U.S. NUCLEAR REGULATORY COMMISSION

REGION III

Reports No. 50-315/89019(DRSS); 50-316/89019(DRSS)

Docket Nos. 50-315; 50-316 Licenses No. DPR-58; DPR-74

Licensee: Indiana Michigan Power Company
1 Riverside Plaza
Columbus, OH 43216

Facility Name: D. C. Cook Nuclear Plant, Units 1 and 2

Inspection At: D. C. Cook Site, Bridgman, Michigan

Inspection Conducted: May 15-19, 1989 (Onsite)
June 5, 1989 (Telephone discussion)

Inspectors: R. B. Holtzman — 6-15-89 Date

J. E. House — 6-15-89 Date

Approved By: M. C. Schumacher, Chief
Radiological Controls and
Chemistry Section — 6-15-89 Date

Inspection Summary

Inspection on May 15-19, 1989 (Reports No. 50-315/89019(DRSS); 50-316/89019(DRSS))

Areas Inspected: Routine unannounced inspection of: (1) the chemistry program, including procedures, organization, and training (IP 84750); (2) primary and secondary systems water quality control programs (IP 84750); (3) quality assurance/quality control program in the laboratory (IP 84750); (4) nonradiolgical confirmatory measurements (IP 79701); and (5) the radiological environmental monitoring Program (REMP) (IP 84750).

Results: The licensee's water quality control program was generally good. The quality of trend charts of the plant chemistry parameters needs to be improved. Laboratory QA/QC Programs were improving and the nonradiological confirmatory measurements were good. The REMP was operating satisfactorily. No violations or deviations were identified.

DETAILS

1. Persons Contacted

[1]W. G. Smith, Jr., Plant Manager, D. C. Cook
[1]L. S. Gibson, Assistant Plant Manager
[1,2]K. Haglund, Technical Physical Science (TPS)/General Chemical Supervisor
[1]S. McLea, TPS/Chemical Supervisor
[1]T. Lantry,TPS/Chemical Supervisor
[1]J. Fryer, TPS/RMC
[1]J. Carlson, TPS/Chemical Supervisor
[1]D. Fitzgerald, TPS/Environmental Supervisor
[1]L. K. Rogers, TPS/Environmental Specialist (Applied Radiological Controls)
[1]B. A. Svenson, Licensing Activities Coordinator
[1]A. A. Blind, Assistant PH Manager
[1]J.J. Nadeau, Site QA, AEPSC
[1]J. Leichron, Radiation Specialist, AEPSC
L. Holmes, Administrative Compliance Coordinator
R. Burgett, Sr. Chemical Technician (CT)
R. Chase, CT

[1]B. L. Jorgensen, Senior Resident Inspector, NRC
[1]D. G. Passehl, Resident Inspector, NRC

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

[1]Present at the Exit Meeting on May 19, 1989.

[2]Telephone discussion held on June 5, 1989.

2. Licensee Action on Previous Inspection Findings

a. (Closed) Open Item (50-315/86037-02;50-316/86037-02): The licensee to install new in-line instrumentation in the secondary system. The new instrumentation has been installed for monitoring secondary system water chemistry parameters in steam generator blowdown, feedwater and condensate. The parameters, including specific and cation conductivity, pH, dissolved oxygen, sodium, and hydrazine, are recorded on multichannel chart recorders. The sample coolers have also been replaced to give more precise temperature control of the in-line sensors. The licensee is in the process of calibrating the instrumentation and evaluating computerized data collection and management systems. This will be followed in subsequent routine chemistry inspections (Section 4).

b. (Closed) Open Item (50-315/88010-01; 50-316/88010-01): Licensee to improve secondary water quality (mainly reduction in chloride), and to introduce trend charts of process chemistry parameters. The chloride concentrations in the secondary systems have been reduced to about 5 ppb, levels which appear to be reasonable in a system without condensate polishers. The licensee implemented the use of trend charts of the chemistry parameters, especially by the chemists, but they have deficiencies which limit their usefulness. These problems are discussed in Section 4 and will be followed under Open Item Nos. (50-315/89019-01; 50-316/89019-01).

