UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA STREET, N.W.
ATLANTA, GEORGIA 30323

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Report Nos.: 50-321/87-03 and 50-366/87-03

Licensee: Georgia Power Company
P. O. Box 4545
Atlanta, GA 30302

Docket Nos.: 50-321 and 50-366 License Nos.: DPR-57 and NPF-5

Facility Name: Hatch

Inspection Conducted: January 26-30, 1987

Inspector: W. J. Ross 2/10/87
W. J. Ross Date Signed

Approved by: J B Kahle 2/10/87
J. B. Kahle, Section Chief Date Signed
Division of Radiation Safety and Safeguards

SUMMARY

Scope: This special unannounced inspection involved a review of procedures and plans developed for the performance of hydrogen water chemistry tests as well as a review of the Hatch water chemistry program.

Results: No violations or deviations were identified.

REPORT DETAILS

1. Persons Contacted

   Licensee Employees

   *H. Nix, Plant Manager
   *W. H. Rogers, Health Physics/Chemistry Superintendent
   *B. C. Arnold, Chemistry Supervisor
   R. Bryant, Plant Chemist
   *D. Elder, Acting Quality Assurance Audit Supervisor
   *W. Kirkley, Engineering Supervisor, HP/Chem.
   S. Lee, Chemistry Foreman
   *V. McGowan, Chemistry Supervisor
   A. Miller, Chemistry Foreman
   P. Moxley, Health Physicist
   C. Parker, Chemistry Foreman
   D. Smith, Health Physics Supervisor

   Other licensee employees contacted included Nuclear Chemistry Technicians.

   Other Organization

   J. Simpson, General Electric

   NRC Resident Inspectors

   *P. Holmes-Ray
   G. Nejfelt

   *Attended exit interview

2. Exit Interview

   The inspection scope and findings were summarized on January 30, 1987, with those persons indicated in Paragraph 1 above. The inspector described the areas inspected and discussed in detail the inspection results. No dissenting comments were received from the licensee. The licensee did not identify as proprietary any of the material provided to or reviewed by the inspector during this inspection.

3. Licensee Action on Previous Enforcement Matters

   This subject was not addressed in the inspection.

4. Hydrogen Water Chemistry Tests

   The initial purpose of this inspection was to monitor hydrogen water chemistry (HWC) tests that were scheduled to be performed on Hatch Unit 1. These tests had been designed to determine the feasibility of mitigating intergranular stress corrosion cracking (IGSCC) of stainless steel by controlling one of the factors, dissolved oxygen, associated with this type of corrosion. Both Hatch units had experienced IGSCC in recent years and repairs had required significant effort and radiation exposure. HWC technology has been developed by General Electric Company and the Electric Power Research Institute (EPRI), working with the BWR industry, to combat this type of corrosion that has become a problem for all BWRs.

HWC involves injection of hydrogen gas into the feedwater of an operating BWR while maintaining the conductivity of the reactor coolant below 0.3 umho/cm. The hydrogen reduces the amount of oxygen produced through radiolysis of water and, thereby, reduces the concentration of oxygen dissolved in the reactor coolant. Tests at other BWRs have shown that when the oxygen concentration is low (~20 ppb), the electrochemical potential of stainless steel decreases to a level (-0.230 volts versus a standard hydrogen electrode) that IGSCC does not occur. In July 1986 feasibility tests had been performed with Hatch Unit 1 for the following stated purposes:

- To determine if the concentration of oxygen dissolved in the reactor coolant could be reduced sufficiently to decrease the electrochemical potential of stainless steel to - 0.230 volts.

- To determine if IGSCC of stainless steel is mitigated at this protective electrochemical potential.

- To determine if a tolerable background radiation level could be maintained under conditions that mitigated IGSCC.

- To determine if excess hydrogen gas could be disposed of safely through the plant's air-ejector system.

