UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA STREET, N.W.
ATLANTA, GEORGIA 30303

Report Nos.: 50-325/84-23 and 50-324/84-23

Licensee: Carolina Power and Light Company
411 Fayetteville Street
Raleigh, NC 27602

Docket Nos.: 50-325 and 50-324

License Nos.: DPR-71 and DPR-62

Facility Name: Brunswick

Inspection Dates: July 30 - August 3, 1984

Inspection at Brunswick site near Southport, North Carolina

Inspector: W J Ross — 8/20/84
W. J. Ross — Date Signed

Approved by: J J Blake — 8/28/84
J. J. Blake, Section Chief — Date Signed
Engineering Branch
Division of Reactor Safety

SUMMARY

Area Inspected

This routine, unannounced inspection involved 44 inspector-hours on site in the area of plant chemistry.

Results

No violations or deviations were identified.

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REPORT DETAILS

1. Persons Contacted

   Licensee Employees

   *P. W. Howe, Vice President/Brunswick Nuclear
   *W. M. Tucker, Assistant to the General Manager
   M. Long, Vice President/Special Projects
   F. Blackman, Radwaste Engineering
   S. Carr, Radwaste Engineering
   *J. W. Chase, Operations Manager
   *A. G. Cheatham, Manager, Environ. and Rad. Control
   *T. E. Cribbe, Regulatory Compliance
   *J. W. Davis, Chemist, E&RC
   *K. E. Enzor, Director, Regulatory Compliance
   S. Gilliland, Engineering
   W. Gurganious, Chemistry Foreman, E&RC
   W. M. Hogel, Engineering
   C. Karling, Engineering
   W. Nurnberger, Chemistry Foreman, E&RC
   *C. E. Robertson, Chemistry Supervisor, E&RC
   B. Wilson, Fuel Engineering

   NRC Resident Inspectors

   *D. O. Myers
   L. Garner

2. Exit Interview

   The inspection scope and findings were summarized on August 3, 1984, with those persons indicated in paragraph 1 above. The licensee acknowledged the inspection results with no dissenting comments.

   Inspector Followup Item 84-23-01 "Implementation of Technical Specification 3.3.5.6 - Chloride Intrusion Monitor."

   Inspector Followup Item 84-23-02 "Role of Ionic Impurities in the Cracking of Valve G31-FO-42 in Unit 2"

3. Licensee Action on Previous Enforcement Matters

   Not inspected.

4. Unresolved Items

   Unresolved items were not identified during this inspection.

5. Plant Water Chemistry (92706)

This inspection consisted of three interrelated efforts:

- Assessment of the capability of the major components of the reactor coolant system to maintain the integrity of the reactor coolant pressure boundary by ensuring the absence of corrosive environments.
- Assessment of the adequacy of the licensee's water chemistry program to monitor the quality of water in the primary and auxiliary water systems.
- Assessment of the licensee's ability to control the quality of water in the two Brunswick units through implementation of the water chemistry program.

a. Assessment of the Design of Components in the Reactor Coolant System

During this inspection period Unit 2 was in its sixth refueling outage and Unit 1 was operating, in its second fuel cycle, until it tripped on August 1, 1984. The inspector reviewed the "as built" units against the description that is in the updated revision (1982) of the Final Safety Analysis Report (FSAR), especially Section 10 "Steam and Power Conversion System." The inspector followed up on previous interviews of cognizant plant personnel (cf. Inspection Report Nos. 50-325/83-27 and 50-324/83-27, August 22, 1983) to review the operational history of the components of the reactor coolant system that are discussed below and to determine what efforts are being taken to maximize the effectiveness of these components.

(1) Main Condenser

Each of the two Brunswick units dissipate waste heat energy through a main condenser into a circulating cooling water (CCW) system that takes water from the Cape Fear River Estuary. Industry experience has shown that the main condenser is a principal pathway for air and water inleakage into the reactor cooling water and the source of contaminants that cause the formation of corrosive environments within the reactor and in the plant's low-pressure turbines.

