UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

March 16, 1981

Docket No. 50-219
LS05-81-03-033

Mr. I. R. Finfrock, Jr.
Vice President - Jersey Central
Power & Light Company
89 East Avenue
Framingham, New Jersey 14649

Dear Mr. Finfrock:

RE: SEP TOPICS V-5, REACTOR COOLANT PRESSURE BOUNDARY LEAKAGE DETECTION AND V-12.A, WATER PURITY OF BOILING WATER REACTOR PRIMARY COOLANT-OYSTER CREEK NUCLEAR POWER PLANT

Enclosed are copies of our evaluation of Systematic Evaluation Program Topic V-5, Reactor Coolant Pressure Boundary (RCPB) Leakage Detection and V-12.A, Water Purity of Boiling Water Reactor Primary Coolant. These assessments compare your facility, as described in Docket No. 50-219, with the criteria currently used by the regulatory staff for licensing new facilities. Please inform us if your as-built facility differs from the licensing bases assumed in our assessments within 30 days of receipt of this letter.

These evaluations will be basic inputs to the integrated safety assessment for your facility unless you identify changes needed to reflect the as-built conditions at your facility. These topic assessments may be revised in the future if your facility design is changed or if NRC criteria relating to these topics is modified before the integrated assessment is completed.

In future correspondence regarding this topic, please refer to the topic number in your cover letter.

Sincerely,

Dennis M. Crutchfield

Dennis M. Crutchfield, Chief
Operating Reactors Branch No. 5
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DS4 USE (51)

Enclosure:
SEP Topic V-5 and V-12.A

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See next page

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OYSTER CREEK

SYSTEMATIC EVALUATION PROGRAM TOPIC V-5
REACTOR COOLANT PRESSURE
BOUNDARY (RCPB) LEAKAGE DETECTION

I. Introduction

The safety objective of Topic V-5 is to determine the reliability and sensitivity of the leak detection systems which monitor the reactor coolant pressure boundary to identify primary system leaks at an early stage before failures occur.

II. Review Criteria

The acceptance criteria for the detection of leakage from the reactor coolant pressure boundary is stated in the General Design Criteria of Appendix A, 10 CFR Part 50. Criterion 30, "Quality of Reactor Coolant Pressure Boundary", requires that means shall be provided for detecting and, to the extent practical, identifying the location of the source of leakage in the reactor coolant pressure boundary. Criterion 32, "Inspection of Reactor Coolant Pressure Boundary", requires that components which are part of the reactor coolant pressure boundary shall be designed to permit periodic inspection and testing to assess their structural and leak tight integrity.

III. Review Guidelines

The acceptance criteria are implemented by the Nuclear Regulatory Commission in Section 5.2.5, "Reactor Coolant Pressure Boundary Leakage Detection", and Section 5.2.4, "Reactor Coolant Pressure Boundary Inservice Inspection and Testing", of the Standard Review Plan. The areas of the Safety Analysis Report and Technical Specifications are reviewed to establish that information submitted by the licensee is in compliance with Regulatory Guide 1.45, "Reactor Coolant Pressure Boundary Leakage Detection Systems", and that the inservice inspection programs are based on the requirements of Section XI of the ASME Boiler and Pressure Vessel Code, "Rules for the Inservice Inspection of Nuclear Power Components". Although not a part of this review, the consequences of break and crack location in component failures is analyzed and evaluated in Section 3.6.1, "Plant Design for Protection Against Postulated Piping Failures in Fluid Systems Outside Containment", and Section 3.6.2, "Determination of Break Locations and Dynamic Effects Associated with Postulated Rupture of Piping", of the Standard Review Plan.

IV. Evaluation

Safety Topic V-5 was evaluated in this review for compliance of the information submitted by the licensee with Regulatory Guide 1.45, "Reactor Coolant Pressure Boundary Leakage Detection Systems." The information in the Safety Analysis Report and Technical Specifications was substantiated by telephone conversation with the licensee. Regulatory Guide 1.45 requires that at least three separate detection systems be installed in a nuclear power plant to detect an unidentified leakage from the reactor coolant pressure boundary of one gallon per minute within one hour. Leakage from identified sources must be isolated so that the flow rates may be monitored separately from unidentified leakage. The detection systems should be capable of performing their functions following seismic events and capable of being checked in the control room. Of the three separate leak detection methods required, two of the methods should be (1) sump level and flow monitoring and (2) airborne particulate radioactivity monitoring. The third method may be either monitoring of condensate flow rate from air coolers or monitoring of airborne gaseous radioactivity. Other detection methods, such as humidity, temperature and pressure, should be considered to be alarms or indirect indication of leakage to the containment. The requirements of Reg. Guide 1.45 and Standard Review Plan 5.2.5 and plant incorporated systems that meet those requirements are tabulated in Table 1.

