main Plant Vent

Analyte	NRC uCi/ml Result	NRC % Random Uncertainty	Ratio: Tenn1/NRC	Ratio: Ort1/NRC	Ratio: Ort3/NRC	Agreement Range
I-131	4.42E-03	2.3	1.08	0.83	0.99	0.75-1.33

The iodine measurements were in agreement.

The second sample obtained was a 47mm filter of reactor coolant suspended solids. The results of the intercomparison are presented in Table 2.

Table 2

Suspended Solids from 100 ml Reactor Coolant

Analyte	NRC uCi/ml Result	NRC % Random Uncertainty	Ratio: Tenn1/NRC	Ratio: Ort1/NRC	Ratio: Ort3/NRC	Agreement Range
Cr-51	2.50E-4	2.4	0.94	0.92	1.06	0.75-1.33
Mn-54	2.38E-5	5.3	0.98	0.91	1.01	0.75-1.33
Co-58	2.39E-5	4.4	0.91	1.04	1.12	0.75-1.33
Fe-59	2.20E-5	12.2	0.82	0.88	0.76	0.60-1.66
Co-60	2.12E-4	1.2	0.94	0.96	1.01	0.80-1.25
Zn-65	2.63E-4	1.7	0.93	0.93	0.98	0.80-1.25
Nb-95	3.10E-5	3.4	0.89	0.85	0.94	0.75-1.33
Zr-95	2.39E-5	7.4	1.00	1.05	1.11	0.60-1.66

Agreement between the NRC and licensee laboratories was satisfactory.

The third intercomparison involved reactor water obtained from the residual heat removal system. The intercomparison of the first sample exhibited several measurement disagreements. A second sample was obtained and similar disagreements were observed. Possible sample sedimentation was suspected, given that the reactor water cleanup system was not operating. A third sample was obtained, filtered through a 0.4 micron filter and split. The results of the filtrate analysis are presented in Table 3.

Table 3

Reactor Water

Analyte	NRC uCi/ml Result	NRC % Random Uncertainty	Ratio: Tenn1/NRC	Ratio: Ort1/NRC	Ratio: Ort3/NRC	Agreement Range
Mn-54	2.12E-05	10.9	1.05	1.15	0.96	0.60-1.66
Co-58	2.22E-05	10.6	0.99	1.04	1.07	0.60-1.66
Co-60	6.49E-05	4.2	0.93	1.06	0.94	0.75-1.33
Zn-65	6.67E-04	1.7	0.93	1.00	0.93	0.80-1.25
Mo-99	6.09E-06	9.0	-	-	-	0.60-1.66
Tc-99m	6.84E-06	9.0	-	-	0.56	0.60-1.66
I-131	2.19E-05	7.0	0.90	1.07	0.94	0.60-1.66
Cs-134	1.24E-04	3.0	0.55	0.61	0.53	0.75-1.33
Cs-136	1.22E-05	19.0	0.49	0.61	0.58	0.50-2.00
Cs-137	1.08E-04	3.1	0.54	0.57	0.51	0.75-1.33

The measurements for soluble nuclides agreed very well. However, disagreements persisted for Mo-Tc-99 measurements and radiocesium measurements. The licensee did not identify Tc-99m in the sample due to counting statistical uncertainty caused by the greater Compton scattering background in their larger detectors. The cesium radionuclides behaved consistently in the licensee's analyses, but did not compare favorably with the NRC analyses. Also, the activity of radiocesiums exhibited an increasing activity trend in the sequence of licensee analyses, indicating that a partitioning effect was occurring. The licensee's current practice was to analyze untreated reactor water samples. The Chemistry Supervisor in charge of the counting room stated that he would evaluate sample acidification, solidification (gelling) and operation of the reactor water cleanup system as actions to improve the radiocesium measurements in routine samples. The inspector will review the results of the licensee's evaluation during a future inspection (50-397/89-15-01).

