U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Report No. 50-440/88008(DRSS) License No. NPF-58

Docket No. 50-440

Licensee: The Cleveland Electric Illuminating Company
10 Center Road
Perry, OH 44081

Facility Name: Perry Nuclear Power Plant, Unit 1

Inspection At: Perry Site, Perry, Ohio

Inspection Conducted: April 11-15, 1988 (Onsite)
April 20, 26, and 28, 1988 (telephone discussions)

Inspector: R. B. Holtzman R. B. Holtzman 5/5/88
Date

Approved By: M. C. Schumacher, Chief M. C. Schumacher 5/6/88
Radiological Effluents and Chemistry Section
Date

Inspection Summary

Inspection on April 11-15, 20, 26, and 28, 1988 (Report No. 50-440/88008(DRSS))
Areas Inspected: Routine, announced inspection of: (1) the chemistry program, including procedures, organization, and training; (2) reactor systems water quality control programs; (3) quality assurance/quality control program in the laboratory; and (4) nonradiological confirmatory measurements.
Results: No violations or deviations were identified.

DETAILS

1. Persons Contacted

F. R. Stead, Director, Perry Plant Technical Department (PPTD)
R. A. Stratman, Acting Director, Perry Plant Operations Department
*S. J. Wojton, Manager, Radiation Protection Section, PPTD/RPS
*°D. L. Reyes, Plant Chemist, PPTD/CU
*C. M. Shuster, Director, Nuclear Engineering Department, (NED)
*+J. J. Grimm, Chemistry QA/QC Training Specialist, PPTD/CHEM
*G. A. Dunn, Supervisor, Compliance, PPTD/LCS/CEI
*D. C. Jones, NRC Interface, PPTD/LCS
*D. A. Wells, Supervisor, QE, NQAD/DQS
C. Shelton, Chemistry Supervisor
D. J. Piller, Chemistry Special Assignments Specialist
D. W. Howard, Chemistry Technician
M. E. Doty, Lead Chemistry Technician
C. F. Wells, Lead Chemistry Technician
J. L. Hartman, Chemistry Technician
D. Wells, Surveillance Quality Engineer, QA Department
K. Kimmel, Lead Auditor, QA Department
A. Lambacher, Lead Auditor, QA Department

*G. O'Dwyer, Resident Inspector, NRC

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

*Denotes those present at the plant exit interview on April 15, 1988.
+Denotes telephone discussion held on April 20, 1988.
°Denotes telephone discussions held on April 26 and 28, 1988.

2. Licensee Action on Previous Inspection Findings

a. (Closed) Open Item No. 50-440/87002-01: Licensee agreed to implement a QA/QC program with technician performance checks, control charts for the nonradiological chemistry performance checks, and improvements in the chemistry QA/QC procedure by November 1987. The QA/QC procedure RAP-0204, "Chemistry Unit Analytical Quality Control Program," was revised by the scheduled date (November 1987), but it was not approved until January 28, 1988. The program has been started, but is not fully implemented. The technician performance testing program has not been instituted under this revision; a licensee representative stated that, in conformance with the procedure, the first set of samples will completed prior to July 1988. Control charts have been implemented on some, but not all analyses; the operational procedures for these charts are still under development. With completion of the revision, this item is considered closed. Progress in implementation of the procedure and development of the program will be followed in subsequent chemistry inspections under Open Item No. 50-440/88008-02. (Section 7)

b. (Open) Open Item No. 50-440/87002-02: Licensee will correct the difficulties in the boron analytical method. The inspector reviewed, in detail, the newly revised boron analytical procedure, OM12A: CHI-10, "Boron Mannitol Potentiometric Method," Revision 1, August 10, 1987. The accuracy appears to have been improved by increasing the concentration of the NaOH titrant, using a larger sample and a larger buret, and adjusting the initial pH on the sample. However, the procedure still had some deficiencies in the chemistry that may affect the accuracy of measurement; namely, that two titration endpoints were not at the proper pH equivalencies. In the standardization of the NaOH titrant against the primary standard material, potassium hydrogen phthalate (KHP), the laboratory used the end point of pH 7.0, rather than the equivalence point of pH 8.6. The sample pH was initially set to 7.6, rather than to the more acidic boric acid equivalence point of about 5.5; this value is somewhat dependent on borate concentration. The problem with the sample initialization appears to be due to having adapted the ASTM mannitol potentiometric procedure, i.e. D 3082-79, "Standard Test Methods for Boron in Water," Volume 11.01, Water, 1985, which incorrectly states that the sample pH should be adjusted to 7.6 prior to adding the mannitol, rather than to the boric acid equivalence point. (This has been corrected in the Brookhaven National Laboratory boron procedure.) The chemist agreed to address these endpoint problems. This item will remain open until these are resolved.