The licensee has experienced significant failures of the tubes of the main condensers of both Brunswick units, with subsequent ingress of saline water from the estuary. Consequently, the copper-nickel condenser tubes and tube sheets described in Section 10.4.1 of the FSAR have been replaced by titanium tubes and aluminum bronze tube sheets (Unit 1 in 1983 and Unit 2 during the current outage). The new tube sheets have double walls with a pressurized water barrier between them to improve resistance against inleakage of the saline water at tube to tube sheet joints. The inner surfaces of the tubes are protected against attack by aquatic organisms by the use of an Amertap cleaning system. The CCW is also chlorinated 2 to 4 hours per day during normal plant operation and for a 72-hour period when the unit is returning to power after an extended outage. The condenser and hotwell have been further protected against corrosion and degradation by (1) the installation of a cathodic protection system, (2) coating the water boxes with neoprene, and (3) developing a helium leak-detection system to monitor air inleakage. The licensee also has the capability of continually monitoring the conductivity of the water in the hotwell discharge header as well as at eight locations within the hotwell. As the consequence of all these actions, the conductivity of the water in the hotwell in Unit 1 has been maintained at ~0.06 umho/cm since the condenser was retubed. This very high quality condensate has reduced the loading of the condensate cleanup system and has helped ensure that the feedwater is of equally high purity.

Similarly the licensee has encountered corrosion problems in the Service Water system that also uses water from the estuary to provide cooling to safety-related components of the plant. The original concrete lined stainless steel pipes exhibited corrosion, at the joints of the liners, that was thought to be initiated by the attachment of barnacles with subsequent formation of localized anaerobic sites on the stainless steel pipe. The small diameter stainless steel pipes in the Service Water system have been changed out and replaced with 70-30 copper-nickel pipes. The licensee is considering replacing larger-diameter pipe with 30-70 copper-nickel pipe and rubber liners.

(2) Condensate Makeup

A second potential source of corrosive contaminants in the condensate/feedwater/reactor cooling water is the water used for condensate makeup and for the Control Rod Drive (CRD) system. This water is taken either from the Brunswick County water supply system or from wells on the licensee's property. The source water is processed through a dual purification train (250,000 gallons per day per train) to remove all organic and ionic impurities and then is stored in the makeup Demineralized Water Storage Tank (MUD Tank). The cleanup process involves the following components: sand separator, weak-cation ion-exchange bed, degassifier, charcoal bed, and a train of ion-exchange resin beds (anion, cation, and mixed resin). Upper limits are placed on the following chemical parameters in the product of the Water Treatment Plant (conductivity, chloride, silica, pH, solids, and total organic carbon compounds) and these parameters are monitored weekly. The MUD Tank is vented to the atmosphere; consequently, the dissolved oxygen content is not controlled. The licensee has observed fouling of the anion resin beds with organic material from the source water and is investigating the use of sodium chloride and commercial surfactants to lengthen the useful life of this resin bed.

The water in the MUD Tank is transferred to the Condensate Storage Tank (CST) to provide water for condensate makeup and the CRD system.

The inspector was informed that plans have been initiated to modify the CRD system so that water for use in this system will be taken downstream of the Condensate Cleanup System rather than from the CST. By this means the licensee hopes to eliminate all impurities (especially silica) that are being transferred into the reactor by substituting condensate water for CST-grade water.

When needed for condensate makeup, water from the CST is pumped to the hotwells where it undergoes further degassification, so that the dissolved oxygen content of the condensate remains ~10 ppb. The quality of the condensate is monitored at the discharge of the Condensate Pump - continually for conductivity which is alarmed and displayed in the Control Room and by 'grab' samples for other desired chemical parameters.

(3) Condensate Cleanup System

The inspector verified that the Condensate Cleanup System described in Section 10.4.6 of the FSAR is installed in each of the Brunswick units. Each system consists of a filter demineralizer subsystem (four Graver cartridge-type resin beds and associated precoating equipment) and a deep-bed subsystem (six mixed-resin beds and associated regeneration equipment). The description of the Condensate Cleanup System in the FSAR is no longer up to date because operation of the deep-bed system was changed significantly in 1978 when the radwaste evaporator that was used to process regener nt waste became inoperable. The licensee currently continually operates all four filter units (CFDs) in series (and upstream of) all six deep-bed units (CDDs). The CFDs are precoated when their differential pressures exceed specified limits, and the CDDS are removed when the conductivity of the effluent is higher or the flow is lower than specified limits. The licensee no longer regenerates the CDDs because of past problems with leakage of regenerant chemicals and the loss of the radwaste evaporator that had been used to recover the large amounts of demineralized water used to regenerate the resins. Because of the high purity of the condensate in Unit 1, the CFDs need to be precoated only every three to four weeks (during planned power reductions). Likewise, the CDDs are changed out when they are ~60% depleted and are expected to remain useful for 1.5 to 2 years if the conductivity of the condensate remains <0.06 umho/cm. The licensee trends the loading of the CDD by computer so that scheduling the replacement of the resin can be facilitated. All but one CDD has been changed out once since the condenser was retubed.

