

U. S. NUCLEAR REGULATORY COMMISSION

REGION III

Report Nos. 50-295/89031(DRSS); 50-304/89027(DRSS)

Docket Nos. 50-295; 50-304

License Nos. DPR-39; DPR-48

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

Facility Name: Zion Nuclear Generating Station, Units 1 and 2

Inspection At: Zion Site, Zion, IL 60099

Inspection Conducted: September 13-19, 1989 (Onsite)
September 20 and 28, and October 3, 1989
(Telephone conversations)

Inspector: *M. E. Holzman*
R. E. Holzman

10/8/89
Date

Approved By: *M. C. Schumacher*
M. C. Schumacher, Chief
Radiological Controls and
Chemistry Section

10/12/89
Date

Inspection Summary

Inspection on September 13-20 and 28, and October 3, 1989 (Reports
No. 50-295/89031(DRSS); No. 50-304/89027(DRSS))

Areas Inspected: Routine, unannounced 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: Two significant events in this period were the separation of the Chemistry Group from the Rad/Chem Department and the division of the Rad/Chem Technicians between the Chemistry and Health Physics Departments. The licensee has an extensive water quality control program that conforms to the EPRI Steam Generator Owners and Primary Systems Guidelines. The chemistry parameters were generally maintained well within these guidelines. A QA/QC program is being developed for inline process instrumentation. The nonradiological confirmatory measurements results were good. Progress in improvements in the chemical measurements QA/QC and chemical parameters trending programs was slow. No violations or deviations were identified.

DETAILS

1. Persons Contacted

- ¹ T. P. Joyce, Station Manager, CECo, Zion
- ¹ C. Schultz, Quality Control Supervisor, CECo, Zion
- ¹ T. Van De Voort, Quality Assurance Supervisor, CECo
- ¹ P. M. Zwilling, Chemistry Supervisor, CECo, Zion
- ^{1,2} D. P. Hemmerle, Lead Chemist, CECo, Zion
- ¹ T. Sakefski, Regulatory Assurance, CECo, Zion
- ^{1,3} D. Guran, Analytical Chemist, CECo, Zion
- ¹ A. Forner, Quality Assurance Inspector, CECo
- K. Moser, Regulatory Assurance, CECo, Zion

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

¹Denotes those present at the plant exit interview on September 19, 1989.

²Telephone conversations held September 20 and October 3, 1989.

³Telephone conversation held September 28, 1989.

2. Licensee Action on Previous Inspection Findings (IP 92701)

- a. (Closed) Open Item (No. 50-295/88024-01; No. 50-304/88024-01):
Licensee to split with Brookhaven National Laboratory (BNL) samples of reactor coolant spiked with anions and feedwater spiked with metals, to analyze them, and to submit the results to Region III. The licensee spiked a reactor coolant sample with fluoride, chloride and sulfate ions and a feedwater sample with metal ions. These were analyzed by the licensee and a split submitted to BNL. Only the chloride and fluoride results are compared in Table 1 because BNL was unable to determine the metals due to the unavailability of their atomic absorption unit, and the licensee does not determine sulfate in reactor coolant. The acceptance criteria are presented in Attachment 1. The relative standard deviations were taken as 5%, which appears to be reasonable for these analyses. Only one of the two values was in agreement. The anion split will be repeated during this inspection.
- b. (Closed) Open Item (No. 50-295/88024-02; No. 50-304/88024-02):
Assess the resolution of the disagreements in the sulfate, iron and silica analyses. These analytes were determined in this inspection and resulted in agreements. Some difficulties still remain with the iron and silica analyses, as discussed in Section 6.
- c. (Closed) Open Item (No. 50-295/88024-03; No. 50-304/88024-03):
Inspector to assess the progress of the QA/QC program. The QA/QC program is discussed in Section 7.

3. Management Controls and Organization (IP 79701)

The licensee has extensively reorganized the Chemistry Department since the previous inspection in this area.¹ It was separated from the Rad/Chem Department with the newly created position of the Chemistry Supervisor as head. He reports directly to the Technical Superintendent, who, in turn, is directly accountable to the Plant Manager. The Supervisor is supported by a Lead Chemist and a Chemistry Foreman. Four Chemists and two Engineering Assistants report to the Lead Chemist and 22 technicians report to the Foreman. The Unit 1 Chemist and Counting Room Chemist (Radiochemist) have been replaced since the previous inspection with a former Rad/Chem Foreman and an experienced corporate chemist, respectively. The technicians are now permanently assigned to the laboratory, and spend minimal time in radiation protection duties. This will give the technician more continuous chemistry experience, and the laboratory more continuity. It will reduce the burden on the laboratory supervisors to continually track the proficiencies of a large number of technicians.

