U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 86-05

Docket No. 50-354

License No. CPPR-120 Priority -- Category C

Licensee: Public Service Electric and Gas Company

80 Park Plaza - 17C

Newark, New Jersey 07101

Facility Name: Hope Creek Generating Station

Inspection At: Hancock's Bridge, Salem, N. J. and Bethesda, MD

Inspection Conducted: January 13-24, 1986

Inspector: H. J. Bicehouse 2/18/86
H. J. Bicehouse, Radiation Specialist date

Approved by: W. J. Pasciak 2/24/86
W. J. Pasciak, Chief, Effluents Radiation Protection Section date

Inspection Summary: Inspection on January 13-24, 1986 (Inspection Report No. 50-354/86-05).

Areas Inspected: Routine, unannounced inspection of the applicant's Preoperational Water Chemistry Control Program and followup on previously identified items in radioactive waste management, effluents and transportation. Within the Water Chemistry Control Program, organization, selection, training, qualification, self identification/correction of deficiencies, plant water chemistry systems, sampling, measurement, program development, preoperational and startup testing were reviewed. The inspection involved 95 hours onsite at Salem, New Jersey and Bethesda, Maryland.

Results: Within the areas reviewed, no violations or deviations were noted. However, several weaknesses in the applicant's water chemistry control program were identified requiring correction. The adequacy of proposed changes to the applicant's chemical and radiochemical tests and measurements is unresolved pending NRC Office of Nuclear Reactor Regulation review (see Detail 9.2).

DETAILS

1. Persons Contacted

During the course of this routine preoperational inspection, the following personnel were contacted or interviewed.

1.1 Public Service Electric and Gas Company (PSE&G)

*R. S. Salvesen, General Manager, Hope Creek Operations
*A. E. Giardino, Manager, Station Quality Assurance
*J. R. Lovell, Radiation Protection/Chemistry Manager
*R. B. Donges, Lead Quality Assurance Engineer (QAE)
*J. F. Duffy, Site Engineering
A. Garrison, Nuclear Training Supervisor, Chemistry
T. Graham, Principal Engineer, Plant Engineering
*R. T. Griffith, Principal QAE
R. Grouser, Senior Staff Engineer, Chemistry
L. Kempa, Lead Scaler, Startup Engineering
R. Martin, Nuclear Training Supervisor, Instrumentation and Control (I&C)
*J. J. Pantazes, Senior Staff Engineer, Site Engineering
*M. C. Simpson, Senior Staff Engineer, Radiation Protection Services
G. Stolz, Staff Assistant, Nuclear Training
G. Suey, Chemistry Supervisor
*T. W. Vannoy, Senior Chemistry Supervisor
J. White, Senior Staff Engineer, Plant Engineering
E. Yochheim, Chemistry Engineer

Other applicant's employees were contacted or interviewed during this inspection.

1.2 Bechtel Construction Company

*R. C. Barclay, Lead Systems Quality Control Engineer
*W. Goebel, QAE
*C. Jaffee, Startup Engineer
*G. Moultan, Principal QAE

Other contractor personnel were contacted or interviewed during the inspection.

1.3 U.S.N.R.C

*R. Borchardt, Senior Resident Inspector
J. Lyash, Resident Inspector
*R. Nimitz, Senior Radiation Specialist

*Attended the Exit Interview on January 24, 1986.

2. Purpose

The purpose of this routine preoperational inspection was to review the applicant's developing water chemistry control program with respect to the following elements:

-- Organization of the Chemistry Control Program;
-- Selection, Training and Qualification of Personnel;
-- Self-Identification/Correction of Deficiencies;
-- Plant Water Chemistry Systems;
-- Sampling and Measurements;
-- Development of Water Chemistry Control Program; and
-- Preoperational and Startup Testing Program.

In addition, the applicant's actions regarding previously identified items in radioactive waste management, effluents control, environmental surveillance and shipment of radioactive materials were reviewed. Selected NRC Bulletins and Circulars were included in this review.

3. Previously Identified Items

3.1 (Closed) Inspector Followup Item (50-354/84-17-01)

Provide analytical sensitivity requirements consistent with commitments in the applicant's Environmental Report. The applicant revised the required analytical sensitivities in the Department Order governing laboratory and analytical services for the radiological environmental monitoring program to be consistent with the NRC-NRR Branch Technical Position. The Department Order covered the period of January 1, 1986 to December 31, 1986.

This item is closed.

3.2 (Closed) Inspector Followup Item (50-354/84-17-02)

Review tests to determine magnitude of self-absorption in alpha counting of aqueous environmental samples. The applicant conducted tests to determine possible increased self-absorption of alpha particles due to varying saline concentrations encountered in esturarine or water samples. The tests were reviewed and deemed satisfactory to determine the degree of self-absorption of alpha particles in environmental samples.

This item is closed.

3.3 (Closed) Inspector Followup Item (50-354/85-44-06)

Review analytical methods for various chemical analyses. The applicant's procedures for sampling and analysis of chemical and radiochemical contaminants as required by proposed Technical Specifications and recommended in Regulatory Guide 1.56 were reviewed and determined to be adequate for initial fuel load and initial criticality.

This item is closed.

3.4 (Closed) Inspector Followup Item (50-354/85-44-07)

Spiked sample intercomparison study successfully completed. During Inspection No. 50-354/85-59, intercomparison studies of the applicant's analytical program were conducted using chemical and radiochemical capability test standards. The applicant utilized contractor-supplied analytical services for strontium-89, strontium-90, Iron-55 and tritium analysis, the results of which were not completed during Inspection No. 50-354/85-59. During this inspection, the results of analysis for the four radionuclides were provided and the intercomparisons were completed (see Detail 12).