The licensee has stated that there are five indicators of leaks inside the drywell - equipment drain pump flow, floor drain pump flow, closed cooling water temperature rise, drywell temperature rise, and drywell pressure rise.

The primary means of detecting leaks inside the drywell are the equipment drain sump and the floor drain sump. The floor drain sump is equipped with alarms which actuate if the sump pump out rate exceeds a predetermined value. The sump and drain tanks will be equipped with two alarms for redundancy. The alarms are actuated by level switches and timers which measure the time between pump operation. The pump activates on high sump level and pump out until the sump water level is reduced to the low trip point when pump out stops. The only source of leakage inside the drywell besides the primary system is from the closed cooling water. Since the closed cooling water is chromated, chemical analysis of the water in the sump can determine if the leakage is from the closed cooling water system without visual inspection.

If this time period is shorter than that corresponding to some preselected average sump flow rate, thus indicating excessive flow into the sump, the alarms trip. The exact setting of the trip on the floor drain sump will vary as the identified inncouous leakage into the floor drain sump varies based on previous operating experience. The alarms on the floor drain will be set at the normal, identified leakage plus 80 percent of the technical specification limit of 15 gpm for unidentified leakage. The alarms on the equipment drain tank will be set to alarm at a flow rate such that the total leakage (floor drain plus equipment drain) does not exceed the proposed technical specification limit of 50 gpm for total leakage. The reactor will be shutdown if either the floor drain sump is 15 gpm above normal or if the total of the floor sump flow plus equipment drain flow reaches 50 gpm.

As an additional qualitative backup to the floor drain sump, the drywell atmospheric conditions are monitored. Because the drywell is a closed, relatively compact vessel, the drywell temperature, pressure, and humidity respond promptly to leaks from the primary system thus providing the operator with additional intelligence. However, this system is not quantitative since fluctuations in atmospheric conditions are normally expected, and quantitative measurements are not possible. But the increase in these parameters does serve to alert the operator. Calculations show that a detectable increase in dewpoint temperature should occur for steam leaks equivalent to about 2 gpm of condensate, and for liquid breaks of 5 gpm. The dewpoint is continuously recorded and will be periodically checked. An increase in drywell temperature (5-10 F) as well as pressure (0.5-0.7 psi) will occur in the event of a 5 gpm steam leak, or a 10 gpm primary coolant liquid leak. Drywell temperature and pressure are both monitored in the control room and the temperature is also recorded. Slightly larger leaks will result in an alarm due to high drywell pressure. At a steam leak of about 12 gpm, the reactor will scram due to high drywell pressure in less than 30 minutes from the onset of the leak.

V. Conclusion

Regulatory Guide 1.45, Regulatory Position 3 requires that three systems be employed to detect leakage from the reactor coolant pressure boundary. This requirement is met by the Oyster Creek leak detection systems. Regulatory Position 5 requires that the system should be capable of detecting leakage at a rate of 1 gpm or its equivalent (for steam leakage) in less than 1 hour. The evaluation above points out that the Oyster Creek leak detection systems do not have the required sensitivity. A decision as to the need to upgrade these systems will be made as a part of the integrated safety assessment.

Table 1 - Reactor Coolant Pressure Boundary Leakage Detection System

System	Plant Incorporated System	S.R.P. 5.2.5 or Reg Guide 1.45 Requirement
1) Sump Level Monitoring (Inventory)	X	Yes, 1 or 2 Mandatory
2) Sump Pump Actuations Monitoring (Time Meters)		Yes, 1 or 2 Mandatory
3) Airborne Particulate Radioactivity Monitoring	X	Yes Mandatory
4) Airborne Gaseous Radioactivity Monitoring		Yes, 4 or 5 Mandatory
5) Condensated Flow Rate from Air Coolers	x	Yes, 4 or 5 Mandatory
6) Containment Atmosphere Pressure Monitoring		Yes Optional
7) Containment Atmosphere Humidity Monitoring		Yes Optional
8) Containment Atmosphere Temperature Monitoring	X	Yes Optional
9) CVCS Makeup Flowrate		Yes Optional
10) Portable Ultrasonic Detectors		Yes Optional
11) Air Conditioner Coolant Temperature Rise	X	No
12) Drywell Atmosphere Pressure Monitoring	X	?
13)		

