U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Report Nos. 50-456/90004(DRSS); 50-457/90004(DRSS)

Docket Nos. 50-456; 50-457 License Nos. NPF-72; NPF-77

Licensee: Commonwealth Edison Company
Post Office Box 767
Chicago, IL 60690

Facility Name: Braidwood Station, Units 1 and 2

Inspection At: Braidwood Site, Braceville, IL

Inspection Conducted: January 16-19, 1990 (On-site)
January 23 and 30, 1990 (Telephone conversations)

M. Schumacher for

Inspector: R. B. Holtzman 2-13-90 Date

M. Schumacher

Approved By: M. C. Schumacher, Chief
Radiological Controls and
Chemistry Section 2-13-90 Date

Inspection [illegible]ary

Inspectio[illegible]nuary 16-19, 23 and 30, 1990 (Report Nos. 50-456/90004(DRSS); 50-457/900[illegible]S))

Areas Inspected: Routine, announced inspection of: (1) the chemistry program, including procedures, organization, and training (IP 79701); (2) primary and secondary systems water quality control programs (IP 79701); (3) quality assurance/quality control program in the laboratory (IP 79701); and (4) nonradiological confirmatory measurements (IP 79701).

Results: The licensee has an extensive water quality control program that conforms to the EPRI Steam Generator Owners and Primary Systems Guidelines. The steam generator (S/G) blowdown had low levels of chloride and sulfate which were well within the EPRI guidelines, showing that the relatively new reactor systems were cleaned up. The process instrumentation included an in-line ion chromatographic system on S/G blowdown and one being installed on the secondary feed water. The in-line instrumentation is computerized and is being upgraded to state-of-the-art equipment. The nonradiological confirmatory measurements results were very good with all being in agreement, a substantial improvement over the previous comparisons. Chemistry sample data are in a computerized data base along with the QC data. No violations or deviations were identified.

DETAILS

1. Persons Contacted

[1] R. E. Querio, Station Manager, Braidwood Station (BWD)
D. E. O'Brien, Technical Superintendent, BWD
[1] R. L. Kofron, Production Superintendent, BWD
[1] J. R. Petro, Chemistry Supervisor, BWD
[1,2] W. E. Lloyd, Chemistry Staff, BWD
[1] D. J. Miller, Regulatory Assurance Supervisor, BWD
[1] P. Holland, Regulatory Assurance, BWD
[1] E. W. Carroll, Regulatory Assurance, BWD
[1] R. D. Kyrouac, NQP Superintendent, CECo
[1] J. M. Watson, NQP Engineer, CECo
G. Vickery, Chemist, BWD
M. Holmes, Chemist, BWD

[1] T. E. Taylor, Resident Inspector, NRC

[1]Present at the Exit Meeting on January 19, 1990.
[2]Telephone conversations held on January 23 and 30, 1990.

The inspectors also interviewed other licensee personnel in various departments in the course of the inspection.

2. Licensee Action on Previous Inspection Findings

a. (Closed) Open Item Nos.(50-456/89004-01; 50-457/89004-01): The licensee split and analyzed a spiked sample of secondary system water spiked with anions and reported the results for comparison with those of Brookhaven National Laboratory (BNL). The results of the analyses for fluoride, chloride and sulfate are presented in Table 1 "Split Cold Chemistry Sample" and the acceptance criteria in Attachment 1. All three analyses were in agreement.

b. (Closed) Open Item Nos. (50-456/89004-02; 50-457/89004-02): The licensee to improve the silica and ion chromatographic (IC) procedures. The laboratory modified the spectrophotometric procedure for analysis of silica by implementing the use of a 5-cm cell for improved precision and accuracy at low concentrations (50 parts per billion (ppb)). The performance check standard is currently 30 ppb and the lower limit of quantitation is set at 5 ppb silica. The reliability of the analytical systems was improved by reducing the uncertainties due to contamination of the dilution water. Water blanks from both deionizing water systems are analyzed daily for various analytes, including fluoride, chloride, sulfate and sodium. This appears to have eliminated the bias experienced in the chloride confirmatory measurements during the previous inspection.[1]

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[1]Region III Inspection Report Nos. (50-456/89004; 50/89004)

c. (Open) Open Item Nos. (50-456/88026-02; 50-457/88026-02): Licensee to provide a report on the effects of the secondary system chemistry excursion on the steam generators. The licensee did a complete eddy-current examination of the S/G tubes in Unit 1 during the recent outage. Licensee representatives stated that no apparent damage was observed. Similar tests will be done during the upcoming refueling outage for Unit 2. The NRC Resident Inspectors will review the results of these tests.