The Chemistry Supervisor appears to be well qualified for this position; he was formerly the plant's Lead Chemist prior to appointment to a corporate position. While the Radiochemist has had limited experience in this field, the laboratory has support for him with several former experienced radiochemists available, including the Lead and the Unit 2 Chemists.

Of the 22 technicians, 13 are qualified under the ANSI N18.1-1971 standard; of the others, three have been on shift since December 1988, and are supervised by a Rad/Chem Foreman (presently still qualified as chemistry supervisors) when the Chemistry Foreman is not available. The remaining six technicians are still in training at the Production Training Center.

The Supervisor stated that several additional positions have been authorized for the department, including two chemists and two chemistry foremen. One chemist is expected to report by the end of October 1989, one foreman has been chosen, and the other foreman position is posted.

The personnel and organization appear to be adequate to perform the required laboratory activities.

No violations or deviations were identified.

4. Water Chemistry Control Program (IP 79701)

The water quality control program is as previously reported² except for minor revisions. The secondary system program is consistent with the EPRI Steam Generator Owners' Group Secondary Water Chemistry Guidelines and the Westinghouse Guidelines for Secondary Side Water Chemistry

¹Region III Inspection Report Nos. (50-295/88024; 50-304/88024)

²Ibid

and other contaminant concerns. The primary system program is consistent with the EPRI Primary System Guidelines, except for lack of a surveillance requirement for sulfate. The analysis for sulfate in primary coolant has been developed by the laboratory and will be implemented shortly.

The secondary system sampling and inline process panels have been rebuilt with digital instrumentation, including specific and cation conductivities, pH, dissolved oxygen, sodium and hydrazine in the various systems. A computerized Datalogger system continuously collects, stores, and plots data from these instruments. The system has been interfaced with a small computer to process and archive the data. The licensee plans to move the computer to the chemistry offices to make the information readily available to the chemists.

The Makeup Demineralizer system (MUD) has been overhauled with the addition of inline instrumentation mainly for conductivity and pH measurements. A vendor-operated reverse osmosis (RO) system removes from lake water the nonionic organic materials that in the radiation fields of the RCS become acidic. The licensee expended considerable effort repairing the defective mixed-bed demineralizer system which does not polish the effluent properly. Since the resins appear to be good, the defect appears to be mechanical, probably valves. It has been temporarily resolved by the use of the leased RO system which has a mixed-bed polisher that supplies high quality water.

As noted previously³ this low conductivity water (0.06 $\mu\text{mho/cm}$) contributes to making the secondary system water quality among the best in the country, for plants (such as Zion) without condensate polishers. Thus, the INPO Chemistry Performance Index (CPI) for Unit 2 has been close to the lower (best) quartile for all PWRs in the country, and Unit 1 has been somewhat higher (about the median), despite a small condenser leak that was only recently corrected.

The inspector reviewed the boron concentration data for the past six months from the various systems having Technical Specification (T/S) requirements, the Boric Acid Storage Tanks (BAST), Reactor Water Storage Tanks, and Accumulators. The most stringent requirements were those on the BASTs with an operational range of 11.5-13% boric acid. Two of the three tanks were always within specifications when connected to an operating reactor system; the third, not connected to an operating system, was sometimes outside the limits, which did not affect operability. The other systems were all above the required concentrations of 2000-2400 ppm boron during this period.

The licensee maintains trend charts on the various chemistry and radiochemistry parameters, including S/G ingress (cumulative cation conductivity), gross beta, Xe-133, I-131, primary to secondary leakage, average monthly cation conductivity and CPI. Short-term charts covering data for about two weeks, especially of cation conductivity, are produced

³Ibid

as problems arise. These show very detailed data within the time span. However, the inspector noted to licensee representatives that long-term charts are not normally produced and used in the laboratory. This might result in missing long-term trends. Such charts are important to a QA program to demonstrate water quality. Secondary system water quality control parameters that would be useful include the control parameters sulfate, chloride, cation conductivity, and possibly the indicator parameter, silica. Possible primary system parameters would be boron and lithium concentrations. A licensee representatives noted these comments.