The results of these tests did not achieve the desired objectives, and the fault was attributed to the presence of sufficient copper in the reactor coolant to interfere with the electrochemical potential of stainless steel. The test procedures have been subsequently revised to overcome the effect of copper and the tests were to be resumed on January 26, 1987. However, on this date one of the unit's recirculating water pumps had to be taken out of service and the power level decreased to 570 MWe maximum for an unknown period of time. Consequently, the HWC tests were postponed until the unit could operate at full power in a stable condition.

The inspector used this opportunity to review the licensee's preparations for the HWC tests and to inspect the plant design changes that had been made for these tests.

a. Feasibility Tests

Through discussions with licensee and General Electric personnel and a review of pertinent documents, the inspector reviewed the following licensee actions taken prior to the initial HWC tests.

(1) General Electric had developed a Safety Analysis Report (SAR) that concluded there was no unreviewed safety concern associated with the HWC. This SAR addressed the location of bulk hydrogen and oxygen storage and associated monitors; compliance with codes and standards, ALARA considerations related to increased volatility of nitrogen-16 produced by radiolysis of reactor water [$^{16}O(n,p)^{16}N$]; fire protection precautions relevant to the use of hydrogen; effect on the plant's offgas system; and the effect of HWC on fuel reliability and plant components.

(2) On the basis of the General Electric SAR, the licensee (actually Southern Company Services) made a safety evaluation (PDCR-S-86-004) that addressed the requirements of 10 CFR 50.59 for identifying an unreviewed safety concern. As the result of this evaluation the licensee concluded that no design change related to the pre-implementation tests constituted an unreviewed safety question.

(3) Permission had been obtained from the NRC to temporarily increase the scram and isolation setpoints of the Main Steam Line High Radiation Monitor during the HWC tests (Technical Specification 3.1 and Table 3.1-1, 3.2-1, and 3.2-8). Previous experience at other sites had shown that HWC would result in an approximate 1- to 8-fold increase in N-16 activity in the steam.

(4) A Special Purpose Procedure (42SD-06186-OC-1-15) had been written to cover the performance of the tests by General Electric personnel and to define the supporting roles of the Hatch Operations, Chemistry and Health Physics personnel. This procedure was updated for the second series of tests with specified objectives and definitive precautions and limitations.

(5) By letter of October 3, 1986, the licensee advised the NRC staff that the second HWC test would be performed within the limits of the SAR and SER that had been developed for the initial tests in July.

b. Plans for the Second HWC Tests

Because of the inconclusive results of the initial HWC tests the second tests will be longer in duration so that an equilibrium copper concentration can be achieved at a hydrogen addition rate of 19 standard cubic feet per minute (SCFM). Previous tests showed that the concentration of copper in the reactor coolant (and in the hotwell water) decreased with time when hydrogen was injected into the feedwater. When the electrochemical potential of stainless steel electrodes becomes stabilized at some value~-0.230 volts vs SHE Constant Extension Rate Tests (CERT) will be performed to establish if IGSCC is mitigated in an environment of low dissolved oxygen when mechanical stress is applied to the electrode.

Before the tests were postponed the inspector walked down the systems to be used to inject hydrogen into the feedwater lines at the suction of the booster pumps. An oxygen line had been run to the air ejector/exhaust system to ensure that an excess of oxygen was always available in the hydrogen-oxygen recombiner. These lines were installed in a manner that was consistent with the safety analysis report.

The inspector also reviewed the radiation level data that had been obtained during the July 1986 tests for background and baseline purposes. As predicted, the level of gamma radiation had increased as the rate of hydrogen injection had been increased from 0 to 60 SCFM because of the increasing partitioning of N-16 into the steam rather than into the reactor coolant. However, where the steam lines were shielded N-16 radiation was significantly reduced. Consequently, the most populated portions of the plant, including the Control Room and Health Physics and Chemistry laboratories as well as the temporary test locations, were not subjected to an impermissable level of radiation. One exception was the area west of the turbine building in the vicinity of the main personnel and vehicle portals into the protected area. In parts of this area the dose rate increased as much ten times the normal background level of 30 µR when the hydrogen injection rate exceeded 20 SCFM.

c. Summary

The inspector concluded that the licensee had made appropriate preparations for the July 1986 tests as well as the proposed HWC tests in 1987. Even though comprehensive radiation mapping had been performed in July 1986, the licensee committed to continue additional monitoring during the second series of tests to ensure that personnel will not be exposed to excessive levels of N-16 radiation.