c. (Closed) Open Item (50-315/88010-02; 50-316/88010-02): The licensee spiked reactor water with anions and condensate with metals, split the samples with Brookhaven National Laboratory, analyzed them and sent the results to Region III. The comparison in Table 1 shows only two agreements in five analyses, with large biases relative to those of BNL in the sulfate, iron and copper. The sources of the biases could not be determined, but they appear to be dilution or plateout problems. However, since a review of selected licensee records indicated that the licensee's analytical data were generally reliable (Sections 6 and 7) and the licensee will repeat the sample split as part of this inspection, this item is considered closed.

d. (Closed) Open Item (50-315/88010-03; 50-316/88010-03): The licensee was to improve the fluoride and sodium analyses to obtain better precision and accuracy. The fluoride analysis was modified by obtaining a more sensitive millivolt meter and revising the analytical procedure. The sodium procedure on the furnace atomic absorption spectrophotometer was also improved through more experience and controls. This analysis is expected to be further improved when the licensee's Perkin-Elmer Zeeman Model 3030 Atomic Absorption Graphite Furnace Spectrophotometer is operational.

e. (Open) Open Item (50-315/88010-04; 50-316/88010-04): Licensee to consider improvements in the laboratory QA/QC program: calculate limits more frequently, better control chart assessment and use of QC data sheets for each analysis. The licensee has upgraded the laboratory QA/QC program with the implementation of QC data sheets, independent standards, multipoint calibration curves, and regular maintenance of the charts and other parts of the program. However, this item will remain open because of the inspectors concerns about the weaknesses in the program discussed in Section 7.

f. (Open) Open Item (50-315/89003-01; 50-316/89003-01): Analyze liquid sample for gross beta, tritium, Sr-89, Sr-90 and Fe-55 and report results to Region III. Results of sample comparisons are given in Table 2; the comparison criteria are given in Attachment 2. Agreement resulted for gross beta and tritium; the Sr-89 and Sr-90 values were not compared due to poor counting statistics and the

Fe-55 was not analyzed by RESL. The licensee agreed to analyze for the latter three nuclides in a spiked sample supplied by the NRC.

3. Management Controls, Organization, and Training (IP 84750)

The management structure of the Chemical Section is essentially unchanged since the previous inspection in this area.[1] The Section has four Chemistry Supervisors, a Chemical Training Specialist, Physical Science Specialist and a Sr. Performance Engineer reporting to the General Chemistry Supervisor. The laboratory has 17 I&M Chemical Technicians (CTs) and 10 contract technicians. The CTs are all qualified under the ANSI N18.1-1971 standard, but by plant qualification standards, four are still considered to be in training and are not allowed to work alone on a shift.

In a letter dated January 11, 1989, INPO found the biennial accreditation status report for the chemistry technician training program to be satisfactory with no exceptions.

No violations or deviations were identified.

4. Water Chemistry Control Program (IP 84750)

The inspectors reviewed the water chemistry control program which is based on PMI-6020, "Chemical/Radiochemical Control Program," Revision 3, March 30, 1988, and 12 THP 6020 LAB.041, "Secondary System Chemistry," Revision 12, May 1, 1989. The licensee is not formally committed to follow the EPRI Steam Generator (S/G) Owners Group Guidelines, but these procedures appear to be consistent with the guidelines. These procedures also specify the chemistry parameters for the primary system, and while not addressing the EPRI Primary System Guidelines, appear to be consistent with them.

Secondary system water parameters measured by in-line monitoring systems include conductivity, pH, dissolved oxygen, hydrazine and sodium. Parameters such as boron, chloride and sulfate are analyzed in the laboratory from grab samples. Secondary water quality appeared to be generally good. The licensee does not have a formal commitment to the EPRI Steam Generator Owners Group Guidelines (SGOG), but plant secondary water standards appeared to be generally consistent with the Guidelines.

The inspectors reviewed selected trend charts of secondary water chemistry parameters and noted their concerns in a number of areas that appeared to be deficient. Trend charts for chloride and sulfate levels in S/G blowdown were not normally reviewed by plant management although

[1]Region III Inspection Reports No. (50-315/89003; 50-316/89003)

licensee representatives stated that values for these parameters were discussed at the morning meeting. The absence of power and action levels on the charts made it difficult to interpret relative contaminant concentrations. The charts normally covered only a short term (14 days) so that the overall water quality for the past year was not readily apparent. A licensee representative stated that these charts were updated and reviewed every other week, that data was added to the computer database weekly, that trend charts were used for short time frames, and that each supervisor reviewed those analyses for which he was responsible.