Various levels of management review the chemistry parameters and their trends, as noted previously.⁴ In general, the various parameters appear to be well controlled, with few out-of-specification problems. Sulfate concentrations in the secondary system appear to be somewhat higher than in most other plants, but are well below the Action Level 1 limits of 20 ppb.

As part of its program to improve and maintain water quality, the Chemistry Department has set three main goals for this year:

- a. to improve operation of the MUD system;
- b. to develop and implement the inline process monitor instrumentation QA/QC program presently estimated by the licensee representatives to be about 70% complete (Section 7); and
- c. to fully implement the QA/QC analytical system in the laboratory (Section 7).

Overall, the licensee's 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. The operations were generally good and instrumentation was similar to that in the past.⁵ The Brinkmann PC 800 Colorimeters were apparently less reliable than the licensee had expected and were being replaced with computerized spectrophotometers (Milton Roy Spectronic 1200) for the silica, ammonia and hydrazine analyses. A Perkin-Elmer (P-E) Model 5100 Atomic Absorption Spectrophotometer (AAS) with a Zeeman Effect background corrector will replace the presently used P-E Model 5000 AAS. The Cold laboratory is

⁴Ibid

⁵Ibid

using a Waters Ion Chromatographic system for anion analyses. Another three-unit Waters system has been set up in the Hot Laboratory for the anion analyses in both the primary and secondary reactor systems and for the analysis of boron by differential refractometry in RCS samples, primarily for post accident analyses. The all-metal tubing and pumps and the temperature-controlled conductivity cell of the new system appear to be more rugged and to give greater sensitivity than the older system. The Waters systems may be particularly useful when combined with the Dionex chemical suppression technology.

The inspector observed several RCLs analyze routine samples on the ion chromatographs. They appeared to be generally knowledgeable about the work and followed the procedures. They appeared to do well in the analyses.

The plant was developing new analytical techniques, using the new instrumentation to improve the sensitivities and efficiencies of 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 (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 Radiological Sciences Division of Brookhaven National Laboratory (BNL). The samples were analyzed by the licensee using routine methods and equipment.

A single dilution for each sample was made 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 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 also prepared a sample of secondary system water spiked with the anion analytes fluoride, chloride and sulfate to be split with BNL. The licensee will determine the concentrations of the analytes and the results will be submitted to Region III and compared to those determined by BNL. This will be followed under Open Item Nos. (50-295/89031-01; 50-304/89027-01).

The licensee determined 12 analytes at three concentrations each. Of the 36 analyses, 34 were in agreement (94%), a very good level of agreement. The disagreements were in the chloride and chromium. However, even when the laboratory achieved agreement, some of the analyses exhibited substantial biases and large uncertainties such as those for iron, chromium, lithium and silica.

These agreements were obtained because of the relatively large RSDs in the licensee's results. This may be due, in part, to the relatively wide control bands of the QC charts of about $\pm 8\%$ of the mean value (see Section 7). Lithium was of particular concern because the guidelines establish a fairly narrow operating range in reactor coolant. Further, the variabilities in flame AAS can generally be controlled to within a few percent relative standard deviation (RSD). The substantial negative biases of 5-12% indicates a possible calibration problem. The problems with the iron and chromium analyses appeared to be due both to the use of the graphite furnace, which appears to be a generic problem with this type of analysis and to the sample matrix which contains copper, nickel and chromium. Additionally, the very small concentrations of the iron (6 - 20 ppb) may have compounded the difficulties. The silica values were in agreement, especially for the lower-level sample because of a large RSD of about 13%. The high variabilities may have been due to high silica in the dilution water and to the fairly wide control limits on the QC chart of about $\pm 5\%$ RSD.

If one takes into account the possibility of matrix effects in the metal ion analyses and the initially low concentrations of the analytes, overall, the results of the analyses were good. Some particular problems were identified, mainly the large biases and control limits in the QC charts, as discussed in Section 7. The licensee is now assessing and correcting the problems. Improvements in the analyses and the modifications in the control chart program will be reviewed in subsequent inspections.

Overall, the results of the analyses were very good, but some problems with the analyses were noted. Laboratory personnel demonstrated a willingness to correct the problems.

No violations or deviations were identified.