OYSTER CREEK

TOPIC V-12.A WATER PURITY OF BOILING WATER REACTOR PRIMARY COOLANT

Topic V-12.A was included in the Systematic Evaluation Program in order to determine the degree of compliance of operating Boiling Water Reactors to the recommendations of Regulatory Guide 1.56, "Maintenance of Water Purity in Boiling Water Reactors." Regulatory Guide 1.56, Revision 1, July 1978, was specifically identified by the NRC's Regulatory Requirements Review Committee as needing consideration for backfit on operating reactors. The purpose of this review is to document whether the facility complies with the recommendations of Regulatory Guide 1.56 or with an equivalent alternative procedure acceptable to the NRC staff. The acceptability or non-acceptability of the identified deviations and the need for further action are judgements which will be made during the integrated review of the facility.

The review was based on information presented by the licensee in the Technical Specifications for the Oyster Creek facility, the Facility Description and Safety Analysis Report (FDSAR), plant and component drawings, and telephone conversations with plant personnel on June 18, 20 and 21, 1979. The inform tion was compared with the requirements of Revision 1 of Regulatory Guide 1.56 issued "For Comment" in July, 1978, which contain the latest approved NRC guidance.

The recommended regulatory position is that the condensate demineralizers in boiling water reactors should be designed and operated to permit an orderly shutdown of the reactor in case of serious leakage in the condenser or heat exchanger without contaminating the reactor coolant pressure boundary or core structural components with potentially harmful constituents of the condenser cooling water. Although our review indicated an area of concern for the acceptability of the licensee's method for compliance to position C.4 of the Regulatory Guide (requiring determination of demineralizer capacity) the main condenser of the Oyster Creek facility was retubed with titanium in 1976 in order to preserve the integrity of the coolant pressure boundary and prevent inleakage to the primary reactor coolant. Additional credit for compliance with the intent of Regulatory Guide 1.56 might be given to the Oyster Creek facility for the corrosion resistance of titanium to replace cupro-nickel alloy tubes in the condenser.

The specific points of the Regulatory Guide 1.56 regulatory positions are quoted below and an explanation of the licensee's degree of conformance follows.

I. Regulatory Position 1.

The licensee should establish appropriate limits for the electrical conductivity of purified condensate to the reactor vessel (the electrical conductivity of the BWR feedwater cycle and that of the reactor water cleanup cycle). Separate limits may be required for such operating conditions as startup, hot standby, low power, high power, and at temperatures ≤212°F (100°C).

Chemical analyses for dissolved and suspended impurities should be performed as called for in the plant technical specifications. A conductivity meter should be provided at each condenser hotwell or in the line between the hotwell and the condensate demineralizer with sufficient range to measure at least all levels of conductivity up to and including the limiting conditions of the technical specifications that require immediate shutdown of the reactor. The recording conductivity meters recommended in regulatory position 4.a may be used for this purpose.

Discussion

Technical Specification 3.3.E.1 sets a limit of 2 umho/cm for steaming rates to the turbine condenser of less than 100,000 lbs/hr. (rated steamflow of Oyster Creek is 5.850 X 10^6 lbs/hr.). Regulatory Guide 1.56 suggests a limit of 2 umho/cm for steaming rates less than one percent of rated steamflow. Technical Specification 3.3.E.2 sets a limit of 10 umho/cm for steaming rates of at least 100,000 lbs/hr. Regulatory Guide 1.56 suggests a limit of 1 umho/cm for steaming rates greater than one percent of rated steamflow, with a maximum limit of 10 umho/cm (not to exceed 72 hours for any single incident, with total time for all such incidents not to exceed two weeks per year). At the maximum limit, an orderly shutdown should be commenced.

Regulatory Guide 1.56 sets a limit for condensate system water at the inlet to the demineralizer of 0.5 umho/cm and at the outlet the limit is 0.1 umho/cm. Oyster Creek has no technical specification limits for condensate conductivity however, alarm setpoints of the conductivity meters at the influent and effluent of the Oyster Creek demineralizers are 0.3 umho/cm and 0.25 umho/cm, respectively. These alarms notify plant personnel of marginal performance of demineralizer units and indicate the need for resin regeneration.

Technical Specification 4.3.E states that a sample of reactor coolant shall be analyzed at least every 72 hours for the purpose of determining chloride and conductivity. Specific analyses for dissolved and suspended impurities are not performed.

Conductivity meters are located at each hotwell of the three condensers and in the line between the hotwell and condensate demineralizer units. These are discussed in more detail in Section IV.