This items is closed.

3.5 (Open) Inspector Followup Item (50-354/85-44-08)

Review completion of installation and testing of sampling stations. Sampling station installation for process liquid radwaste, reactor coolant and condensate were complete. However, preoperational testing had not been completed.

This item remains open pending completion of preoperational testing.

3.6 (Closed) Inspector Followup Item (50-354/85-44-09)

Verify performance of components of solid radwaste system during preoperational testing. Available portions of the solid radwaste system were reviewed during Inspection No. 50-354/85-52 and preoperational testing was observed. During this inspection, additional walkdowns of the system were completed to verify that the solid radwaste compactor described in the applicant's letter to NRC-NRR (dated November 29, 1985) requesting deferral and substitution of a contracted radwaste vendor was ready for operation.

This item is closed.

3.7 (Open) Inspector Followup Item (50-354/85-44-10)

Review test results for solid radwaste system. Preoperational testing of the solid radwaste system was incomplete.

This item remains open.

3.8 (Open) Inspector Followup Item (50-354/85-44-11)

Review correction of ALARA concerns with Resin Regeneration/Transfer and labeling of radwaste control room liquid flow paths. The concerns identified in this item were reviewed. No changes were noted in the Resin Regeneration/Transfer room. Liquid flow paths, ventilation and lighting in the control room remained unchanged.

This item remains open.

3.9 (Open) Inspector Followup Item (50-354/85-44-12)

Review test results for liquid radwaste system. Tests of the liquid radwaste system were incomplete and results were not available to review.

This item remains open.

3.10 (Open) Inspector Followup Item (50-354/85-44-13)

Verify correction of valve No. 246 failure mode and installation of radiation detectors. Installation and calibration of the radiation detectors just upstream of Valve No. 246 were underway but incomplete. The failure mode of valve No. 246 was undergoing change review.

This item remains open.

3.11 (Open) Unresolved (50-354/85-44-14)

Radiation Monitoring System (RMS) deferral request acceptability. On January 17, 1986, the inspector attended a meeting with NRC-NRR reviewers in Bethesda, Maryland during which the applicant presented the latest schedule for completion of the RMS. Plans and system capabilities were discussed with the applicant. The applicant provided safety reviews supporting the request for deferral and responded to questions and concerns raised by the NRC-NRR reviewers. However, the acceptability of the deferred portions of the RMS remains unresolved.

3.12 (Open) Inspector Followup Item (50-354/85-52-01)

Review completion of Action Items 4, 5 and 6 of NRC Bulletin No. 79-19. The development of operating procedures and training/retraining programs was reviewed. Progress was noted in the development of procedures for collection, processing and packaging was noted. However, procedures were incomplete and training programs were under development.

This item remains open.

3.13 (Open) Inspector Followup Item (50-354/85-52-02)

Review actions related to NRC Bulletin No. 80-10. Procedures for grab samples of nonradioactive samples regarding frequency, sample size and type of analysis remained incomplete. Procedures for safety reviews under 10 CFR 50.59 were under development.

This item remains open.

3.14 (Closed) Inspector Followup Item (50-354/85-52-03)

Verify effectiveness of sodium hypochlorite and initiation of heat exchanger performance monitoring. The applicant's actions regarding NRC Bulletin No. 81-03 were reviewed. Sodium hypochlorite treatment appeared to be adequate relative to indigenous species. Heat exchanger monitoring was initiated.

This item is closed.

3.15 (Open) Inspector Followup Item (50-354/85-52-16)

Verify calculation of line loss for particulate sampling of Drywell. The applicant stated that a OOP particulate test of line losses in the Drywell sampling line would be completed by 60 days after initial fuel load. This action will be reviewed following its completion.

This item remains open.

3.16 (Open) Inspector Followup Item (50-354/85-52-33)

Review development of radwaste operating procedures. The applicant stated that the following operating and alarm response procedures would be completed by initial fuel load:

-- OP-SO-HC-001, "Solid Radwaste - Collection System Operation;"
-- OP-SO-HB-001, "Liquid Radwaste - Equipment Drain System Operation;"

-- OP-SO-HB-002, "Liquid Radwaste - Floor Drain System Operation;
-- OP-SO-HB-003, "Liquid Radwaste - Chemical Waste System Operation;
-- OP-SO-HB-004, "Liquid Radwaste - Regenerate Waste Collection and Processing;" and
-- OP-AR-HB-001 through OP-AR-HB-007, Liquid radwaste alarm response procedures.

The applicant also stated that the remaining radwaste operating procedures listed in Inspection Report No. 50-354/85-52 would be completed by initial criticality. These actions will be reviewed during subsequent inspections.

This item remains open.

3.17 (Open) Inspector Followup Item (50-354/85-52-34)

Develop procedures for shipping containers used under 10 CFR 71.12. The applicant revised Procedure RP-RW.ZZ-004(Q), "Shipment of Radioactive Material," Revision 1 (January 20, 1986) to require development of procedures in accordance with applicable manufacturer's Technical Manuals. However, specific procedures had not been developed. This item will remain open to be reviewed in a subsequent inspection prior to the first shipment under 10 CFR 71.12.

3.18 (Closed) Inspector Followup Item (50-354/85-52-35)

Correct conversion factor for LSA shipments. The applicant revised Procedure RP-RW.ZZ-004(Q), "Shipment of Radioactive Material," Revision 1 (January 20, 1986) to correct the dose rate to activity conversion factor.