Mo-99 was not identified, despite the identification of its daughter, Tc-99m, in one analysis. To quantify Mo-99, the licensee used the 740 keV gamma ray as the primary peak, rather than using the more abundant 140 keV gamma ray emitted by both Mo-99 and Tc-99m. Use of the 740 keV line allowed measurement of Mo-99 without interference. However, the 740 keV peak did not pass the software statistical uncertainty test, and Mo-99 was not identified. The use of the low-abundance 740 keV gamma ray

impaired the detection limit for Mo-99 as compared with the other gamma emitters specified in TS Table 4.11-2, note f. Given that the filter comparison did not involve particulates from gaseous effluent, a direct evaluation of TS LLD performance was not possible with this sample. The inspector will examine the sensitivity of the licensee's Mo-Tc-99 analyses in a future inspection (50-397/89-15-02).

The fourth sample was obtained from a treated liquid waste storage tank. Two gallons of sample was obtained, acidified and split between the licensee, NRC and a representative of the State of Washington. The results of the gamma isotopic intercomparison between the licensee and NRC laboratories is presented in Table 4.

Table 4

Treated Liquid Waste

Analyte	NRC uCi/ml Result	NRC % Random Uncertainty	Ratio: Tennl/NRC	Ratio: Ort3/NRC	Agreement Range
Cr-51	9.86E-07	10.3	0.65	0.70	0.60-1.66
Mn-54	8.75E-08	20.3	1.04	0.92	0.50-2.00
Co-58	1.49E-07	13.2	0.78	0.80	0:50-2.00
Co-60	1.57E-06	2.5	0.76	0.83	0.75-1.33
Zn-65	1.20E-06	5.2	0.83	0.87	0.75-1.33
Ag-110m	1.45E-07	9.3	0.80	-	0.60-1.66
I-131	1.92E-07	8.0	0.96	0.82	0.60-1.66
Cs-137	7.35E-08	20.4	-	0.74	0.50-2.00

The licensee analyses did not identify Cs-137 and Ag-110m due to less sensitivity with respect to the NRC analysis and random uncertainties associated with the licensee's gamma peak evaluation. However, each licensee analytical method met TS Table 4.11-1 requirements for lower limit of detection.

Portions of the batch release tank sample were retained by the licensee, NRC and State of Washington for further measurements of Sr-89/90, Fe-55 and tritium. The licensee will forward their results to the inspector for comparison with measurements by the NRC reference laboratory (50-397/89-15-03).

The licensee's program in radiochemical analysis was satisfactory to meet safety needs. However, the non-homogeneity of liquid samples contributed to measurement biases for certain nuclides. The licensee typically gels liquid effluent samples to prevent non-homogeneity effects in pre-release analyses. For samples measured in the liquid state, such as reactor water isotopic analyses, the license needs to evaluate the effect of neutral to high pH and sample suspended solids to prevent measurement inconsistencies.

B. Water Chemistry Control and Chemical Analysis

The inspector examined Corporate Licensing and Assurance audit 88-440, dated June 22, 1988. This audit examined the program for radiological and nonradiological environmental and effluent monitoring. The depth of the audit was adequate to assess the areas examined. The chief audit findings involved cumulative problems with procedural compliance in nonradiological environmental water quality monitoring.

The inspector requested any Corporate Licensing and Assurance audits involving plant process water chemistry analysis and control. The Corporate Licensing and Assurance organization had not performed any recent audits in this area.

The inspector examined several Plant Quality Assurance Surveillances dealing with chemistry department activities. Several of the Surveillances paralleled the Corporate audit areas, examining radiological effluent analyses and effluent monitor testing. One Surveillance involving circulating water and service water chemical control was performed. However, Plant Quality Assurance activities in the radiochemistry and chemistry areas declined in 1989 as the assigned Quality Assurance Engineer was reassigned to the Nuclear Safety Assurance Group.

The licensee's quality assurance oversight of chemistry department activities was adequate to meet commitments and requirements. Weakness was observed in the lack of oversight for plant process water chemistry activities, and the declining number of surveillances for this area in 1989.

The inspector briefly reviewed analytical control records for various instruments, including ion chromatographs, pH probes, and spectrophotometers. Primary calibration methods were adequate, with multipoint calibrations performed at acceptable concentrations. Analytical control charts were employed for those instruments where secondary standards were analyzed for measurement control, without recalibration of the instrument. However, measurement control charts were not used for instruments recalibrated with multiple standards during or prior to each sample set. The proximity of the calibration to the analyses would reduce effects of calibration drift over time. However, the analyses were vulnerable to calibration error due to calibration standard error. A superior practice would involve the use of an independent standard or standards following the calibration, with measurement control charts to identify possible problems with standard preparation, instrument linearity or calibration drift.