The licensee will continue to keep the NRC Resident Inspector informed of plans and schedules for the second series of tests.

5. Inspection of the Hatch Water Chemistry Program (79701)

This inspection was an updating review of the effectiveness of plant design and construction in preventing ingress of corrodants into the primary coolant cycle of the Hatch units. A reassessment of the licensee's capability to maintain an acceptable level of chemistry control was also made during this site visit.

a. Effectiveness of Components

During the most recent inspection, in May 1985, the inspector had observed that increased effort was being made to improve the quality of reactor coolant by the following actions:

- increasing the integrity of the main condenser

- reducing the transport of copper from the copper-alloy condenser tubes to the reactor
- increasing the efficiency of the reactor water cleanup system (RWCU).

A re-assessment of these efforts is summarized as follows.

(1) Condenser. The inspector was informed that a continual effort, consistent with the ALARA concept, had been made to reduce air and water inleakage through the main condenser. As the result, air inleakage had been stabilized at ~20 SCFM, a rate that yields ~20 ppb of dissolved oxygen in the condensate and feedwater. This level is acceptable, and even desired, in BWRs to prevent general corrosion of carbon steel pipes.

During an audit of chemistry control data obtained during 1986, the inspector observed that inleakage of condenser cooling water had been maintained at such a low level in both units that the conductivity of the hotwell water was routinely near the level of pure water (0.055 umho/cm) when the units were operating in a stable manner.

(2) Condensate Cleanup System

The licensee has always operated the powder demineralizers in this system continually to achieve full-flow polishing of the condensate. The effluent normally has had a conductivity of 0.055-0.060 umho/cm; however, trace amounts (<1 ppb) of copper were always observed in both the polisher effluent and in the feedwater. Copper subsequently was concentrated in the reactor coolant to a level of ~30 ppb and tended to plate out on fuel elements where localized corrosion of the fuel cladding was initiated. This level of soluble copper also was considered to have detrimentally affected the pre-implementation HWC in July 1986, probably by reacting with the injected hydrogen.

During the past year, the licensee initiated a "body coating" program to enhance the efficiency of the demineralizers. This program entails overlaying the precoated demineralizer vessels with small amounts of powdered ion-exchange resin several times per day until a maximum pre-selected pressure differential is reached. All resin is then backwashed from the filter vessel, the vessel precoated with resin, and the overlay cycle resumed. As the result of this program the conductivity of the polisher effluent has always been 0.055 umho/cm. Also the time periods between precoatings has been increased from 7-10 days to 15-17 days. However, the retention of copper has not been significantly improved.

(3) Reactor Water Cleanup System (RWCU)

As the licensee moves toward possible implementation of HWC to mitigate IGSCC, the efficiency of the RWCU system becomes more critical. Based on an audit of 1986 data the quality of the reactor water in Unit 1 has improved since the last inspection. When plant power has been stable the conductivity of the reactor water was $\leq$ 0.2 umho/cm. The inspector was informed that the effectiveness of the RWCU system had been improved through increased reliability of the RWCU pumps and less down time of the entire RWCU system. Improved pumps are to be installed during the next refueling outage in an effort to further decrease down time.