This item is closed.

3.19 (Closed) Inspector Followup Item (50-354/85-52-36)

Review procedures for sampling, analysis, offsite dose calculations, recording and reporting of gaseous and liquid radwaste effluents. The applicant's interim procedures in each of the areas were reviewed and discussed with cognizant members of the applicant's staff. Interim procedures, adequate for initial fuel load and initial criticality were in place.

This item is closed.

3.20 (Open) Inspector Followup Item (50-354/85-52-38)

Line loss determination for sampling North and South Plant Vents. The applicant stated that line loss tests for the North and South

Plant Vent monitoring systems would be conducted by 60 days after initial fuel load. This action will be reviewed following its completion.

This item remains open.

3.21 (Closed) Inspector Followup Item (50-354/85-52-39)

Review Radwaste procedures for quality control inspection hold points. Revisions to radwaste packaging and shipping procedures were reviewed. Quality Control inspection hold points were included in the revised procedures

This item is closed

3.22 (Closed) NRC Bulletin No. 79-20 (50-354/79-BU-20)

"Packaging, Transport and Burial of Low-Level Radioactive Waste," (August 10, 1979). The applicant has committed to perform the actions specified in NRC Bulletin No. 79-19 dealing with radwaste packaging and shipping activities. Remaining actions (including development of necessary procedures and provision of training) are covered under Inspector Followup Item No. 50-354/85-52-01.

This item is closed administratively.

3.23 (Closed) NRC Circular No. 77-10 (50-354/77-CI-10)

"Vacuum Conditions Resulting In Damage To Liquid Process Tanks," (July 15, 1977). The applicant completed an engineering study to verify that adequate low pressure protection was provided for process holdup tanks.

This item is closed.

3.24 (Closed) NRC Circular No. 77-14 (50-354/77-CI-14),

"Separation of contaminated Water Systems From Uncontaminated Plant Systems," (November 22, 1977). The applicant's construction contractor and site engineering organizations reviewed water system designs. That review determined that adequate separation existed between potable water and contaminated plant water systems. Operating procedures have been prepared to ensure proper valve lineups.

This item is closed.

3.25 (Closed) NRC Circular No. 78-03 (50-354/78-CI-03)

"Packaging Greater Than Type A Quantities Of Low Specific Activity Radioactive Material For Transport," (May 12, 1978), Station administrative and radwaste shipping procedures were reviewed for inclusion

of radwaste activity determinations and to determine if specific regulatory problem areas discussed in the circular were addressed. Lesson plans for training in radwaste packaging and shipping were discussed with the applicant. In each instance, the inspector noted that the applicant had included information relevant to regulatory concerns raised in the circular.

This item is closed.

3.26 (Closed) NRC Circular No. 79-21 (50-354/79-CI-21)

"Prevention of Unplanned Releases of Radioactivity," (October 17, 1979). The applicant's preoperational test program, including system walkdowns, flushings and test completion verified correct routing of radwastes. Operating procedures were also checked during the preoperational test program. Engineering and plant operating staff reviews of "as-built" systems incorporate guidance as provided in item No. 2 of the Circular. Plant operating and maintenance procedures and review and testing of modifications address guidance as provided in item No. 3 of the Circular.

This item is closed.

3.27 (Closed) NRC Circular No. 80-14 (50-354/80-CI-14)

"Radioactive Contamination of Plant Demineralized Water System and Resultant Internal Contamination of Personnel," (June 24, 1980). The applicant's control program for temporary modifications addressed the possibility of cross-connecting contaminated systems with the Demineralized Water System. Operating procedures for temporary connections to the Demineralized Water System caution operators to remove those temporary connections immediately after use.

This item is closed.

3.28 (Closed) NRC Circular No. 80-18 (50-354/80-CI-18)

"10 CFR 50.59 Safety Evaluations For Changes to Radioactive Waste Treatment Systems," (August 22, 1980) Station administrative procedures governing reviews by the Station Operating Review Committee and controlling design changes addressed concerns raised in the Circular.

This item is closed.

3.29 (Closed) NRC Circular No. 81-09, (50-354/81-CI-09),

"Containment Effluent Water That Bypasses Radioactivity Monitor," (July 10, 1981). The applicant's construction contractor completed an engineering review of effluents from the Reactor Building and concluded that effluent water would not bypass radiation monitoring system detectors. The inspector reviewed the engineering evaluation and examined selected drawings to confirm the contractor's conclusion. No effluent pathways bypassing radiation monitoring system detectors were identified.

This items is closed.

4. Organization

The organization of the applicant's water chemistry control program was reviewed to determine if the applicant had established an effective, documented program for controlling the quality of the primary coolant water. The Electric Power Research Institute (EPRI) Boiling Water Reactor (BWR) Owners Group Water Chemistry Guidelines Committee "BWR Water Chemistry Guidelines," (April, 1984) provided recommendations and guidance used in this review. NRC Regulatory Guide 1.33, "Quality Assurance Program Requirements (Operation)" was also used.

4.1 Management Policy

The applicant's management policies relative to the water chemistry control program were reviewed to determine if the applicant had provided a management commitment to, and support for, an effective water chemistry control program. The inspector noted that the Vice President -Nuclear had not issued a corporate policy statement governing the quality of the primary coolant water at the Hope Creek Generating Station. However, the General Manager, Hope Creek Operations and the Manager, Public Service Startup Group had issued chemistry guidelines delineating a program to ensure that water chemistry of the Nuclear Steam Supply System (NSSS) and NSSS-related water systems were maintained within vendor (i.e. General Electric Company) and industry acceptable standards. The EPRI Guidelines recommend that corporate management establish policies and procedures and provide the resources necessary to support and enforce the guidelines. The inspector noted that a corporate policy statement was being developed. However, the absence of a policy statement regarding primary water quality issued by the Nuclear Department is considered a weakness in the applicant's water chemistry control program.