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

The inspector reviewed the nonradiological QA/QC program in the laboratory. The program is required by the corporate directive, "Nuclear Operations Chemistry Quality Control Program Manual," Nuclear Operations Chemistry Quality Control Program, Revision 4, May 1, 1989. It is implemented in the procedures for the various analyses. A licensee representative stated that laboratory personnel are writing a procedure to deal with the overall operation of the QC/QA program.

Improvements have been made since the previous inspection in this area.⁶ Performance check standards now come from different lots than the calibration standards. The control charts for the check standards now have statistically based parameters with two-SD control limits, and cover most of the analyses, including fluoride, chloride, sulfate, ammonia, hydrazine, boron, lithium, silica, copper, iron, chromate, and magnesium. However, license supervisors still were not regularly evaluating the charts to verify control of the analyses. Some of the charts showed substantial biases (mean values relative to the expected values) and/or drifts in the data without evidence of management evaluation. Overall, progress has been somewhat slow owing apparently to lack of effort. Licensee representatives stated that additional help will be available when the new chemists are hired.

The station participates in a nonradiological interlaboratory comparison program managed by the corporate Technical Services Department which supplies unknowns quarterly for analysis. The data from the last four quarters showed a decreased fraction of results (81, 61, 62, and 69%, respectively) falling within the acceptance criterion of $\pm 10\%$ of the known value - somewhat lower than the licensee's other two PWR stations.

The technician performance program described in procedure ZCP 1021-3, "Radiation Chemistry Technician Proficiency Check Program," Revision 2, November 17, 1988, is required by the Nuclear Stations Division Chemistry Quality Control Program Manual, which, in turn, is a requirement of the Commonwealth Edison Company Quality Assurance Manual, Quality Procedure No. 12-54. Technicians must be tested semi-annually and acceptance criteria are presently set at $\pm 10\%$ for most analyses. The program, as operated prior to 1989, appeared to be satisfactory and the RCTs generally did well in it. The data were collected, tabulated, and evaluated in a timely manner since the previous inspection. However, since January 1989, this procedure has not been implemented. Licensee representatives stated that plans have been made to start the actual testing within a month. They agreed to address the resolution of this problem in the Open Item below.

The licensee is developing a program for QA/QC of inline process instrumentation in which periodic performance checks would be made using laboratory analyses, calibrated portable instrumentation or performance standards. A licensee representative stated that the program was about 70% complete and should be implemented by the end of 1989.

These QA/QC program weaknesses were discussed at the exit interview. Licensee representatives agreed to describe planned improvements in a letter to be sent to Region III by November 30, 1989. This matter will be followed in subsequent inspections. (Open Item Nos. 50-295/89031-02; 50-304/89027-02).

No violations or deviations were identified.

⁶Ibid

8. Audits and Appraisals (IP 79701)

The inspector reviewed 14 surveillances relating to Chemistry done over the year. No deficiencies were found. These surveillances appeared to adequately assess the quality of the chemistry 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. 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 September 19, 1989. The inspector discussed the Open Items in Section 2 and observations on the quality control program and the confirmatory measurements. The inspector acknowledged some improvement in the QA/QC program, but notes that slow progress since the previous inspection, reflected a lack of effort. (Section 7). Licensee representatives noted that an additional chemist has been authorized for this program and should arrive in October 1989. Licensee representatives agreed to consider modifications of the program, as discussed in Section 7, and to submit a letter to Region III describing changes to be made and completed. Telephone discussions were held with licensee representatives on September 20 and 28, and October 3, 1989.

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

Attachments:

1. Table 1, Nonradiological Interlaboratory Split Sample Results, October 1988
2. Table 2, Nonradiological Interlaboratory Test Results, September 13-20, 1989
3. Attachment 1, Criteria for Comparing Analytical Measurements (Nonradiological)

TABLE 1
 Nonradiological Interlaboratory Split Sample Results
 Zion Nuclear Generating Station
 October 1988

Analyte	Matrix ^a	Analysis Method ^b	NRC	Licensee ^c	Ratio	Comparison ^d
			Y ± SD	X ± SD	Z ± SD	+2 SD
<u>Concentration, ppb</u>						
F ⁻	RCS	SIE	48 ± 3	81 ± 4	1.69 ± 0.13	D
Cl ⁻	RCS	SIE	62 ± 6	59 ± 3	0.951 ± 0.104	A

a. Matrix:
 RCS - Reactor Coolant System

b. Analytical method:
 SIE - Specific Ion Electrode

c. The relative standard deviation for each of the analyses is assumed to be as given or ± 5%, whichever is larger.

d. Comparison:
 A Agree
 D Disagree.