3. Management Controls, Organization, and Training (IP 79701)

The management structure of the Chemistry Department was modified somewhat since the previous inspection in this area,[2] and the organization appears to have stabilized. The Department is headed by the Chemistry Supervisor (former title: the Assistant Rad-Chem Supervisor), who now has one year of experience in this position. The Lead Chemist and three Laboratory Supervisors report to him and four chemists/chemical engineers and four Chemistry Engineering Assistants report to the Lead Chemist. Currently 13 of the 21 Chemistry Technicians (CT) are qualified as technicians under ANSI N18.1, 1971. A licensee representative stated that, due to the likely loss of the more experienced CTs to transfers to other positions in the company, the experience level of the CTs is not likely to increase. This results in the midnight shift being manned only by the more junior CTs (not ANSI qualified). The problem has been alleviated by having a chemistry staff member on duty at all times.

The division of the technicians into chemistry and health physics technicians appears to have resulted in improved technician proficiency and laboratory continuity.

No violations or deviations were identified.

4. Water Chemistry Control Program (IP 79701)

Primary system chemistry is controlled by procedure BwCP PD-1, "Braidwood Station Primary Chemistry Program," Revision 2, August 23, 1988. It appears to be consistent with Technical Specifications (T/S) and Westinghouse Criteria and Specification, 1985. The pH is controlled by a coordinated lithium-boron program to minimize solubility of the protective magnetite coating on the reactor vessel. Use of enriched (99.9%) Li-7 minimizes tritium production in reactor coolant.

The secondary system water chemistry control program is based on the corporate directive NOD-CY.1, "PWR Secondary Water Chemistry Control Program," Revision 2, July 24, 1989 and implemented in BwCP PD-4, "Braidwood Station Secondary Water Chemistry Program," Revision 6, December 15,1989. This document commits the licensee to and is consistent with the EPRI S/G Owners Group Guidelines. Approval of waiver to the guidelines has been expanded to include the Nuclear Stations Duty Officer.

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[2] Ibid.

In-line process monitors provide data for secondary water systems, including condensate, feedwater and main steam. The instrumentation is being upgraded. It is tracked by strip chart recorders on the panels and Autograph 800 Dataloggers located in the laboratory area. The data are sampled, processed and archived on a computer; they can then be easily retrieved and processed, as desired. This system is being further updated with improved data processing and expanded storage facilities (Anatel PC-compatible Hewlett-Packard system). The plant has an in-line Dionex Ion Chromatograph on the steam generator blowdown (S/G BD) for continuous monitoring of chemistry parameters; a similar system is ready for connection to the secondary system sample panel.

The licensee studied the hideout return on both units to estimate the removal of S/G sludge contaminants, including chloride, sulfate, calcium, magnesium, sodium and silica. They found that the older Model D-4 S/Gs in Unit 1 had more hideout than those of the more recent Model D-5 S/Gs in Unit 2. The chloride inventory could be estimated from the 4-hour power hold, but the time was not long enough for cleanup. The licensee concluded that no chloride from the September 1988 chemistry excursion from the demineralizer exhaustion was evident in the hideout.

The Makeup Demineralizer system monitoring instrumentation and controls have been upgraded. Automatic isolation valves on the inlet and outlets of the process train stop the flow of water, e.g., from a vendor demineralizer, when high conductivity levels are detected. External sources of demineralized water are also processed and controlled through this system to prevent the introduction of impure water into the plant.

The water chemistry parameters are monitored daily by Chemistry and Operations. Monthly reports are also submitted to upper management with monthly and yearly trend charts of significant parameters, including bar charts that show the effects of the various chemistry parameters on the INPO Chemistry Performance Index (CPI). An extensive set of trend charts for water quality is maintained by the laboratory with daily data. A review of selected data for the previous year showed that plant water quality has improved, i.e., decreased cation conductivity, sulfate and chloride, over that for the previous inspection.[3] In Unit 1, over 1989, the various chemistry parameters, including sulfate, chloride, and conductivity improved, and the CPI was in the highest (best) quartile just prior to the refueling outage in August 1989. Unit 2 showed similar improvements. However, the inspector noted a concern that the long-term trend charts were based only on monthly averages, so that short excursions and their occurrence over the long-term were not easily apparent. A licensee representative agreed to implement detailed long-term charts on the significant parameters, including those for chloride, sulfate, conductivity and dissolved oxygen in the secondary system and lithium, boron and chloride in the RCS.