Subsequent to the onsite visit, the licensee submitted to the inspectors long term charts provided by the corporate office that were normally not available to plant personnel. From these charts, the inspectors were able to review overall plant water quality. The inspectors discussed improvements in the trending system with licensee management representatives.

Licensee management representatives noted that water quality was being monitored, and that they considered it to be very important. They requested the names of nuclear plants that had good water quality trending systems. Deficiencies in the trending program suggest that improvements and additional upper management support for this program are needed. Licensee representatives agreed to submit a letter to Region III on their proposed actions by July 31, 1989. This letter and improvements in trending secondary water chemistry parameters will be followed under Open Item Nos. (50-315/89019-01; 50-316/89019-01).

No violations or deviations were identified.

5. Implementation of the Chemistry Program (IP 84750)

The inspectors reviewed the chemistry programs, including physical facilities and laboratory operations. In the environmental laboratory, the housekeeping and space were good. However, in the hot laboratory where most of the analyses on plant samples were done, the housekeeping was fair and the benches were somewhat crowded. Further, the latter was a radiologically-controlled area that requires the extensive use of protective clothing (PC), which is somewhat of a burden on both the analysts and supervisors. The laboratory supervisor noted that the laboratory is basically radiologically clean and they expect to eliminate this PC requirement by the end of May 1989. The laboratories were well equipped. They have acquired a Fisher Accumet 950 pH Millivoltmeter for improved sensitivity of the fluoride specific ion probe and a Milton Roy Spectronic 501 UV/Vis Spectrophotometer with a 100-mm absorption cell for improved sensitivity for the ammonia, hydrazine and silica analyses. The laboratories are equipped with good instrumentation and appear to be operating well.

The inspectors observed several CTs analyze the confirmatory measurements samples on the ion chromatograph, atomic absorption spectrophotometer, and the boron titrator. They appeared to be generally knowledgeable about the work and followed the procedures.

No violations or deviations were identified.

6. Nonradiological Confirmatory Measurements (IP 79701)

The inspectors 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 Radiological Sciences Division of Brookhaven National Laboratory (BNL). The samples were analyzed by the licensee using routine methods and equipment.

A single dilution was made for each sample 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 3 and the criteria for agreement in Attachment 1. These criteria for agreement are based on comparisons of the mean values and estimates of the standard deviations (SD) of the measurements. Modifications made to these criteria (Attachment 1 Notes) are based on the consideration that the uncertainties (SD) 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.

The licensee will also prepare a sample of reactor coolant spiked with fluoride, chloride and sulfate to be split with BNL. The licensee will determine the concentrations of the analytes 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 Nos. (50-315/89019-02; 50-316/89019-02).

The licensee determined 11 analytes at three concentrations each. Of the initial 33 analyses 30 were in agreement (90%). The disagreements were with the results of the low-level iron and silica and the middle-level ammonia. The low-level chloride had a high bias, which indicated contamination; it was an agreement with the 3% RSD modification of the uncertainties. The licensee then repeated the chloride, iron, and silica analyses which then were agreements. The ammonia sample analysis was not repeated. The licensee initially identified a problem in the ammonia analysis, possibly due to defective samples, reagents or dilutions; after the CT prepared new dilutions and reagents, the results were reasonable.

Due to some uncertainties in the values of the boron standards, in this assessment the mean values of the concentrations obtained by the other plant laboratories in Region III were used as the NRC values in Table 3 (Attachment 1 Notes). This licensee did not adjust the starting point pH and titrated to a dead-stop endpoint of pH 8.50 and obtained satisfactory results.

Overall, the results of the analyses were very good. Laboratory personnel demonstrated a willingness and good ability in determining the causes of the disagreements.

No violations or deviations were identified.

7. Implementation of the QA/QC Program in the Laboratory (IP 84750)

The inspectors reviewed the chemistry laboratory quality assurance program as specified by PMI-6020, "Chemical/Radiochemical Control Program," Revision 3, March 30, 1988 and 12 THP 6020 LAB.044, "Laboratory Quality Assurance," Revision 10, January 13, 1989. These documents define the operation of the QA/QC program and mandate the use of multiple point calibration curves, independent controls and statistically-based control charts.