4.2 Corporate Chemistry Control Organization

The Plant Engineering Group (within the Nuclear Department) was assigned responsibility for the Salem and Hope Creek Generating

Stations chemistry control programs. Two mechanical engineers in the Plant Engineering Group provide technical support to the stations and technical expertise to Quality Assurance (QA) audit activities. The inspector noted that the engineers had extensive experience in fossil fuel plant water chemistry and Pressurized Water Reactor chemistry but limited experience in BWR chemistry.

4.3 Station Chemistry Control Organization

The General Manager - Hope Creek Operations has responsibility for the station chemistry control program. Under the General Manager, the Operations Manager is responsible for plant operation in accordance with the chemistry control program guidelines. The Maintenance Manager is responsible for corrective and/or preventative maintenance on chemistry control systems. Implementation of the program has been delegated to the Chemistry Engineer. The inspector noted that the Chemistry Engineer has direct access to the General Manager or the Assistant General Manager regarding abnormal chemistry conditions.

The Chemistry Engineer, (within the Chemistry/Radiation Protection Department), is responsible for:

- establishing chemistry limits in conjunction with Plant Engineering;

- providing timely and knowledgeable chemistry data reviews;
- providing chemistry control procedures including limits, monitoring frequencies and corrective action requirements;
- providing action levels, response to each action level, corrective actions and notifications; and
- making necessary changes in the monitoring and/or limit requirements to improve the chemistry control program.

Within the scope of this review, the duties and responsibilities of the Hope Creek Generating Station staff appeared to be consistent with the EPRI Guidelines.

4.4 Procedures

Regulatory Guide 1.33 recommends, in part, chemical and radiochemical procedures to prescribe the nature and frequency of sampling and analysis, instructions maintaining water quality within prescribed limits and limitations on concentrations of agents that may cause corrosive attack or fouling of heat transfer surfaces or that may become sources of radiation hazards due to activation.

The Chemistry Control Program's principal station administrative procedure, i.e. Station Administrative Procedure (SA-AP.ZZ)-052(Q), "Chemistry Control Program," Revision 0 (December 4, 1985), was

reviewed to determine its consistency with the EPRI Guidelines. Control and diagnostic chemical parameters were compared with those in the EPRI Guidelines for cold shutdown, startup/hot standby and power operation conditions. SA-AP.ZZ-052(Q) also provided water chemistry requirements for the period between preoperational and system turnover to Hope Creek Operations.

Water quality standards used during the flushing phase of construction were governed by Startup General Test Procedure (GTP)-1, "General Flushing and Cleaning Procedure." During Inspection No. 50-354/85-35, water chemistry sampling and analysis were reviewed to determine that proper samples were taken and evaluated prior to injection of water into safety-related equipment. During this inspection, water quality standards in GTP-1 were reviewed relative to guidance provided in NRC Regulatory Guide 1.37, "Quality Assurance Requirements For Cleaning Of Fluid Systems And Associated Components Of Water-Cooled Nuclear Power Plants."

Within the scope of this review, the applicant appeared to be conforming to generally accepted industry standards in the choice of applicable water quality standards in procedures governing the water chemistry program.

4.5 Staffing

Staffing within the station Chemistry Department was reviewed during Inspection No. 50-354/85-44 and appeared to be adequate for fuel loading at that time.

5. Selection, Training and Qualification

The applicant's selection, training and qualification program for personnel assigned responsibilities for plant chemistry systems and water chemistry control was reviewed relative to criteria and commitments provided in the HCGS-FSAR and its referenced ANSI standard and guidance in the EPRI "BWR Water Chemistry Guidelines." Training programs given onsite and those offered by the applicant's Training Center in Salem, New Jersey were reviewed.

5.1 Selection

The applicant's selection of incumbents in water chemistry controls was reviewed relative to ANSI/ANS 3.1-1981, "American National Standard For Selection, Qualification and Training Of Personnel For Nuclear Power Plants." Resumes and other records were reviewed relative to the criteria as summarized below:

Position	ANSI/ANS 3.1-1981 Section
Chemistry Engineer	4.4.3, "Chemistry and Radiochemistry"
Senior Chemistry Supervisor	4.3.2, "Supervisors Not Requiring NRC Licences"
Chemistry Supervisors	4.5.2, "Supervisors Not Requiring NRC Licenses"
Chemistry Technicians	4.5.2, "Technicians"
Chemistry Assistant	4.5.1.1, "Non-Licensed Operators"

Within the scope of this review, no deviations from previous commitments were noted.

5.2 Training Qualification

The applicant's training program for chemistry management and technicians was reviewed during Inspection Nos. 50-354/85-44, 50-272/84-02 and 50-311/84-02. Those reviews examined the applicant's training program relative to chemistry laboratory analyses, sampling and calibration of instrumentation. During this inspection, the training program relative to plant chemistry control systems and water chemistry control was reviewed relative to criteria provided in ANSI/ANS 3.1-1981. Section 5.3.5 of ANSI/ANS 3.1-1981 provides training criteria for individuals permitted to operate systems of equipment independently and provided the basis for the review. The applicant's performance was determined by interviews of training supervisors and instructors at the Nuclear Training Center, review of training procedures, lesson plans and course materials and examination of station training/qualifications given following completion of Training Center courses.