c. (Open) Open Item (50-440/87020-01): The licensee agreed to split a waste tank sample and determine the gross beta, H-3, Fe-55, Sr-89 and Sr-90 concentrations and report the results to Region III. The comparison of the reported licensee results and those from the NRC Reference Laboratory, the Radiological Environmental and Safety Laboratory (RESL) of the Department of Energy, Idaho Falls, Idaho are presented in Table 1 of this report, with agreement criteria in Attachment 1. No Sr-90 was found in the sample so that a comparison was not possible. Of the remaining nuclides, the licensee had three disagreements in four analyses. The probable cause of disagreement in the gross beta values was due to the difference in the calibration nuclide; the licensee used Sr-90 (Y-90), rather than the more commonly used Cs-137 (that used by RESL). The causes of the other disagreements were not ascertained, but their low values suggest plate out on the containers and incomplete recovery by the licensee contractor. The licensee agreed to analyze for Sr-89, Sr-90, Fe-55, and gross beta in a spiked sample from RESL and report the results to Region III.

3. Management Controls, Organization, and Training

The inspector's review showed the organization and management of the Chemistry Unit to be essentially unchanged since the previous inspection in this area.[1] The laboratory now has eight chemists and 24 technicians under the Plant Chemist, who reports to the Manager, Radiation Protection

[1]Region III Inspection Report No. 50-440/87020.

Section. Although the staffing appears adequate to do the required work, the inspector noted that the plant has been slow to initiate a satisfactory QA/QC program. In a subsequent telephone discussion on April 26, 1988, a licensee representative stated that the plant is in the process of hiring a new chemist who will assist in this program.

The Chemistry and Senior Chemistry Technicians are all qualified under the ANSI N18.1-1971 standard. Further, one of these ANSI-qualified technicians, designated as the "Responsible Technician," is assigned to each shift to oversee laboratory operations.

The licensee's Chemistry Technician program was certified by INPO on January 27, 1988.

No violations or deviations were identified.

4. Water Chemistry Control Program

The inspector reviewed aspects of the water chemistry control program in the plant implemented by Procedure OM1A: PAP-1102, "Plant Chemistry Control Program," Revision 1, August 18, 1987. It is based on the fuel warranty and Electric Power Research Institute (EPRI) BWR Owners Water Chemistry Guidelines. The administrative limits, both the action levels and achievable values, in this procedure are consistent with the EPRI recommended guidelines. Since the last inspection,[2] sulfate was added to the parameters to be determined.

Trend charts are maintained on various chemistry parameters, including chloride, sulfate, conductivity, and metals (iron, copper, chromium, and nickel) in the reactor coolant system, feedwater, hotwell discharge, and condensate demineralizer effluent. Dissolved oxygen is also determined in feedwater where it is maintained between 20 and 50 ppb. (The oxygen level is deliberately kept above 20 ppb to maintain the protective oxide coating in this system.) The charts show data for up to three months and are updated weekly. Some of the parameters, normally held below LLD levels, showed some measurable increases to above LLD, correlated with changes in power levels. Over the time span reviewed (December 1987 - March 1988), the parameters were maintained well within the EPRI Action Levels.

The licensee is considering zinc addition to the reactor coolant for the purpose of reducing radiation levels from various reactor components.

Licensee management appears to be very aware of the value of a good water quality control program and is putting substantial effort into maintenance and system improvements.

No violations or deviations were identified.

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[2] ibid.

5. Implementation of the Chemistry Program

The inspector reviewed the chemistry programs, including physical facilities and laboratory operations. Housekeeping and bench space were adequate for the analyses performed. The laboratories were well equipped, including an automated dual-unit Dionex Ion Chromatographic system with automatic sample changers, a new UV/visible spectrophotometer with a long-path (10-cm) sample cell (to allow low-level silica analyses), an IL AA/AE Atomic Absorption/Atomic Emission Spectrophotometer (AAS), and a total organic carbon (TOC) analyzer.