The licensee continually monitors the conductivity of the effluent of the CFD and the CDD, and these parameters are displayed and alarmed in the Radwaste Control Room. The efficiency of the cleanup system is monitored by also displaying the conductivity of the influent to the CFDs and the effluent from each CFD and each CDD, and alarms are located on the Radwaste Control Room board that are set at 0.25 umho/cm. Taps for obtaining 'grab' samples have also been located in the influent and effluent headers of the CFD so that individual contaminants can be monitored.

(4) Feedwater Lines

A third potential source of contaminants that might initiate corrosion is the transport of soluble and/or solid corrosion products from other parts of the reactor coolant system to the reactor itself. These materials, through plating out or precipitating on fuel elements or sensitized sites of stainless steel pipe, increase the possibility for localized pitting or stress corrosion as well as intergranular stress corrosion cracking (IGSCC). The generation and transport of corrosion products downstream of the Condensate Cleanup system is of special concern.

The inspector verified that the flow of condensate/feedwater downstream of the Condensate Cleanup System is as described in Section 10.3 of the FSAR, i.e., the effluent of the CFDs and CDDs is pumped by the condensate booster pump through two drain coolers and then three sets of feedwater heaters (Nos. 1, 2, and 3) to the suction of the feedwater pump and then through two high-pressure feedwater heaters (Nos. 4 and 5) to the reactor. The feedwater heaters use extraction steam taken from the high and low pressure turbines and from the moisture separator reheater.

During plant startup, the feedwater pipes downstream of the Condensate Cleanup System are flushed and the dissolved and solid contaminants (corrosion products from the carbon-steel pipe) are removed by cycling the water to the hotwell and then back through the Condensate Cleanup System. The licensee initially cycles and cleans the condensate lines as far as the condensate booster pumps and then cycles through Feedwater Heater No. 5. Therefore, only the feedwater line between Feedwater Heater No. 5 and the reactor is not flushed. When the plant begins to produce steam, the extraction steam that is directed to the feedwater heaters is condensed in two drain tanks, one for Feedwater Heaters 1 and 2 and another for the four intermediate and high-pressure feedwater heaters. The contents of these drain tanks are cycled (sucked) back to the hotwell as power ascension continues. Only when the quality of the water in the 'deaerator' (the drain tank for Feedwater Heaters 3, 4, and 5) is acceptable (i.e, <50 ppb solids and conductivity <0.2 umho/cm) may it be pumped forward to the feedwater lines to supply the additional feedwater (~30%) required for 100% plant power.

The inspector was informed that the tubes in all feedwater heaters are fabricated from 304L stainless steel. the licensee experienced "tiger striping" erosion of one section of the carbon steel extraction steam line in Unit 1 and has replaced this section in both units with chromium-mobybdenum steel. The licensee's water chemistry program requires that the feedwater be analyzed three times a week for iron, copper, chromium, and nickel to determine if oxides of these metals are being formed through corrosion and being transported to the reactor. The inspector audited the results of these analyses for Unit 1 for a period of six months and observed that the iron content was ~1 ppb while the concentrations of copper, nickel, and chromium were <0.1 ppb (based on large-volume samples).

(5) Reactor, Recirculation System, and Reactor Water Cleanup System

The inspector was informed that two leaking fuel rods were observed in the core of Unit 2 during its last fuel cycle. Neither leakers were attributed to corrosion or to chemical degradation. Unit 1 had one leaking fuel rod during its first fuel cycle but has had no problems attributable to abnormal chemistry. The vendor (General Electric) has inspected the internals of both cores and has observed the presence of solids that appeared as fluffy iron oxide. Also, iron oxide scale has been removed twice from the fuel elements of Unit 2 during its operational life.

Intergranular stress corrosion cracking (IGSCC) has been observed in welds in the Recirculation Systems of both Brunswick Units. The inspector was informed that major repair of the faulty welds in Unit 1 is planned during the next refueling outage (Spring 1985). As is discussed later in this report, evidence of IGSCC has also been found in a valve in the RWCU return line.

During the current outage for Unit 2 major modifications of the Reactor Water Cleanup System were being made to replace the regenerative heat exchangers. The licensee attributes the degradation of these heat exchangers to mechanical problems associated with the RWCU filter demineralizers in the past. The licensee has also had problems maintaining the desired efficiency of the RWCU demineralizers for the removal of iron from reactor water.