Within the scope of this review, the following items were noted:

- Training on plant chemistry control systems, (e.g. the Condensate Demineralizer and Reactor Water Cleanup Systems), is provided in the BWR General Systems, Apprentice Chemistry Assistant and Chemistry Technician courses.

- Individual understanding of the information provided is evaluated by a written examination requiring a 70% passing score.

- Specific plant chemistry control equipment and system operation, operational requirements, operating procedures, functions and responsibilities during chemistry transients and demonstration of the ability to perform the tasks necessary to operate the equipment and systems are the responsibility of the station. However, at the time of inspection, none of the 18 Chemistry Technicians and Assistants had completed station training and qualification to operate the Condensate Demineralizer and Reactor Water Cleanup systems. The applicant stated that training/qualification on those systems had not been completed as a result of the late turnover of the systems to Hope Creek Operations. The applicant acknowledged the need for the training/qualification to support plant startup and stated that fully-qualified operators for the two systems sufficient to staff each shift would be provided by fuel load (50-354/86-05-01)/

6. Plant Water Chemistry Systems

Primary and auxiliary water systems ("as-built") were reviewed relative to descriptions, design criteria and Piping and Instrumentation Drawings (P&ID) provided or referenced in the HCGS-FSAR. Operation was reviewed relative to Regulatory Guide 1.56 "Maintenance Of Water Purity In Boiling Water Reactors."

6.1 Condensate System

The Condensate System, (P&ID No. M-05-1) was reviewed during plant tours for familiarization with major components and to identify potential flow paths for the ingress of contamination into the reactor feed water. Sampling points, (P&ID No. M-23), were identified and reviewed for representativeness and early detection of the possible failure of condenser tubes, air inleakage through condensate pump seals and turbine gland seals and escape of condensate demineralizer resins into the feedwater.

Within the scope of this review, no concerns were identified.

6.2 Condensate Demineralizer System

At 100% Condensate System flow, the applicant's Condensate Demineralizer System is designed to remove dissolved (by ion exchange) and suspended (by filtration) contaminants from the condensate using 6 deep resin bed filter-demineralizers (with a seventh filter-demineralizer in standby). The Condensate Demineralizer System, (P&ID No. M-16) was reviewed during plant tours for familiarization with major components. The following components of the Condensate Demineralizer System were observed:

- Demineralizers (AF 106, BF 106, CF 106, DF 106, EF 106, FF 106 and GF 106);
- Control panels (OC 122 and OC 178);
- Resin Separation and Cation Regeneration Vessel (OT 143);
- Anion Regeneration Vessel (OT 144);
- Resin Mix And Hold Vessel (OT 145);
- Ultrasonic Resin Cleaner (OF 152);
- Acid Storage Tank (OT 141);
- Caustic Dilution Hot Water Tank (OT 142);
- Caustic Storage Tank (OT 140); and
- Sampling locations, pressure indicators, flow meters and conductivity sensors.

The inspector noted that conductivity was recorded at 25 locations:

- in the condenser;
- at analysis stations located on the common influent and effluent headers to the Condensate Demineralizer System;
- at the discharge of each ion exchange vessel;
- at the discharge header of the primary condensate pumps and the reactor feed pumps.

Condensate Demineralizer System operation was reviewed and discussed with the applicant's representatives. Operating sequences, indications of operation and alarm/trouble indications were reviewed at Control Panels Nos. OC-122 and OC-136. Applicant's Procedure No. CH-SD.AK-001(Q), "Operation Of The Condensate Demineralizer System," Revision 0 (October 21, 1985) was reviewed. The following Condensate Demineralizer System operations were reviewed:

- removal of dissolved and suspended contaminants from the condensate using the deep resin bed filter-demineralizers;

- cleaning the resin bed when it becomes loaded with solids;

- chemical regeneration of the resin when it becomes depleted; and

- processing of water being transferred from the fuel pool or cask storage pit to the Condensate Storage Tank.

The applicant plans to use differential pressure or conductivity as an indication of when to regenerate a demineralizer rather than by calculation as described in C.4.c of Regulatory Guide 1.56. The Condensate Demineralizer System was reviewed to determine if monitoring capability had been provided to measure:

- conductivity at each individual demineralizer vessel effluent;

- differential pressure across each vessel (inlet to outlet); and

- total volume through each vessel.

Pressure, flow and conductivity sensors were provided sufficient to provide the measurements needed. However, the conductivity elements installed on the demineralizer vessel outlets were not temperature regulated. The applicant indicated that this concern had been identified by the Chemistry Department and temperature-regulated conductivity measurements would be provided. The inspector stated that the provision of temperature-regulated conductivity measurement capability for each demineralizer vessel outlet would be reviewed during a subsequent inspection (50-354/86-05-02).

6.3 Reactor Water Cleanup (RWCU) System

The RWCU System removes solid and dissolved impurities from the reactor coolant and measures the reactor coolant conductivity. The system takes its suction from the inlet of each reactor main recirculation pump and from the reactor pressure vessel bottom head train line (when the recirculation pumps are unavailable). The reactor coolant is circulated by the cleanup pumps through the regenerative

and nonregenerative heat exchangers for cooling, through the filter-demineralizers for contaminant removal and back through the regenerative heat exchanger for reheating. The processed reactor coolant water is normally returned to the reactor pressure vessel through the feedwater lines. Normal operation of the RWCU system maintains water quality in accordance with Regulatory Guide 1.56 using less than 1% of the main steam flow rates.