The inspector observed several RCTs analyze the confirmatory measurements samples by titration, UV/visible spectrophotometry, AA/AE, and ion chromatography. They were knowledgeable about the work, followed the procedures, found and corrected problems, and did well in the analyses.

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

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.

The samples were diluted by licensee personnel 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 in Attachment 2. These criteria for agreement are based on comparisons of the mean values and estimates of the standard deviations (s.d.) of the measurements. Consideration was given to the fact that the uncertainties (s.d.) of the licensee's results were not necessarily representative of the laboratory's because they were obtained by one analyst over a short period of time. Consequently, when the licensee s.d. was less than that of BNL, and a disagreement resulted, the BNL value was substituted for that of the licensee in calculating the s.d. of the ratio Z (S_z in Attachment 2).

The licensee also prepared two samples to be split with BNL. To these were added analytes supplied by the inspector. Reactor water was spiked with the anions, chloride, and sulfate, and samples of condensate were spiked with the cations, copper, iron, nickel, and chromium. The licensee will determine the concentrations of the analytes in each,

and the results will be sent to Region III for comparison with the values determined by BNL. This will be followed under the Open Item No. 50-440/88008-01.

The licensee analyzed nine materials at three concentrations each. Of the 27 initial analyses, 21 or 78% were in agreement with the BNL values. The disagreements included the two lower-level iron samples, one each of the sulfate and chloride results, and one chromium and the higher-level silica value. The sulfate values were biased about 14% high, suggesting that the standard made from solid sodium sulfate may have had excess water over the formula weight. The silica showed a similar, but lesser problem, in which the ratios of all three samples were biased about 5% low, suggesting that the standard was about 5% high. The licensee is looking into obtaining other standards (probably commercial liquid standards) to check these.

There were difficulties with the AAS analyses as indicated by the initial two disagreements for Fe; these were corrected by the analyst in the rerun by addition of ammonium chloride, as provided in the procedure. The chromium analyses showed one disagreement, even after the analyst modified the matrix to correct for the Fe-Cr interference; the analyst also used a special test, the method of standard additions, to check the suspect value of the high-level chromium.

The disagreements in the chloride and chromium values were not significant in themselves, in that they were within about ±5% of the BNL values and the precision of the results was high. The Na analyses showed substantial high biases, but because of the inherent uncertainties in the BNL measurements, they were all agreements. This is a difficult analysis to perform, due to the high probability of environmental contamination of the samples at the levels measured; high accuracy is not necessary because Na is only an indicator of condenser inleakage.

Although the two of the three boron results were within 1% of the BNL values, the 3% low bias in the third analysis, with respect to the BNL value, may indicate a problem because of the high accuracy required by Technical Specifications; possible improvements in the analysis are being reviewed by the licensee, as discussed in Section 2.b.

While the results of this intercomparison were fairly good, the laboratory encountered difficulties in the analyses which appear to be due to weaknesses in the QA/QC program, including the fact that the control charts were only recently implemented and did not have statistically-derived control limits, and the performance check standards were not from different lots than the calibration standards.

Progress in resolving the problems of the analyses and standards and in development of the control chart program will be followed in subsequent inspections, as discussed in Section 7.

No violations or deviations were identified.

7. Implementation of the QA/QC Program in the Chemistry Laboratory

The inspector reviewed the nonradiological QA/QC program in the laboratory. This program was based on the revised Procedure RAP-0204, discussed in Section 2.a. Some of the QA/QC program was operational prior to the revision, including a technician performance testing program initiated in 1987, duplicate measurements on most of the analyses, including those on the IC and boron, performance control standards with acceptance limits (not statistically-based), and multi-point calibrations on the AAS and UV/vis spectrophotometer. While the IC uses only a one point calibration, performance checks are made at lower concentrations than those of the calibrations.

Under the previous QA/QC program, each technician was tested twice during the year on the analyses pH, specific conductivity, chloride and sulfate by ion chromatography (IC), and a group of radiological standard samples. The more senior technicians were also tested on the boron mannitol titration method. Acceptance criteria for the technicians' results were based on a two-standard-deviation limit criterion derived from laboratory results. These results were tabulated both by technician and by analysis. The list of analyses will be expanded to include silica, TOC, iron, and copper.