The licensee continually monitors the conductivity of water in the reactor, in the recirculation lines, and in the effluent of RWCU. Also grab samples from the reactor RWCU are taken to determine silica. As discussed earlier, the licensee attributes the silica concentration of ~100 ppb primarily to the water that is taken from the CST for use in the CRD system.

(6) Steam Lines

The inspector was informed that cracks had been observed in the keyway regions of disks in the low-pressure turbines of both units. Although these cracks have been attributed by the vendor to stress corrosion at points of steam condensation, there remains the possibility that crack initiation may be facilitated by the presence of oxides or corrosive anions that are carried over from the reactor in the steam. The licensee has initiated procedures to minimize stress on the disks by heating the rotors to a specified temperature before the turbine is rolled. Also, the licensee is planning to install and test two new designs of the vendor's rotors during future outrages of both units. The licensee's water chemistry program also requires that the conductivity of the main steam be continually monitored. "Grab" samples of the steam are also taken.

Summary

This review of the reactor coolant system revealed that the description of the main condense and the Condensate Cleanup System in the Brunswick FSAR needs to be updated.

The inspector's review of the design and operational experience of the two Brunswick units established that both units have IGSCC in the recirculation lines that may be attributed to improper chemical control of the reactor coolant. As will be discussed in greater detail in the next sections of this report, the factors that lead to IGSCC are only now being understood. Although the tube degradation that was experienced in the original main condenser of both units resulted in transients as high as 5 umho/cm in the conductivity of the condensate, the licensee was able to make effective use of the dual condensate cleanup system to prevent serious contamination of the feedwater. The ability to maintain the conductivity of the condensate in Unit 1 at ~0.06 mho/cm since the condenser in this unit was retubed indicates that inleakage has been essentially stopped. The licensee has opted to continue to use all units of the condensate cleanup system to provide the minimal polishing of condensate that is required and also to continue to provide protection from potential inleakage of the saline CCW. The licensee has also chosen to place the CFDs upstream of the CDDs so that the life of the CDDs is extended for approximately a fuel cycle. Although the CFDs must be precoated at least every month, the potential for contamination of the feedwater from resin fines is minimal since the CDDs are downstream of the CFDs. Also the licensee has eliminated the possibility of contaminating the feedwater with the corrosive chemicals used to regenerate cation and anion exchange resins by replacing the spent resin in the CDDs rather than regenerating the resin.

The licensee also protects the high quality of the feedwater by administratively controlling the cleanup of water from the feedwater drain tank before this water is cycled forward.

Except for the aluminum-bronze condenser tube sheets, none of the components in the reactor coolant system contains copper; therefore, the licensee has eliminated the corrosive environments, on fuel elements and structural components, that have been attributed in other BWRs to copper.

Although the presence of iron oxides, with or without copper oxides, on the internal surfaces of the reactor and the reactor fuel has been shown to facilitate chemical attack by such corrosive ions as chloride or sulfate, the presence of iron oxide in the reactors of the two Brunswick units has had no detrimental effect on the fuel rods. However, in addition to maintaining the conductivity of the reactor water as close as possible to that of pure water (i.e., 0.055 umhos/cm), the licensee should continue to closely monitor the formation, transport, and corrosive effect of iron oxides.

It is known that IGSCC can occur when the concentration of dissolved oxygen is at the level (~200 ppb) normally produced by radiolysis in a BWR. Although there are efforts underway to better understand the role of oxygen and to eliminate its adverse effect (by such means as hydrogen addition) the inspector was not informed of any plans to reduce the dissolved oxygen concentration in the reactor coolant of the two Brunswick units.

b. Scope and Adequacy of the Licensee's Water Chemistry Program

Control and surveillance of key chemical parameters in the reactor coolant (i.e., chloride and conductivity) are required by the Brunswick Technical Specifications (T.S. 3.3.5.6, Table 4.3.5.6-1, and 3.4.4-1). In addition, in Table 10.4.7-1 of the updated FSAR, the licensee has designated 29 key sampling points for determining the conductivity of the condensate/feedwater. Also, in Section 10.4.6 of the FSAR, upper limits are specified for the following chemical variables in the effluent of the condensate polishing system: specific conductivity, pH, chloride, silica, copper, and other metals.