The RWCU System, (P&ID Nos. M-44-1 and M-45-1), was reviewed during plant tours for familiarization with major components. The following components of the RWCU System were observed:

- Cleanup Filter Demineralizers (AF 203 and BF203);
- Cleanup Precoat Tank (OT 209);
- Cleanup Precoat Pump (OP 222);
- Reactor Water Cleanup Recirculation Pumps (AP 221 and BP 221);
- Regenerative Heat Exchangers (AE 207, BE 207 and CE 207);
- Nonregerative Heat Exchangers (AE 208 and BE 208);
- Sampling points (Panel 10 C251 and hooded sample station);
- Panel 10 C251 (Conductivity Cells); and
- Control Panels (10 C076 and 10 C205).

Operation of the RWCU System was reviewed and discussed with the applicant's representatives. Procedure No. CH-SO.BG-001(Q), "Operation Of The Reactor Water Cleanup System," Revision 0 (October 17, 1985) was reviewed. The following RWCU System operations were reviewed:

- normal operation with both filter demineralizers in service;
- filter demineralizer isolation, backwash and precoat cycle; and
- operation in conjunction with the Fuel Pool Cooling And Cleanup System during refueling.

The inspector noted that the backwash and precoat cycle for each filter demineralizer was automatic but was initiated by the RWCU Control Operator, (i.e. a Chemistry Assistant/Technician).

The applicant uses pressure-precoat type filters using a premixed ion exchange resin and binder, (typically Gravor Ecodex). Spent resins are sluiced from the filter demineralizer to a backwash tank. From the tank, spent resins are transferred to the solid waste system for processing, solidification and disposal. The applicant has established the following conditions for filter demineralizer vessel isolation and initiation of the backwash and precoat cycle whenever:

- the differential pressure across the vessel reaches 25 pounds per square inch (psi);
- a vessel exceeds 30 psi differential pressure;
- alarms are actuated automatically at 25 psi differential pressure;
- initial set-up pressure exceeds 10 psi differential; and
- measurement of water quality in effluent from a vessel is unacceptable.

Within the scope of this review, no concerns were identified.

6.4 Demineralized Water System

The Demineralized Water Makeup, Storage and Transfer System, (P&ID No. M-18) was reviewed during plant tours and operation of the system was discussed with Chemistry personnel. Operation was reviewed by observation of Panel 00C-136 and examination of Procedure No. CH-SO.AN-001(Q), "Operation Of The Demineralized Water Makeup Plant," Revision 0 (October 17, 1985). Grab sampling locations were also reviewed.

Within the scope of this review, no concerns were identified.

7. Sampling/Measurement

The applicant's program for sampling and measurement of possible chemical contaminants in high-purity reactor water and systems supplying makeup and cooling water was reviewed against commitments in the HCGS-FSAR and guidance in Regulatory Guide 1.56 and the EPRI "BWR Water Chemistry Guidelines," (April 1, 1984).

7.1 Process Sampling System

The applicant's Process Sampling System, (P&ID No. M-23) provides a means to monitor radioactive and nonradioactive water systems and provides continuously flowing samples for in-line and/or laboratory analysis. Five sample stations provide 53 different sampling points. The following table summarizes the sample stations:

Panel	Sample Designation	Samples
10 C 250	Residual Heat Removal (RHR)	Outlets A or B RHR heat exchangers RHR drain to radwaste control rod drive water reactor water recirculation inlet filter demineralizer discharges filter demineralizer Inlet
10 C 150	Balance of Plant (BOP)	Condensate Demineralizer System Main steam from Reactor Plant Chiller Refueling Water
10 C 350	Radwaste	Radwaste systems
00C 540	Auxiliary Boiler	Auxiliary boiler feed and steam.

The RHR, RWCU and BOP sample stations were reviewed during plant tours to determine if the sample stations "as built" provided grab sampling capabilities and automatic monitoring functions as described in the HCGS-FSAR, Table 9.3-3. Calibrations of on-line analysers were reviewed and alarm setpoints (as applicable) were verified through Startup Engineering.

Within the scope of this review, no deviations were noted.

7.2 Sampling Program

The applicant's preoperational and planned operational sampling programs were reviewed and discussed with Chemistry personnel. The applicant's pre-fuel load chemistry sampling program was contained in Chemistry Department Directive (CH-DD), ZZ-003(Z), Revision 5 (December 2, 1985). The following items were noted during the review of CH-DD.ZZ-003(Z):

- During startup system flushing activities, sampling frequencies were established during the "Plan of the Day" meetings, by work orders or requests from the startup group.

- During preoperational testing (until the beginning of initial fuel load), sampling frequencies were established in CH-DD.ZZ-003(Z).

- Acceptance criteria for parameters in influent flush water during startup system flushing activities were:

  pH 5.5-8

  Specific Conductivity <3.0 micro Siemens/centimeter (μS/cm)

  Silica as SiO_2 <50 parts per billion (ppb)

  Chloride <500 ppb

  Total Suspended Solids <5,000 ppb

  Turbidity <1 NTU

  Fluoride <1,000 ppb

  Sulfide <1,000 ppb

- Acceptance criteria following flushing were tightened to be generally consistent with EPRI Guidelines and the applicant's analytical capabilities.

The applicant's planned operational sampling program (applicable with initial core load) was provided in Procedure No. CH-TI.ZZ-012(Q), "Chemistry Sampling Frequencies, Specifications And Surveillances," Revision 0 (November 15, 1985). The procedure was reviewed relative to the "General Electric Standard Technical Specifications" Surveillance requirements. The procedure was also reviewed relative to the EPRI Guidelines.