Control charts have been implemented on some, but not all analyses; the operational procedures for maintaining these charts are still under development; they do not have statistically-derived control parameters, as required by procedure. The chemist stated that these will be instituted shortly when sufficient data points are accumulated.

In a telephone discussion on April 28, 1988, a licensee representative stated that the plant is planning, by July 1988, to institute a cold chemistry interlaboratory comparison program with a nearby contractor laboratory, Racerca, Inc.

The inspector noted to licensee representatives that while the QA/QC program is basic to analytical chemistry, its development has progressed very slowly since the previous inspection. A licensee representative stated plans to correct this shortcoming (Section 3).

Progress in resolving the problems with the standards and the AAS analyses, the use of multiple standards, updating of the technician performance testing program to conform to the revised RAP-0204, the implementation of a cold chemistry interlaboratory program, and implementation of statistically-derived parameters on control charts will be followed in subsequent inspections under Open Item No. 50-440/88008-02.

No violations or deviations were identified.

8. Audits and Appraisals

The inspector reviewed the latest corporate QA audits relating to the Chemistry Unit, Audit PIO 87-31, September 8-October 7, 1987. The

auditors gave the Unit an overall rating of "good" on conformance to Technical Specifications and procedures. Some improvements in operations were suggested. A second audit on the Radiological Environmental and Effluent Monitoring Program, PIO 87-33, also looked at the laboratory radiological QC charts and found no problems with them. Members of the QA Department were knowledgeable on chemistry and chemistry QA/QC problems. They noted that in future audits they would look at the nonradiological QA/QC program based on the newly instituted Procedure RAP-0204.

The audit and surveillance reports indicate that the licensee's mechanisms for responding to audit findings are adequate.

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. Open items disclosed during the inspection are discussed in Sections 6 and 7.

10. Exit Interview

The scope and findings of the inspection were reviewed with licensee representatives (Section 1) at the conclusion of the inspection on April 15, 1988. The inspector discussed the Open Items in Section 2 and observations on the quality control program and the confirmatory measurements. He noted the slow progress in the QA/QC program development since the previous inspection and the need for more effort in it. Licensee representatives agreed to improvements in the QA/QC program, as discussed in Section 7. In a subsequent telephone discussion on April 26, 1988, a licensee representative stated that within two months a chemist (to be added to the staff) would assist in the QA/QC program (Section 3), and further, on April 28, 1988, he noted that a cold chemistry interlaboratory comparison program would begin by July 1988.

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, Confirmatory Measurements Program Results, 1st Quarter 1988
2. Attachment 1, Criteria for Comparing Analytical Measurements (Radiological)
3. Table 2, Nonradiological Interlaboratory Test Results, April 11-15, 1988
4. Attachment 2, Criteria for Comparing Analytical Measurements (Nonradiological)

TABLE 1

U S NUCLEAR REGULATORY COMMISSION

OFFICE OF INSPECTION AND ENFORCEMENT

CONFIRMATORY MEASUREMENTS PROGRAM
FACILITY: PERRY
FOR THE 1 QUARTER OF 1988

		NRC		LICENSEE		LICENSEE:NRC		
SAMPLE	ISOTOPE	RESULT	ERROR	RESULT	ERROR	RATIO	RES	T
L WASTE	G BETA	4.6E-04	2.0E-05	2.0E-04	1.4E-05	4.4E-01	2.3E 01	D
	H-3	3.2E-04	5.0E-06	2.9E-04	9.5E-06	9.1E-01	6.3E 01	A
	SR-89	6.7E-07	1.4E-07	3.0E-07	1.0E-08	4.5E-01	4.8E 00	D
	FE-55	3.2E-04	1.0E-06	2.3E-05	5.0E-07	7.2E-02	3.2E 02	D

T TEST RESULTS:
A=AGREEMENT
D=DISAGREEMENT
*=CRITERIA RELAXED
N=NO COMPARISON

ATTACHMENT 1

CRITERIA FOR COMPARING ANALYTICAL MEASUREMENTS

This attachment provides criteria for comparing results of capability tests and verification measurements. The criteria are based on an empirical relationship which combines prior experience and the accuracy needs of this program.