Although the reliability of the RWCU pumps in Unit 2 had also been improved, the effect on the purity of reactor water was not evident because the conductivity varied from 0.2-0.5 umho/cm much of the year. These values were not consistent with the very low conductivities of water in the hotwell, feedwater, and the product of the makeup water treatment plant, all of which were 0.055 umho/cm; however, the licensee had not identified any other source of contamination.

b. Water Chemistry Program

The inspector reassessed the principal components of the Hatch water chemistry program and concluded that, since the last inspection, the capability to monitor and control water chemistry had improved. The results of this evaluation are summarized as follows.

(1) Staffing

Attrition within the chemistry staff had been unusually high, primarily due to transfer of personnel to the licensee's Plant Vogtle. The licensee had replaced these losses and, at the time of this inspection, had a staff of two supervisors, six foremen, and 39 technicians. Foremen and technicians were divided into six shifts so that sufficient manpower was always available to provide three shifts per day and also allow for training and off days. All extra staff members worked during the day shift.

(2) Training

The Hatch chemistry staff and program have been accredited by INPO. Training for the three levels of Nuclear Chemistry Technicians involved both classroom and on-the-job (OJT) activities and curricula. After discussions with foremen, technicians, and staff members of the Training Department the inspector concluded that this policy of mixing classroom and OJT training was effective.

The Plant Chemist and all foremen and supervisors had completed a 13-week chemistry training course provided by General Electric. The Engineering Supervisor was a member of the BWR Owners Group (BWROG) and had participated in the development of this Group's Guidelines for BWR Water Chemistry which have been adopted by most, if not all, BWR licensees in the U.S. The inspector was informed that members of the Hatch Chemistry Staff were frequently provided the opportunity to attend technical conferences related to water chemistry control.

(3) Procedures

The licensee has endorsed the BWROG Guidelines and was implementing these guidelines through a corporate directive and Administrative Control Procedure 60AC-HPX-010-05. This procedure addresses three action levels that have been defined to maintain short- and long-term reliability of the plant. The procedure also identifies the responsibilities of plant personnel and actions to be taken to control water quality and the quality of fluid systems.

As part of the effort to implement the BWROG Guidelines the chemistry procedures were being reviewed and revised to be consistent with the Administrative Control Procedure.

(4) Quality Control

In an effort to meet the stringent criteria of the BWROG Guidelines and HWC, the licensee was upgrading the chemistry quality control program by revising procedures and expanding the inter- and intra-laboratory calibration and cross-check activities. After a review of control charts for 1986 data and discussions with the cognizant chemistry foreman the inspector concluded that the licensee's chemistry quality control program was acceptable. The inspector emphasized that the combination of radiochemistry and trace-element analysis required that all aspects of laboratory activities be performed in a careful, professional, and controlled manner to ensure the credibility of analytical results. This concern also includes care of instruments and general housekeeping.

(5) Instrumentation

The extremely low limits on organic and inorganic contaminants that have been established for BWR water chemistry require the use of analytical methodology that was not available a few years ago. The inspector observed that the licensee had continued to provide state-of-the-art analytical instrumentation for trace element analysis. Two instruments in particular have become essential; i.e., atomic absorption spectrophotometers and ion-chromatographs. The chemistry staff has late models of these instruments and, in addition, has recently acquired two inline instruments that are adaptable for both ion chromatographic or spectrophotometric analyses of part per billion (ppb) and sub-ppb quantities of anions and cations. These instruments, as well as improved models of oxygen analyzers will also be used in the upcoming HWC tests to ensure the purity of the recirculating water is maintained and to study the effect of HWC on fuel elements and carbon/stainless steel pipe and structural components.

The inspector was informed that for the near future these sophisticated and expensive instruments would be operated only by the Plant Chemist and/or two technicians who had received training by the instrument vendors. Eventually other technicians will be equally trained, and a group of "instrumental specialists" is to be formed. The inspector observed that some OJT on these instruments had been initiated and plans were being made to supplement this training in the Hatch Training Center and at courses provided by vendors.

c. Conclusions

During this inspection no violations or deviations were identified. The actions being taken by the licensee to improve the effectiveness of plant components in preventing corrosion of the reactor coolant boundary are considered to be appropriate and timely. Participation of licensee personnel in the activities of the BWROG and endorsement of BWROG criteria in plant procedures are considered the best available bases for the design of an effective water chemistry program. Finally, there is a need for continual attention to upgrading the capabilities of the chemistry staff to meet the increased responsibilities and technical demands placed on the staff by the BWROG guidelines. Implementation of the HWC will further increase the requirement for a "new breed" of higher quality chemistry supervisors and technicians as well as a new generation of analytical technology for power plants.