Within the scope of this review, no concerns were identified.

7.3 Laboratory Analyses

The applicant's chemical laboratory analytical capabilities were reviewed during Inspection Nos. 50-354/85-44 and 50-354/85-59.

8. Implementation Of The Water Chemistry Control Program

The applicant's development and initial implementation of the water chemistry control program was reviewed relative to commitments in the HCGS-FSAR and guidance provided in Regulatory Guide 1.56 and the EPRI Guidelines.

8.1 Sampling and Analysis

The implementation of the applicant's sampling and analysis program under CH-DD.ZZ-003(Z) was reviewed by examination of chemistry logs and other records and interviews with chemistry personnel. The applicant appeared to be adhering to sampling and analysis frequencies and action limits as provided in the directive.

8.2 General Program Development

The applicant's program was reviewed to determine if it could control known paths of impurity ingress including:

- exposure to air during plant outages;
- failure of condenser tubes;
- leakage of air through condensate pump seals or turbine gland seals;
- accidental loss of resin fines from the condensate demineralizer or RWCU to the feedwater;
- leaching of regenerative chemicals from demineralizer beds;
- erosion or corrosion of copper from feedwater heaters, condenser tubes and moisture separator reheaters;
- air contamination of auxiliary feedwater;
- leakage through heat exchangers of cooling water; and
- contamination of reactor or condensate makeup water by plant operating or maintenance activities.

In each instance, the applicant's sampling/monitoring and action levels appeared adequate to identify the source of the contaminant and provide timely action.

8.3 Regulatory Guide 1.56

The applicant's water chemistry program was reviewed relative to the 6 items in Section C of Regulatory Guide 1.56. Within the scope of this review, the following item was identified:

Item C.3 of Regulatory Guide 1.56 recommends, in part, that the initial total capacity of new anion and cation demineralizer resins be measured. For resins that are to be regenerated, the determinations should be repeated at least semiannually. For resins that are not regenerated but are instead replaced periodically with material of the same type, measurements of initial capacity should be made on a sample at least once a year or at each replacement when the time between replacements exceeds one year. Contrary to these recommendations, the applicant accepted the vendor's Certificate of Analysis for bead-type and powder-type demineralizer resins without independently determinating ion exchange capacity at least as recommended in Item C.3. Although, the applicant had developed a procedures for resin analysis, (i.e. CH-CA.ZZ-034(Q), "Resin Analysis," Revision 0, (May 20, 1985)), frequencies for resin analysis had not been established. This item was discussed with the applicant and will be reviewed in a subsequent inspection (50-354/86-05-03).

9. Preoperational/Startup Tests

Preoperational and startup (i.e. "power ascension") tests conducted or planned by the applicant to demonstrate the design capability of chemical control systems and process sampling systems were reviewed against commitments in the HCGS-FSAR. Completed tests were reviewed for dispositioning of test exceptions. Test procedures were reviewed relative to Regulatory Guide 1.68, "Initial Test Programs For Water-Cooled Nuclear Power Plants."

9.1 Preoperational Tests

The RWCU System was preoperationally tested using Preoperational Test Procedure (PTP)-BG-1, "Reactor Water Cleanup And Filter/Demineralizer System," Revision 1 (released for test performance on July 25, 1985). The test was reviewed and test exceptions were dispositioned during Preoperational Review Committee (PORC) Meeting No. 129 on December 23, 1985. Sixty-six test exceptions were noted during the test and reviewed by the inspector. Of those test exceptions/dispositions, two were of concern:

- Since Sample Station 10 C 251 was not available, samples were taken at local taps (i.e. influent at 1-PBG-V9999, effluent from AF 203 at 1-PBG-V9949 and effluent from BF 203 at

1-PBG-V9950). The capability of Sample Station 10 C 251 to take representative samples should be verified. (Note related item 50-354/85-44-08).

- During the 48 hour service run, chloride removal could not be verified since influent chloride levels (i.e. demineralized water) were below detectable limits. Chloride removal should be verified prior to operation (50-354/86-05-04).

PTP-AK-1, "Condensate Demineralizer System, "Revision 0 (released for test performance on August 26, 1985) was completed, reviewed during PORC Meeting No. 110 on November 20, 1985 and its 10 test exceptions were dispositioned. The test results and test exceptions were reviewed and the following items were noted:

- Chemical analyses to verify effluent quality of the condensate demineralizers were not completed. Only pH and conductivity were measured and recorded during the test. Chemical parameters (including iron, copper, nickel, chloride, silica, total dissolved solids and total metallic impurities) were not determined during chemical tests of the 7 demineralizer bed effluents. The applicant should test the chemical parameters noted to the limits of analytical capability to verify the condensate demineralizers can perform their intended function (50-354/86-05-05).

- The Ultrasonic Resin Cleaner did not operate properly in the automatic mode during testing. Manual operation was used to demonstrate its cleaning function. The filter cleaning operation was designed to be automatic to minimize potential operator error. The Ultrasonic Resin Cleaners should be shown to operate in the automatic mode.

The following preoperational tests were in progress and were not reviewed:

- PTP-AN-1, "Demineralized Water Makeup System;"

- PTP-AN-2, "Demineralized Water Storage and Transfer System; and

- PTP-AP-1, "Condensate Storage and Transfer."

PTP-AN-2 was reviewed during Inspection No. 50-354/84-28 and PTP-AP-2 was reviewed during Inspection No. 50-354/85-18. Test results will be reviewed during a subsequent inspection (50-354/86-05-06).