However, the inspectors noted various concerns about the QC system. The control charts were removed from the instrument logbook when completed and the technicians could not easily review the history of the analysis. A more significant concern was that the control limits were not statistically based but were set arbitrarily by procedure. This practice limits knowledge of the quality of the analyses. Further, the laboratory personnel consider an assay to be out of control only when at the control limit. However, a significant bias can often be detected before this happens. Frequent review of control charts can detect the formation of non-random trends, so that corrective action can be taken before the assay is out of control. The inspectors also discussed the fact that not all of the charts were adequately labeled. Some charts did not have the mean value or control parameters labeled. Licensee representatives agreed to address these problems.

The charts are designed to demonstrate the random statistical operation of the system; thus, trends in the performance check data also indicate a lack of control, such as seven consecutive points being on one side of the mean line. Other non-random behavior also may be seen from these charts using the Shewhart criteria. These criteria do not necessarily need formalization, but the chemists responsible for the QC should be aware of them and able to estimate the probabilities of various types of events as being purely random occurrences, e.g., the probability of an event occurring near the 2-sigma control limit is about 1 in 20, of two such consecutive events, 1 in 400. Licensee representatives agreed to leave at least one older chart (or copy) in the logbook and to

consider these other criteria for estimating out of control analyses including the use of ± 2 SD control limits. Licensee representatives also stated that the Training Department is developing a statistics and data interpretation course for senior technicians and supervisors.

The licensee's Interlaboratory Comparison Program is vendor-supplied. Data from the first three quarters of 1987 and the third quarter of 1988 showed that 74% of the analyses were within ± 10% of the reference value. A few assay results exhibited large biases indicating analysis problems. However, since a number of technicians performed each assay, from which a mean and SD could be determined, the outliers could be readily observed. Removal of the outliers resulted in improved agreement between licensee and vendor values. Overall licensee performance in this program is reasonably good; however, data from the fourth quarter of 1987 and from three quarters of 1988 were not available. Licensee representatives stated that the vendor-supplied unknowns were received, but laboratory personnel had failed to analyze them due to lack of technician time. Although the licensee's QA program requires participation in this program, there was no laboratory procedure establishing its parameters. The inspectors noted this weakness along with the importance of an outside confirmation of the QA program to licensee representatives. The interlaboratory comparison program will be followed under Open Items No. (50-315/89019-03; 50-316/89019-03).

The Intralaboratory Comparison Program (technician performance testing), described in the Laboratory Quality Assurance Procedure, is extensive and appears to be generally well managed. The inspectors did note that on a few occasions, technicians who had failed certain analyses were not retested on a timely basis. Licensee representatives agreed that this was the case, but stated that those failures did not represent critical analyses, and, in the future, any technician failures would be retested on a timely basis. The acceptance criteria were not statistically based, but used a percent variation from the mean value. The inspectors discussed the use of a statistically-based criterion with the licensee. Progress in this area will be followed in subsequent routine inspections.

No violations or deviations were identified.

8. Radiological Environmental Monitoring Program (REMP)(IP 84750)

The inspectors reviewed the REMP, including the 1988 Annual Environmental Report, the maintenance records, and the air sampling stations. The Annual Environmental Report appeared to comply with the REMP requirements. All of the required samples were collected and analyzed, except as noted in the report, and a perusal of the results showed them to be reasonable.

The inspectors toured the air sampling stations around the plant and observed a licensee representative demonstrate the testing of the air samplers, i.e. check the systems for operability, and leakage of the

sampling train. The sampling assemblies in the stations are a unit ("one-piece") design with the pump and controllers mounted on a plate and connected by a tube to the filter-charcoal cartridge assembly. The units are scheduled for annual calibrations. The inspectors noted a concern that, although the system was tested for inleakage and operability up to the filter-cartridge holder, the train, as whole, was not tested for air inleakage by some procedure, such as blocking the face of the filter holder. A licensee representative agreed to address this concern. This will be followed in subsequent inspections under Open Item Nos. (50-315/89019-04; 50-316/89019-04). The six air samplers observed appeared to be operating satisfactorily, both with respect to vacuum and flowrate.

Overall, the REMP appeared to be operating satisfactorily.

No violations or deviations were identified.

9. Audits and Appraisals (IP 84750)

The inspectors reviewed the most recent Corporate assessment of the Chemical/Radiochemical Control program conducted from March 3 - May 10, 1988 and the laboratory's subsequent response. The auditors appeared to address in adequate detail the nonradiological chemistry quality assurance program. Items identified in the audit appeared to have been addressed in a timely manner.