With the improvement of the water quality, the plant presently operates the condensate polishers only at startup. A licensee representative

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[3]Ibid.

stated that water quality was actually improved; sulfate concentrations decreased, and the probability of chemistry excursions due to polisher bed breakthrough is reduced.

The water quality control programs appear to be satisfactory and well run.

No violations or deviations were identified.

5. Implementation of the Chemistry Program (IP 79701)

The inspector reviewed the chemistry programs, including physical facilities and laboratory operations. Housekeeping was good and bench space was adequate for the analyses performed. The laboratories were well equipped. The cold laboratory was made a radiologically-controlled area to better integrate the hot and cold laboratory operations. The laboratory has four PC computer-controlled Dionex AI 400 Ion Chromatographs, used for both anion and cation analyses. A Perkin-Elmer Model 5100 Zeeman Effect Atomic Absorption Spectrophotometer (AAS) has been installed and will replace the P-E Model 5000 furnace AAS after the procedures are developed.

A computer database for chemistry parameter and QC results has just become operational. A hardcopy printed record is produced periodically as a permanent record. While more development is to be done, it appears to be working well. The laboratory has also developed a computer-based system for control (Chembase) of all laboratory chemicals. It produces a control number, directions for reagent preparation, preparation and expiration dates, and a standard label with the laboratory number in a barcode. Security is maintained by the use of keycards to produce an electronic signature for each authorized user.

Overall, the laboratory appeared to be adequate for the proper operation of the plant and to be operating satisfactorily.

No violations or deviations were identified.

6. Nonradiological Confirmatory Measurements (IP 79701)

The inspector submitted chemistry samples to the licensee for analysis as part of a program to evaluate the laboratory's capabilities to monitor nonradiological chemistry parameters in various plant systems with respect to various Technical Specification and other regulatory and administrative requirements. These samples had been prepared, standardized, and periodically reanalyzed (to check for stability) for the NRC by the Safety and Environmental Protection Division of Brookhaven National Laboratory (BNL). The samples were analyzed by the licensee using routine methods and equipment.

Licensee personnel made one dilution of each sample as necessary to bring the concentrations within the ranges normally analyzed by the laboratory, and run in triplicate in a manner similar to that of routine samples. The results are presented in Table 2 and the criteria for agreement at the end of the Table. These criteria are derived BNL results of the present samples and the relative standard deviations (RSD) derived from the results of the 1986 interlaboratory comparisons from the various plants in the study (Table 2.1, NUREG/CR-5422). The acceptance criteria were that the licensee's value should be within ± 2 SD of the BNL value for agreement and between 2 and 3 SD for qualified agreement.

The licensee determined the concentrations of nine analytes at three concentrations each, including boron samples from two different series. All of the results were in agreement with those of BNL, except for the high-level boron in the new series, which was a qualified agreement.

The results of the analyses were very good. Laboratory personnel demonstrated a willingness to do these analyses.

No violations or deviations were identified.

7. Implementation of the QA/QC Program in the Laboratory (IP 79701)

The inspectors reviewed the chemistry laboratory quality assurance/quality control (QA/QC) program as specified by Nuclear Operations Chemistry Quality Control Program, Revision 5, September 1, 1989. The licensee maintains statistically-based control charts on which the mean ± 2 standard deviations (SD) are plotted. Independent controls are in use and these data are used in preparing control charts. The inspector expressed concerns that the control limits on the charts were calculated only infrequently, with the result that limits did not represent the data well. However, with the recent implementation of the computerized database that had on-screen plotting capabilities for QC charts, licensee representatives agreed to determine these limits more frequently (after the collection of about 100 or so points, depending on the frequency of analysis). Laboratory personnel agreed to do this after implementation of the hardcopy plotting system in less than two months. A licensee tracking item, AIR #456-225-90-00300 was implemented to follow this item. Progress in this will be followed in subsequent routine chemistry inspections.