TABLE 2
 Nonradiological Interlaboratory Test Results
 Zion Nuclear Generating Station, Units 1 and 2
 September 13-20, 1989

Analyte	Analytical Method ^b	NRC ^a		Licensee ^a		Ratio	Comparison ^c
		Y ± SD		X ± SD		Z ± SD	± SD
<u>Concentration, ppb</u>							
Fluoride	SIE	45.0 ± 4.0		43.4 ± 1.4		0.964 ± 0.091	A
		84.6 ± 1.6		82 ± 5		0.969 ± 0.062	A
		166 ± 3		164 ± 7		0.990 ± 0.046	A
Chloride	IC	6.17 ± 0.03		6.8 ± 0.2		1.102 ± 0.049	D
		12.4 ± 0.2		13.4 ± 0.2		1.078 ± 0.046	A+
		25.5 ± 0.4		26.3 ± 0.6		1.031 ± 0.029	A
Sulfate	IC	6.5 ± 0.5		7.0 ± 0.3		1.077 ± 0.086	A
		12.8 ± 0.9		13.9 ± 0.5		1.086 ± 0.086	A
		26.0 ± 0.8		26.8 ± 0.6		1.031 ± 0.039	A
Fe	AA/FU	6.20 ± 0.17		8.3 ± 1.2		1.339 ± 0.197	A
		13.3 ± 0.2		15.6 ± 2.0		1.173 ± 0.151	A
		19.5 ± 0.5		20.6 ± 0.8		1.056 ± 0.049	A
Cu	AA/FU	6.67 ± 0.10		6.90 ± 0.50		1.034 ± 0.077	A
		13.4 ± 0.5		13.1 ± 1.1		0.978 ± 0.090	A
		20.0 ± 0.5		20.0 ± 0.3		1.000 ± 0.029	A
Cr	AA/FU	49.5 ± 1.3		43.2 ± 3.9		0.873 ± 0.082	A
		96.3 ± 1.2		90 ± 2		0.935 ± 0.040	A+
		145 ± 3		130 ± 3		0.897 ± 0.038	D+
Na	AA/FL	60.5 ± 7		55 ± 3.4		0.909 ± 0.119	A
		106 ± 6		104 ± 6		0.981 ± 0.079	A
		158 ± 9		155 ± 10		0.981 ± 0.084	A
Li	AA/FL	492 ± 10		469 ± 18		0.953 ± 0.041	A
		750 ± 18		657 ± 59		0.876 ± 0.081	A
		1032 ± 25		958 ± 55		0.928 ± 0.058	A
Ammonia	Clr	520 ± 25		527 ± 48		1.013 ± 0.104	A
		1500 ± 15		1570 ± 56		1.047 ± 0.039	A
		2460 ± 115		2570 ± 36		1.045 ± 0.051	A
Hydrazine	Clr	19.9 ± 0.3		20.2 ± 0.6		1.015 ± 0.034	A
		49.9 ± 0.5		49.5 ± 0.3		0.992 ± 0.012	A
		100 ± 1		98.9 ± 0.3		0.989 ± 0.010	A

Analyte	Analytical Method ^b	NRC ^a		Licensee ^a		Ratio	Comparison ^c
		Y ± SD		X ± SD		Z ± SD	±2 SD
<u>Concentration, ppb</u>							
Silica	Clr	106	± 1	126	± 17	1.189 ± 0.161	A
		208	± 8	194	± 5	0.933 ± 0.043	A
		314	± 4	293	± 19	0.933 ± 0.062	A+
<u>Concentration, ppm</u>							
Boron	Titr	1002	± 10	1002	± 3	1.000 ± 0.010	A
		2970	± 23	2957	± 3	0.996 ± 0.008	A
		2459	± 24	2446	± 8	0.995 ± 0.010	A

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

b. Analytical methods: Titr - titration
 IC - Ion chromatography
 Clr - Colorimetric probe
 SIE - Specific ion electrode
 AA/Fu - Atomic absorption Spectroscopy (furnace)
 AA/FL - Atomic absorption Spectroscopy (flame)

c. A = Agreement
 D = Disagreement

* Substituted the BNL uncertainty for licensee's uncertainty.

+ Substituted 3% relative Standard Deviation for BNL and licensee 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,

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

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

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.

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

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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 $\pm 1.7\%$, although the analytical methods differed.