No violations or deviations were identified.

10. Open Items

Open items are matters which have been discussed with the licensee, which will be reviewed further by the inspectors, 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 4, 6, 7 and 8.

11. Exit Interview

The scope and findings of the inspection were reviewed with licensee representatives (Section 1) at the conclusion of the inspection on May 19, 1989. The inspectors discussed the Open Items in Section 2 along with observations on the quality control program, the water chemistry trend charts and the confirmatory measurements.

The licensee will prepare, split and analyze samples as described in Section 6. The inspectors discussed preparation and use of trend charts for water chemistry. The licensee agreed to consider improvements in this area and submit a letter outlining their proposed actions (Section 4). The Interlaboratory and Intralaboratory Comparison Programs were reviewed and licensee representatives agreed to consider modifications in these areas (Section 7).

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

Attachments:

1. Table 1, Nonradiological Interlaboratory Split Sample Results, July 1988.
2. Table 2, Radiological Interlaboratory Test Results, 1st Quarter, 1989.
3. Table 3, Nonradiological Interlaboratory Test Results, May 15-19, 1989
4. Attachment 1, Criteria for Comparing Analytical Measurements (Nonradiological)
5. Attachment 2, Criteria for Comparing Radiological Measurements

TABLE 1

Nonradiological Interlaboratory Split Sample Results
D.C. Cook Nuclear Plant, Units 1 and 2
July 1988

Analyte	Analytical Method[a]	NRC Y ± SD	Licensee X ± SD	Ratio Z ± SD	Comparison[b] ±2 SD
		Concentration, ppb			
Reactor Coolant					
Fluoride	SIE	39.3 ± 0.4	39.3 ± 2.5	1.000 ± 0.064	A
Chloride	IC	65 ± 1	59.3 ± 3.0	0.908 ± 0.048	A
Sulfate	IC	40.3 ± 0.4	15.8 ± 00.3	0.392 ± 0.008	D
Feedwater					
Fe	AA/FL	490 ± 10	183 ± 3	0.373 ± 0.022	D*
Cu	AA/FL	490 ± 14	427 ± 14	0.871 ± 0.038	D

a. Analytical method: IC - Ion chromatogphy
SIE - Specific ion electrode
AA/FL - Atomic absorption spectrophotometry (flame)

b. Comparison: A - Agree
D - Disagree

c. *Substituted NRC SD for licensee's SD

TABLE 2

U.S. NUCLEAR REGULATORY COMMISSION

OFFICE OF INSPECTION AND ENFORCEMENT

CONFIRMATORY MEASUREMENTS PROGRAM

FACILITY: D. C. COOK

DATE: 1ST QUARTER 1989

SAMPLE	NUCLIDE	NRC VAL.	NRC ERR.	LIC.VAL.	LIC.ERR.	RATIO	RESOL.	RESULT
LIQUID	GR BETA	5.60E-05	3.00E-06	4.45E-05	1.86E-05	0.79	18.7	A
WASTE	H-3	3.47E-02	5.00E-04	3.50E-02	7.00E-05	1.01	69.4	A

TABLE 3

Nonradiological Interlaboratory Test Results
D. C. Cook Nuclear Plant, Units 1 and 2
May 15-19, 1989