The licensee has implemented a QA/QC program for in-line instrumentation based on corporate NOD directive NOD-CY.8, "Nuclear Operations In-line Chemistry Instruments Quality Control Program," Revision 1, July 1, 1988, in which the various instruments are checked biweekly against either standards or laboratory analyses. Control limits are based on the suggested INPO values of chemistry good practices. The values are not plotted, due partly to the large number of instruments in the program (over 150). The inspector's review of some of the results indicated that the program was operating satisfactorily.

The licensee's interlaboratory comparison program is managed by the CECo Technical Center for all stations. Data for 1989 showed the station achieving about 89% agreement with some decline in the fourth quarter results due to problems with the AAS furnace analyses of the metals; these problems appear to have been corrected. The intralaboratory (CT) comparison program is described by procedure BwCP PD-8, "Braidwood Station Chemistry Performance Evaluation Program," Revision 4, August 22, 1988. Technicians are required to be tested annually on a variety of analyses including those required by T/S. Statistically derived acceptance criteria are based on the QC control chart limits (mean ± 2 SD). The latest set of tests were done at the corporate Production Training Center in Braidwood, which has laboratory instrumentation identical to that of the plant. In the tests in the last quarter of 1989, only one result was in disagreement. The CT was retrained and the analysis done in the plant laboratory was in agreement. A review of selected data showed technicians to be undergoing the required testing.

No violations or deviations were identified.

8. Audits and Appraisals (IP 79701)

The inspector reviewed the most recent off-site audit of the chemistry laboratory conducted from January 6-13, 1990, and the laboratory's subsequent response. The audit had one finding, one observation and two comments. The auditors appeared to address in adequate detail the nonradiological chemistry quality assurance program. Items identified in the audit appear to have been addressed in a timely manner.

The Braidwood office of the corporate Nuclear Quality Programs (NQP) Department (formerly the QA Department) has instituted an "extended surveillance" program in which the auditors look at a group of surveillances for a few hours per day over the period of a week or so. If done several times a year, it may give a better picture of the actual operations of the laboratory than a single audit, it appears to be almost equivalent to an audit and to be less intrusive on laboratory operations. The surveillance of June 28 - July 10, 1989, QAS 20-89-065, was detailed and covered several aspects of laboratory operations.

No violations or deviations were identified.

9. Open Items

Open items are matters which have been discussed with the licensee, which will be reviewed further by the inspector, and which involve some action on the part of the NRC or licensee, or both. No open items were disclosed during the inspection.

10. Exit Interview

The scope and findings of the inspection were reviewed with licensee representatives (Section 1) at the conclusion of the inspection on January 19, 1990. Subsequent telephone discussions were held with W. Lloyd on January 23 and 30, 1990, about the confirmatory measurements results. The inspector discussed the Open Items in Section 2 and the improvements in the quality control program. The computerized plotting of the QC charts will be done within two months and be followed by the licensee's tracking system under AIR #456-225-90-00300 and in subsequent routine chemistry inspections. The confirmatory measurements, while not complete at this time appeared to be very good. Licensee representatives noted modifications that longer-term trend charts will be made shortly.

During the exit interview, the inspector discussed the likely informational content of the inspection report with regard to documents or processes reviewed by the inspector during the inspection. Licensee representatives did not identify any such documents or processes as proprietary.

Attachments:
1. Table 1, Cold Chemistry Interlaboratory
   Test Results, March 1989
2. Attachment 1, Criteria for Comparing
   Analytical Measurements (Nonradiological)
3. Table 2, Nonradiological Confirmatory Measurements
   Results, January 16-30, 1990

TABLE 1
Cold Chemistry Interlaboratory Split Sample Results
Braidwood Nuclear Power Station
March 1989

Analyte	Matrix[a]	Analysis Method[b]	NRC Y ± SD	Licensee X ± SD	Ratio Z ± SD	Comparison[c] ±2 SD
			Concentration, ppb			
Fluoride	Sec	IC	55.8 ± 0.2	54.8 ± 1.2	0.982 ± 0.022	A
Chloride	Sec	IC	54.8 ± 4.2	49.8 ± 1.0	0.909 ± 0.072	A
Sulfate	Sec	IC	53.5 ± 1.5	52.5 ± 2.0	0.981 ± 0.046	A

a. Matrix: Secondary System water.

b. Analytical method:
IC Ion Chromatatography

c. Comparison:
A Agree
D Disagree
(See Attachment 1 for agreement criteria.).