The inspector established that the licensee is implementing the requirements of the Technical Specifications by means of a water chemistry program that is described in the following types of documents: Administrative Procedures, Administrative Instructions, Periodic Tests, and Environmental and Radiation Control (E&RC) Procedures. Through a review of these documents (especially the Administrative Procedures, E&RC-1000 "Sampling and Analysis Schedule for Technical Specification Related Radioactive and Non-Radioactive Chemistry", E&RC-1001 "Sampling and Analysis Schedule for Radioactive and Non-radioactive Non-Technical Specification Related Chemistry", and Abnormal Operating Procedure AOP-26.0 "High Reactor Coolant or Condensate Conductivity) the inspector verified that guidance and responsibilities had been established for the following:

(1) Organization and responsibilities of the E&RC Chemistry Group

(2) Identification of key chemical variables, allowable limits, control points, and frequency of sampling.

(3) Identification of procedures used to measure the values of critical variables

(4) Procedures for the recording and management of data

(5) Procedures defining corrective actions for abnormal conditions (for both chemistry and operations personnel)

Critical chemical parameters have been identified, and their allowable limits specified, on the basis of fuel warranty requirements, Technical Specifications, and industry experience. The inspector observed that the licensee is also actively involved, with the BWR Owners Group and the Electric Power Research Institute (EPRI), in establishing guidelines for appropriate water chemistry conditions in the cooling systems of BWRs. Through interviews of licensee personnel, the inspector concluded that management of the plant and at corporate levels are committed to and supportive of the Brunswick water chemistry program.

On the basis of this portion of the inspection, and using the draft BWR owners Group/EPRI Guidelines as a yardstick, the inspector concluded that the licensee has developed the elements of an effective water chemistry program.

c. Implementation of the Brunswick Water Chemistry Program

In this portion of his inspection the inspector assessed the licensee's efforts to implement the requirements of the Brunswick Technical Specifications and the objectives of the water chemistry program. This assessment was based on discussions with plant personnel, a limited review of selected instruction and procedures, and an audit of recent data obtained for Unit 1. This part of the inspection is summarized as follows:

(1) Activities related to the water chemistry program (and radiochemistry) are performed by the Chemistry Section of the Environmental and Radiation Control (E&RC) Department under the Manager - E&RC. The inspector established that the Chemistry Section is currently staffed to the extent described in the Plant Administrative Procedures; i.e., Environmental and Chemistry Supervisor, four foremen, and 27 technicians. The Chemistry Section also has a support group that consists of three chemical specialists, two engineers, and two technicians who also report, through the Project Specialist, to the Manager-E&RC and who assist in all areas of plant chemistry.

All members of the Chemistry Section are required to meet the requirements of ANSI Standard N18.1-1971 "Selection and Training of Nuclear Plant Personnel." Technicians are qualified in chemistry procedures through an on-the-job-training program and through more formal classroom training provided by the Corporate Training Department.

(2) The requirements of the Technical Specifications and the water chemistry program (specifically Procedures E&RC-1000 and E&RC-1001) as well as other program-related responsibilities are implemented on three work shifts. Essentially all analyses, except for conductivity, are performed on 'grab' samples that are taken according to Procedure E&RC-1005 "Collection of Routine and Nonroutine Samples" (The inspector was informed that plans are underway to install inline oxygen monitors and to upgrade the stations used to take grab samples). Procedures E&RC 1000 and 1001 also specify which E&RC Procedure is to be used for determining critical chemistry parameters, the calibrations that are required, and the actions to be taken if a parameter is outside its allowable limit. In general, corrective action consists of bringing the abnormal situation to the attention of chemistry supervision and the plant shift foreman in the control room. The basic instruction for subsequent action by the Operations Department is given in abnormal Operating Procedure 26.0 "High Reactor Coolant or Condensate Conductivity." This action consists primarily of modifying the operation of the condenser water boxes and/or the condensate cleanup system, increasing chemical surveillance, and, if necessary, decreasing the power level of the unit.

The inspector audited the results of analyses performed per Procedure E&RC-1000 for the period January, February, and March 1984, and verified that the requirements of Technical Specification 3/4 4.4-1 (determination of chloride and conductivity) had been implemented satisfactorily. Likewise, the inspector established that the analyses specified in Procedure E&RC-1001 for corrosion products in the feedwater and reactor water had been performed during the period January - June 1984. As stated earlier in this report, the concentrations of iron and copper in the feedwater was <5 ppb and 0.05 ppb respectively and, in the reactor water these concentrations usually were <50 ppb and <10ppb although a few data indicated iron concentrations of 100 ppb and copper concentrations of 30 ppb.