Analyte	Analytical Method[b]	NRC[a] Y ± SD	Licensee[a] X ± SD	Ratio Z ± SD	Comparison[c] ±2 SD
		Concentration, p			
Fluoride	SIE	22.5 ± 2.0	20.3 ± 0.1	0.902 ± 0.080	A
		42.3 ± 0.8	41.0 ± 0.5	0.969 ± 0.022	A
		82.8 ± 1.7	83.3 ± 0.6	1.006 ± 0.022	A
Chloride	IC	9.25 ± 0.05	10.0 ± 0.2	1.081 ± 0.048	A+
		18.6 ± 0.3	18.9 ± 0.3	1.013 ± 0.023	A
		38.2 ± 0.6	38.3 ± 1.8	1.001 ± 0.050	A
(rerun)		9.25 ± 0.05	9.5 ± 0.3	1.027 ± 0.033	A
Sulfate	IC	9.75 ± 0.70	9.80 ± 0.50	1.005 ± 0.089	A
		19.2 ± 1.4	19.7 ± 0.3	1.029 ± 0.074	A
		39.0 ± 1.2	41.0 ± 1.3	1.051 ± 0.046	A
Fe	AA/Fu	18.6 ± 0.5	21.0 ± 0.5	1.129 ± 0.046	D+
		39.8 ± 0.5	39.2 ± 0.5	0.985 ± 0.018	A
		58.5 ± 1.5	59.3 ± 1.0	1.014 ± 0.031	A
(rerun)		18.6 ± 0.5	20.0 ± 0.3	1.075 ± 0.041	A*
Cu	AA/Fu	20.0 ± 0.3	21.0 ± 0.4	1.050 ± 0.025	A
		40.3 ± 1.5	39.7 ± 0.7	0.985 ± 0.041	A
		60.0 ± 1.5	59.4 ± 0.8	0.990 ± 0.028	A
Na	AA/Fu	12.1 ± 1.4	11.8 ± 0.3	0.975 ± 0.116	A
		21.2 ± 1.2	20.0 ± 0.3	0.943 ± 0.055	A
		31.6 ± 1.8	29.0 ± 0.5	0.918 ± 0.055	A
Li	AA/FL	788 ± 16	755 ± 6	0.958 ± 0.028	A*
		1200 ± 28	1242 ± 5	1.035 ± 0.025	A
		1652 ± 40	1588 ± 5	0.961 ± 0.023	A
NH3	Spec	104 ± 5	110 ± 2	1.058 ± 0.054	A
		300 ± 3	260 ± 10	0.867 ± 0.034	D+
		492 ± 23	476 ± 1	0.967 ± 0.045	A

Analyte	Analytical Method[b]	NRC[a] Y ± SD	Licensee[a] X ± SD	Ratio Z ± SD	Comparison[c] ±2 SD
Hydrazine	Spec	19.9 ± 0.3	21.3 ± 0.6	1.070 ± 0.034	A+
		49.9 ± 0.5	52.3 ± 0.6	1.048 ± 0.016	A+
		100 ± 1	104.7 ± 0.6	1.047 ± 0.015	A+
Silica	Spec	26.4 ± 1.4	22.0 ± 1.0	0.833 ± 0.062	D+
		52.0 ± 2.0	47.3 ± 0.6	0.910 ± 0.049	A*
		78.5 ± 1.0	76.7 ± 1.5	0.977 ± 0.023	A
(rerun)		26.4 ± 1.4	24.6 ± 0.4	0.932 ± 0.052	A
		Concentration, ppm			
Boron[d]	Titr	1000 ± 10	1001 ± 2	1.001 ± 0.017	A
		2960 ± 40	2994 ± 28	1.011 ± 0.017	A
		4902 ± 76	4929 ± 11	1.006 ± 0.016	A

a. Value ± standard deviation (SD); number of BNL analyses is 6 to 9. The number of licensee analyses is 3 to 4.

b. Analytical methods:
- Titr - Titration
- IC - Ion chromatography
- Spec - Spectrophotometric
- AA/Fu - Atomic absorption spectroscopy (furnace)
- AA/FL - Atomic absorption spectroscopy (flame)
- SIE - Specific ion electrode

c. A = Agreement
D = Disagreement

d. NRC (BNL) value replaced by mean values of plants in Region III.

*Substituted the BNL uncertainty for licensee's uncertainty.

+Substituted 3% relative SD for BNL and licensee's SDs.

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).

4/6/87

ATTACHMENT 1

NOTES

I. The uncertainties may be modified in cases of disagreement:

a. If the licensee's SD, S_x is smaller than that of the NRC, the NRC's relative standard deviation (RSD) (S_y/Y) will be substituted for that of the licensee (S_x/X), and the agreement criteria recalculated.

b. If a disagreement and the RSDs appear to be unreasonably low, RSDs of 3% will be substituted for those of both the NRC and the licensee. This will not be done for the boron analyses where the expected RSDs are 0.5-1%.

II. Due to some uncertainties in the values of the 1987 (87) boron standards, the mean values of the concentrations obtained by the plant laboratories in Region III are used as the NRC values. These results appear to have resolved the problem of the consistently negative biases between the licensees and BNL boron analyses. The licensees generally reported similar values of the 1000-ppm standard with a relatively small RSD of ±1.7%, although the analytical methods differed.

ATTACHMENT 2

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.