ATTACHMENT 1

Criteria for Comparing Analytical Measurements

This attachment provides criteria for comparing results of the capability tests. The acceptance limits are based on the uncertainty (standard deviation) of the ratio of the licensee's mean value (X) to the NRC mean value (Y), where

(1) $Z = X/Y$ is the ratio, and

(2) S_z is the uncertainty of the ratio determined from the propagation of the uncertainties of licensee's mean value, S_x, and of the NRC's mean value, S_y.[1] Thus,

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

$$S_z = Z \bullet \left(\frac{S_x^2}{X^2} + \frac{S_y^2}{Y^2}\right)^{1/2}$$

The results are considered to be in agreement when the bias in the ratio (absolute value of difference between unity and the ratio) is less than or equal to twice the uncertainty in the ratio, i.e.

$$| 1-Z | \leq 2 \bullet S_z .$$

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1. National Council on Radiation Protection and Measurements, A Handbook of Radioactivity Measurements Procedures, NCRP Report No. 58, Second Edition, 1985, Pages 322-326 (see Page 324).

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TABLE 2
Nonradiological Interlaboratory Test Results
Braidwood Nuclear Generating Station, Units 1 and 2
January 16-30, 1990

Analyte	Method[1]	Conc[2]	Ratio[3]	Acceptance Ranges[4] ± 2sd	± 3sd	Result[5]
		ppb				
Fluoride	IC	2	0.942	0.875-1.125	0.813-1.187	A
		4	0.956	0.875-1.125	0.813-1.187	A
		8	1.026	0.875-1.125	0.813-1.187	A
Chloride	IC	2	1.003	0.917-1.081	0.879-1.121	A
		6	0.958	0.917-1.081	0.879-1.121	A
		8	0.966	0.926-1.074	0.895-1.105	A
Sulfate	IC	2	1.063	0.895-1.105	0.842-1.158	A
		4	0.989	0.895-1.105	0.868-1.132	A
		8	0.963	0.900-1.100	0.867-1.133	A
Iron	AA/FL	250	0.974	0.904-1.096	0.854-1.146	A
		450	1.059	0.903-1.097	0.857-1.143	A
		800	1.040	0.903-1.097	0.855-1.145	A
Copper	AA/FL	250	0.961	0.904-1.095	0.859-1.141	A
		450	0.964	0.904-1.096	0.857-1.143	A
		800	0.987	0.904-1.096	0.857-1.143	A
Lithium	AA/FL	400	1.000	0.859-1.141	0.788-1.212	A
		900	1.034	0.859-1.141	0.788-1.212	A
		1900	1.032	0.868-1.142	0.787-1.213	A
Silica	Spec	20	1.094	0.906-1.094	0.859-1.141	A
		50	0.918	0.909-1.091	0.860-1.136	A
		90	0.944	0.907-1.093	0.857-1.143	A
Boron	Titr	1000	0.979	0.979-1.021	0.968-1.032	A
(New		3000	1.003	0.979-1.021	0.968-1.032	A
Series)		5000	0.971	0.979-1 021	0.968-1.032	A*
Boron	Titr	1000	1.004	0.979-1.021	0.968-1.032	A
(Old		3000	0.996	0.979-1.021	0.968-1.032	A
Series)		5000	0.996	0.979-1.021	0.968-1.032	A

1. Methods: Titr - Titration
   IC - Ion Chromatography
   Spec - UV/VIS Spectrophotometry
   AA/FL - Atomic absorption spectrophotometry (flame)

2. Conc: Approximate concentration analyzed.

3. Ratio of Licensee mean value to NRC mean value.

4. The SD in the fifth and sixth columns represents the coefficient of variation obtained from averaging licensee data from the preceding cycle (Table 2.1 of NUREG/CR-5244). The licensee value is considered to be in agreement (A) if it falls within the ± 2 SD range; a qualified agreement (A*) if it lies outside ± 2 SD, but within ± 3 SD; and in disagreement (D) if it is outside the ± 3 SD range.