The inspector evaluated the inventory of in-line chemistry monitors at the Unit laboratories. The current inventory of in-line analyzers included all control variables and most diagnostic variables recommended by the Electric Power Research Institute (EPRI). In addition, the licensee had installed a state-of-the-art in-line ion chromatography system with dedicated personnel for maintenance and operation. The licensee's in-line surveillance equipment was superior.

The inspector examined trend charts for key reactor coolant system chemistry control parameters, as compiled by the Chemistry Department for Supply System management. The chemistry history for the 1988-1989 operating cycle is presented below.

20 June:	Water chemistry transients during recovery from 1988 refueling outage.
28 July:	Loss of reactor water cleanup with action level 1 chemistry excursion, forced outage.
8 Sept:	Recovery from forced outage with chemistry transients below action level 1.
17 Dec:	Type resin employed for RCS cleanup changed, improving conductivity to <0.20 uS/cm.
1 Jan:	Type resin employed for RCS cleanup changed, conductivity remains below 0.20 uS/cm.
6 Jan:	Condenser tube leak chemistry transient.
10 Feb:	RCS cleanup resin changed, conductivity steady at 0.18 uS/cm.
18 Mar:	Conductivity increase to 0.20 uS/cm, followed by precoat on two condensate filter demineralizer beds. Conductivity falls to 0.18 uS/cm.
7 Apr:	Condenser tube leak chemistry transient.

The inspector noted that the number and severity of condenser tube leak transients had declined significantly compared to the previous operating cycle. This indicated that the modifications to the condenser to prevent water impingement and missiles had had their intended effect. Also, the changes to cleanup systems had allowed for incremental improvements in overall reactor water purity during the second half of the 1988-89 cycle. If the licensee can sustain their excellent performance, reactor water conductivity may improve to 0.15 uS/cm in the next cycle.

The inspector discussed the status of hydrogen water chemistry initiatives with the Chemistry Support Supervisor. The licensee had purchased a computer program to evaluate the possible impact of hydrogen water chemistry on the radiation dose rates from the main steam system. The program employed current plant data on water chemistry and dose rates to extrapolate possible hydrogen water chemistry effects. The program had not been extensively used due to the unavailability of liquid sample point SP-1 on the reactor water recirculation system. The isolation valve has had difficulty in meeting surveillance testing, and may be manually isolated prior to restart. Until the availability of SP-1 is resolved, the licensee's database for computer evaluation of hydrogen water chemistry will be limited.

The licensee's program for chemistry control and chemical analysis was satisfactory to meet safety objectives for corrosion and radiation field

control, with superior control of reactor water chemistry, as measured by conductivity and weighted-mean chemistry data and superior chemistry instrumentation.

Weaknesses meriting improvement included inconsistent use of measurement control charts and the lack of emphasis on water chemistry oversight by the Corporate and Plant Quality Assurance organizations.

4. Exit Meeting

The inspector met with licensee management on May 19, 1989 to discuss the scope and findings of the inspection. The licensee acknowledged commitments to verify radioanalytical instrument calibrations annually, and to evaluate nonhomogeneities in reactor water samples. The inspector stated that the the plant had aggressively maintained good water chemistry and superior instrumentation, and could attain superior performance in all program areas with additional improvements in laboratory quality control and quality assurance.

Enclosure

Criteria for Accepting the Licensee's Measurements

Resolution	Ratio
<4	0.4 - 2.5
4 - 7	0.5 - 2.0
8 - 15	0.6 - 1.66
16 - 50	0.75 - 1.33
51 - 200	0.80 - 1.25
200	0.85 - 1.18

Comparison

1. Divide each NRC result by its associated uncertainty to obtain the resolution. (Note: For purposes of this procedure, the uncertainty is defined as the relative standard deviation, one sigma, of the NRC result as calculated from counting statistics.)

2. Divide each licensee result by the corresponding NRC result to obtain the ratio (licensee result/NRC).

3. The licensee's measurement is in agreement if the value of the ratio falls within the limits shown in the preceding table for the corresponding resolution.