(3) The results of trace-metal analyses presented above are indicative of the sensitivity of the state-of-the-art analytical equipment in the licensee's chemistry laboratory. The inspector observed that equally sensitive instrumentation was being used to analyze the condensate/feedwater/reactor water for chloride. Less emphasis was being placed on the concentration of sulfate, and other

corrosive anions, that are known to aggravate (if not initiate) IGSCC.

During this inspection the inspector was informed that indications of IGSCC had been found in the interior surfaces of a 4-inch globe valve in the RWCU return line (valve G31-F042) of Unit 2. The cause of these cracks had not been established; however, the inspector was concerned that the cracks might be attributed, in part, to fragments of ion-exchange resins, or sulfate-containing degradation products of these resins, from the upstream RWCU filter demineralizer. The inspector discussed with the licensee the benefit of monitoring the RWCU effluent and the reactor coolant for sulfate as well as chloride even though the conductivity of the RWCU effluent, in Unit 1, is always low (0.07-0.09 umho/cm). Pending resolution of the cause of IGSCC in this valve, this subject will be designated as Inspector Followup item 84-23-02 "Role of Ionic Impurities in the Cracking of Valve G31-F042 in Unit 2."

(4) The inspector established that the results of all chemical tests are reviewed daily by supervisory personnel of chemistry section and then entered into a computerized data base. The values of control and diagnostic chemical variables taken at key points in the condensate/feedwater/reactor coolant train are entered into a computerized data base and a daily report is subsequently distributed to selected members of plant management.

(5) The Condensate Cleanup System and the Makeup Water Treatment Plant are operated by the Radwaste Section of the Operations Department. The present staff consists of a supervisor, five control operators, and 15 auxiliary operators - each of whom have had two years or more experience. The inspector was informed that these operators have gone through a training program that consists of lectures, hands-on experience and oral and written examinations based on Training Instruction 106. The inspector reviewed Training Instruction 106 and verified that it provided detailed information for operating and regenerating (or precoating) both the filter demineralizers used in the CFD and the deep-bed demineralizers used in the CDD.

The inspector was also informed that the Radwaste Section currently operates with five shifts but would soon change to a six-shift organization with each shift consisting of a foreman, a control operator and two auxiliary operators.

The filter demineralizers that are used in the RWCU system are precoated and operated by the Auxiliary Control Operators in the Operations Department.

Summary

During this part of the inspection no violations or deviations were identified. Although the inspector verified that the surveillance of chloride and conductivity that is required by Technical Specification 3/4 4.4-1 is being performed, he did not determine if the other chemistry-related Technical Specification, TS 3.3.5.6, was also being implemented. Technical Specification 3.3.5.6 requires the licensee to have in line chloride intrusion detectors that are operable or else take compensatory measures to monitor the chloride content of the condensate (at the hotwell outlet header, the condensate pump discharge, as well as at the inlets of the CFD and CDD). The inspector was informed that conductivity was measured in lieu of chloride because in-line chloride detectors were less reliable. The licensee's surveillance program places great reliance on both in-line and grab-sampling measurements of conductivity at sample points associated with essentially every component of the condensate/feedwater system. Some in-line conductivity cells are for control use and have a range of 0-1 umho/om while others are for monitoring inleakage and have ranges of 0-10 umho/cm or 0-100 umho/cm. The inspector did not determine which measurements are used to implement Technical Specification 3.3.5.6, and will designate this action as Inspector Followup Item 84-23-01 "Implementation of Technical Specification 3.3.5.6."

The draft guidelines prepared by the BWR Owners Group and EPRI state that "IGSCC can occur in 280°/200 ppb of dissolved oxygen, even at conductivity levels well below those achievable in an operating plant, but that the rate of cracking decreases with impurity content. Except for the possibility of 'throw' of trace amounts of sulfate and chloride from the CDD and the RWCU demineralizer, the inspector considers that the licensee is maintaining the concentration for ionic species in the reactor water (i.e., the conductivity) at a level that will minimize initiation or propagation of IGSCC. The licensee's policy of continually using all CFDs and CDDs for 100% condensate flow will ensure that the condensate is adequately polished as well as will provide a defense for timely protection of the reactor against an intrusion of saline CCW. The inspector also considers the use of a full-time, well-trained Radwaste staff for the operation of the Condensate Cleanup System to be an important and positive policy.

The licensee is following the investigations by EPRI and General Electric to prevent IGSCC through the reduction of the concentration of dissolved oxygen in the reactor water by the addition of hydrogen gas to the feedwater. The inspector was not informed of any plans to implement a hydrogen water chemistry program at either Brunswick units.