9.2 Startup Tests

Regulatory Guide 1.68 requires, in part, chemical and radiochemical tests and measurements to demonstrate the design capability of

chemical control systems to maintain reactor water quality within limits. The following chemical and radiochemical "power ascension" test procedures were reviewed:

- TE-SU, ZZ-011(Q), "Chemical and Radiochemical Pre-Fuel Load Test," Revision 0 (November 29, 1985) and Revision 1 (in routing);

- TE-SU.ZZ-012(Q), "Chemical and Radiochemical Heatup Test," Revision 0 (November 29, 1985);

- TE-SU.ZZ-013(Q), "Chemical and Radiochemical 15 to 25% Power Tests," Revision 0 (November 29, 1985);

- TE-SU.ZZ-014(Q), "Chemical and Radiochemical 45 to 55% Power Tests and No-Reactor Water Cleanup Test," Revision 0 (November 29, 1985);

- TE-SU.ZZ-015(Q), "Chemical and Radiochemical 65 to 80% Power Tests," Revision 0 (November 29, 1985); and

- TE-SU.ZZ-016(Q), "Chemical and Radiochemical 90 to 100% Power Tests and No-Reactor Water Cleanup Test," Revision 0 (November 29,1985).

In a letter to NRC-NRR dated December 9, 1985, the applicant requested a modification to the chemical and radiochemical tests and measurements programs to:

- substitute plant surveillance procedures for the chemistry and radiochemistry monitoring requirements previously submitted in Applicant's Test Number 1; and

- delete the integrated performance testing of the RWCU and Condensate Demineralizer Systems at Test Condition 3 (i.e. TE-SU.ZZ-014(Q) above).

The adequacy of the proposed changes to the chemical and radiochemical "power ascension" tests is unresolved pending NRC-NRR review of the changes. 50-354/86-04-07 Completion of the tests will be reviewed in a subsequent inspection. 50-354/86-05-08

10. Self Identification/Correction of Deficiencies

The applicant's development of a program to identify and correct chemical control deficiencies was reviewed to determine if a program to identify, investigate, document, report, track, close and trend discrepancies in the chemistry control program had been developed. Under Station Administrative Procedure (SAP)-20, "General Detail and Corporate Test Procedures," deficiency reports are issued when chemical parameters are determined to be above action levels in Chemistry Department Directive 3. The following deficiency reports were reviewed and discussed with the applicant:

- HCH-85-001, (June 16, 1985) Demineralized Water Storage Tanks (OAT-121, OBT-121, OCT-121, ODT-121 and the condensate Storage Tank) had silica levels exceeding the control value of less than 0.01 parts per million (ppm);

- HCH-85-004, (July 2, 1985) Demineralized Water Storage Tanks had total organic carbon (TOC) greater than 50 ppb;

- HCH-85-005, (July 10, 1985) Demineralized Water Storage Tanks had total suspended solids (TSS) greater than 100 ppb; and

- HC-85-012, (September 13, 1985) Reactor water had a specific conductance of 4.46 microsiemens per centimeter and a chloride concentration of 860 ppb.

The applicant determined that the demineralized water problems were due to failures in the vendor's temporary demineralizer trailer being used to supply demineralized water for flushing and filling activities. Appropriate corrective actions were taken in each instance.

Within the scope of this review, no concerns were identified.

11. Results of Capability Test Standard

The results of a capability test standard submitted to the licensee during a previous inspection on November 18-22, 1985 (Inspection Report Number 50-354/85-59) for analyses requiring wet chemistry were compared. The results of the standards comparison indicated that all of the measurements were in agreement under the criteria used for comparing results. (See Attachment I) The results of the comparisons are listed in Table I. Radioactivity standards are used to evaluate the licensee's capability to measure radioactivity in effluents as required by the proposed Technical Specifications. The test standards were prepared by the NRC reference laboratory, DOE Radiological and Environmental Sciences Laboratory (RESL), and duplicated the types of samples and nuclides that the licensee would encounter during operation. The standards were analyzed by the licensee's contractor laboratory. No violations were identified in this area.

12. Exit Interview

The inspector met with the applicant's representatives (denoted in Detail 1) at the conclusion of the inspection on January 24, 1986. During the meeting, the inspector summarized the purpose and scope of the inspection and identified findings as described in this report.

At no time during this inspection was written material provided to the applicant by the inspector. No information exempt from disclosure under 10 CFR 2.790 is discussed in this report.

TABLE I

CAPABILITY STANDARD TEST RESULTS

SAMPLE	ISOTOPE	NRC VALUE	LICENSEE VALUE	COMPARISON
		RESULTS IN MICROCURIES PER MILLILITER		
NRC	Sr-89	(5.19 ± 0.16)E-4	<9E-5	No Comparison
Standard	Sr-90	(5.7 ± 0.23)E-5	(7.3 ± 0.1)E-5	Agreement
1/11/85	H-3	(1.23 ± 0.03)E-4	(1.1 ± 0.1)E-4	Agreement
	Fe-55	(4.31 ± 0.09)E-5	(5.2 ± 0.5)E-5	Agreement

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 and empirical relationship which combines prior experience and the accuracy needs of this program.

In these criteria, the judgement limits are variable in relation to the comparison of the NRC Reference Laboratory's value to its associated uncertainty. As the ratio, referred to in this program as "Resolution", increases the acceptability of a licensee's measurement should be more selective. Conversely, poorer agreement must be considered acceptable as the resolution decreases.

$$\text{RATIO} = \frac{\text{LICENSEE VALUE}}{\text{NRC REFERENCE VALUE}}$$

Resolution	Agreement
<3	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