6. Information Notice No. 86-106, Feedwater Line Break

During the site visit the inspector discussed with various members of plant management and staff the incident covered in this Notice and the applicability of the Notice to the operation of the Hatch units. These discussions specifically related to the phenomenon of general corrosion. The inspector requested that the licensee review the design of the feedwater and condensate systems in the Hatch units in light of the accident described in the Notice. Also, the members of the chemistry staff were requested to review the applicability of the BWROG criteria to the control of general corrosion of carbon steel pipe.

7. Previous Enforcement Actions

(Closed) 50-321/82-26-04: Discrepancies in the measurement for tritium in water samples collected from wells on the Hatch site were resolved during

Inspection No. 50-321/83-21. Although additional followup items pertinent to this program were opened in Inspection Report No. 50-321/83-21 the original concern was attributed specifically to samples provided to the licensee by an outside vendor. Subsequent use of these samples has ensured that proper determination for decay of the tritium standard was included in the licensee's procedures. These actions are considered acceptable.

(Closed) 50-321/83-32-01: NUREG-0737, Item II.B, Post Accident Sampling listed eleven criteria that should be met to provide an acceptable capability for monitoring gases and liquids. Although, in Inspection 50-321/84-50, a positive determination was made on adequacy of the licensee's PASS, that inspection did not address several items that had been opened during an earlier inspection of the PASS (Inspection No. 50-321/83-32). One of these open items related to the operating status of several manually operated valves in the reactor building that are associated with the PASS. The licensee has subsequently reviewed this matter and has modified Operating Procedure HNP-7740 to provide control over the positioning of these valves and requirements for locking the valves open in advance of an accident. These actions are considered acceptable.

(Closed) 50-321/83-32-02: Another item that remained open from the original inspection of the PASS related to the development of a formal training program for qualification of personnel to operate the PASS. The licensee has responded to this concern by developing a lesson plan for post accident sampling. The first class was given in June 1984 with plans to provide additional formal training on a semi-annual basis. These actions are considered acceptable.

(Closed) 50-321/83-32-03: A third concern stemming from the initial inspection of the PASS related to the development of periodic surveillance tests with acceptance criteria for the system including design modifications for boron testing. The licensee responded to this concern by the following actions.

- An administrative program was developed in June 1984 to provide capability for sampling and analyzing reactor coolant and drywell atmosphere.

- Procedures were developed in June 1984 for periodic testing of the PASS.

- An implementing schedule for boron testing was developed in June 1984.

These actions are considered acceptable.

(Closed) 50-321/83-32-04: During the initial inspection of the PASS the licensee was not able to obtain a liquid sample from Unit 2, and the adequacy of the system was considered an unresolved issue. The licensee attributed the failure to obtain a sample to damage to the PASS caused by failure of the pressure regulator. The pressure reducing system was redesigned and other modifications performed in January 1984. Subsequently, 15 samples were taken without problems. Since the licensee was required by order to have an operable system by December 1, 1983, the licensee had requested the NRC to extend this deadline until August 1, 1984, to complete all procedures, training, validation, etc. to ensure the PASS was operable. These actions are considered to be acceptable.

(Closed) 50-321/83-32-05: During the initial inspection of the PASS system the licensee had not completed arrangements with a contractor (Oak Ridge National Laboratory) to analyze grab samples for backup capability to the PASS. The licensee subsequently completed this contract in June 1984. This action is considered acceptable.