In these criteria, the judgment limits are variable in relation to the comparison of the NRC's value to its associated one sigma uncertainty. As that ratio, referred to in this program as "Resolution", increases, the acceptability of a licensee's measurement should be more selective. Conversely, poorer agreement should be considered acceptable as the resolution decreases. The values in the ratio criteria may be rounded to fewer significant figures reported by the NRC Reference Laboratory, unless such rounding will result in a narrowed category of acceptance.

RESOLUTION	RATIO = LICENSEE VALUE/NRC REFERENCE VALUE
	Agreement
<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

Some discrepancies may result from the use of different equipment, techniques, and for some specific nuclides. These may be factored into the acceptance criteria and identified on the data sheet.

TABLE 2
Nonradiological Interlaboratory Test Results
Perry Nuclear Power Plant, Unit 1
April 11-15, 1988

Analyte	Analysis Method[b]	NRC Y ± s.d.(n)	Licensee X ± s.d.(n)	Ratio Z ± s.d.	Comparison[c] ±2 s.d.
		Concentration, ppb			
Cl^-	IC	9.25 ± 0.05(7)	9.13 ± 0.10	0.987 ± 0.012	A
		18.6 ± 0.15(7)	18.6 ± 0.1	1.000 ± 0.010	A
		38.3 ± 0.6(8)	40.2 ± 0.06	1.050 ± 0.023	D*
Sulfate	IC	9.75 ± 0.7(7)	10.6 ± 0.06	1.087 ± 0.078	A
		19.2 ± 1.4(7)	22.7 ± 0.5	1.182 ± 0.113	A*
		39.0 ± 1.2(9)	44.1 ± 0.6	1.131 ± 0.046	D*
Silica	Spec	26.4 ± 1.4(7)	25 ± 0.0	0.947 ± 0.050	A
		52 ± 2.0(7)	49.7 ± 0.6	0.955 ± 0.039	A
		78.5 ± 1.0(7)	74.7 ± 0.6	0.952 ± 0.018	D*
Fe	AAS	93 ± 2.5(7)	111 ± 2.9	1.194 ± 0.045	D
		199 ± 2.5(6)	185 ± 2.1	0.930 ± 0.017	D
		293 ± 7.5(7)	281 ± 2.1	0.959 ± 0.026	A
Fe (rerun)	AAS	93 ± 2.5(7)	97 ± 8.5	1.043 ± 0.096	A
		199 ± 2.5(6)	193 ± 8.3	0.970 ± 0.043	A
Cu	AAS	100 ± 2.5(7)	106 ± 1.5	1.060 ± 0.0304	A
		201 ± 7.5(7)	205 ± 2.0	1.017 ± 0.039	A
		300 ± 7.5(7)	305 ± 3.5	1.017 ± 0.028	A
Ni	AAS	101.5 ± 3.0(7)	104 ± 4.5	1.025 ± 0.054	A
		208.5 ± 3.5(7)	201 ± 7.5	0.964 ± 0.039	A
		302.5 ± 12.5(7)	305 ± 3.5	1.008 ± 0.042	A
Cr	AAS	99 ± 2.5(7)	101 ± 1.7	1.020 ± 0.031	A
		192 ± 2.5(6)	183 ± 3.5	0.952 ± 0.022	D
		290 ± 5.0(7)	284 ± 1.2	0.979 ± 0.017	A
Na	AE	30.2 ± 3.5(7)	33.7 ± 0.6	1.116 ± 0.131	A
		53 ± 3.0(6)	61 ± 1.0	1.151 ± 0.086	A*
		79 ± 4.5(6)	86.3 ± 1.5	1.092 ± 0.065	A

		Concentration, ppb				
Boron	Titr	1040	± 10.5(7)	1034	± 0(1)	0.995 ± 0.010	A
		3100	± 100(7)	2999	± 0.7	0.968 ± 0.031	A
		5000	± 90(7)	4987	± 7	0.997 ± 0.018	A

a. Value ± standard deviation (s.d.); n is number of BNL analyses. The number of licensee analyses is 3 unless otherwise noted.

b. Analytical methods:
- Titr - titration
- IC - Ion chromatography
- Spec - UV/vis Spectrophotometry
- AAS - Atomic absorption spectrophotometry (flame)
- AE - Atomic emission spectrophotometry

c. A = Agreement
D = Disagreement

*Substituted the BNL uncertainty for licensee's uncertainty.

ATTACHMENT 2

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,

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

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

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).

4/6/87