Areas of Concern

a. Oyster Creek has no provisions for the time-related conductivity limit of 1 umho/cm.

b. Oyster Creek has no conductivity limits for the condensate system.

c. Analyses for dissolved and suspended impurities are not performed.

Recommendations

a. We believe that the time-related normal operating limit of 1 umho/cm should be observed. Oyster Creek's limit of 10 umho/cm meets the regulatory position's maximum limit but significantly enhances the possibility of corrosion failures for extended periods of operation near that limit.

b. The specific conductivity limits for condensate system water were established to monitor possible marginal performance of demineralizer units. We believe that the alarms of the conductivity meters at the influent and effluent of the demineralizers will fulfill that function, especially because the influent alarm is set conservatively.

c. Analyses for chloride and conductivity, performed at least every 72 hours, will indicate the presence of significant quantities of dissolved and suspended impurities. We feel the present analysis procedure is sufficient.

II. Regulatory Position 2.

The licensee should establish the sequential resin regeneration frequency or resin replacement frequency required to maintain adequate capacity margin in the condensate treatment system for postulated condenser cooling water inleakage. The capacity required and corresponding resin regeneration or replacement frequency will depend on several parameters, including condenser cooling water composition, chloride concentration, flow rate in each demineralizer unit, type and quantity of resin, cation/anion resin ratio, postulated condenser leakage, and time for orderly reactor shutdown.

Discussion

In the condensate treatment system, the resins of the demineralizer units are regenerated approximately once every week. The resins in the reactor water clean-up system are replaced (not regenerated due to high radioactivity levels) approximately once a year. In both systems, the frequency of replacement or regeneration is determined by conductivity readings and not upon capacity calculations. Specifically, the exact time for replacing the resins in the clean-up system is based upon conductivity measurements, and the frequency of regeneration in the condensate system is determined from operating experience and conductivity measurements.

The issue of maintaining adequate capacity margin is not being addressed at Oyster Creek. The need for resin capacity calculations at Oyster Creek is discussed in Section IV.

Areas of Concern

Refer to Section IV.

III. Regulatory Position 3.

The initial total capacity of the new anion and cation demineralizer resins should be measured. Anion exchange capacity may be determined by a procedure recommended by the resin manufacturer. The total exchange capacity of the cation resin may be measured by a procedure recommended by the resin manufacturer or by paragraphs 41 through 49 of ASTM D2187-71, "Standard Methods of Test of Physical and Chemical Properties of Ion-Exchange Resins." For resins that are to be regenerated, these deter ions should be repeated at least semi-annually. The resins shou discarded and replaced when their capacity following regenerati falls below 60 percent of the initial value. More frequent determinations should be made at plants using seawater or other water containing large amounts of dissolved or suspended matter as coolant in their heat exchangers. 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 of new material at least once a year (when the time between replacements is less than 1 year) or at each replacement (when the time between replacements exceeds 1 year). When the type of anion or cation resin is changed, a measurement of total capacity of the replacement resin should be made prior to use in the demineralizer.

Discussion

The initial total capacity of demineralizer resins is specified by the supplier's documentation which refers to several ASTM standards (including ASTM D2187-71) which apply to resin capacity. The Jersey Central Power & Light Company, the licensee, checks samples at its laboratory to confirm the purchase specifications.

For the condensate treatment system, capacity measurements are made periodically during regeneration periods (not at every regeneration but at periods shorter than six months). The resins are discarded when capacity falls below 60 percent of the initial value. For the reactor water clean-up system, capacity measurement is made at each replacement.

Areas of Concern

None.

Recommendations

Oyster Creek satisfies Regulatory Position 3.

IV. Regulatory Position 4.

The licensee should verify that the minimum residual demineralizer capacity in the most depleted demineralizer unit established in accordance with the recommendations of regulatory position 2 is maintained. The following is an example of an acceptable method for determining the condition of the demineralizer units so that the ion exchange resin can be replaced or regenerated before an unacceptable level of depletion is reached.

a. Recording conductivity meters should be installed at the inlet and outlet of both the condensate treatment system and reactor water cleanup system. The range of these instruments should be sufficient to measure all levels of potential water conductivity specified in the plant technical specifications. For the condensate treatment system, the conductivity meter readings should be calibrated so that estimates of condenser leakage can be made based on cooling water conductivity, condensate conductivity, and flow rate. The chemical composition of the cooling water and its relation to specific conductance should be established and periodically confirmed so that estimates of residual demineralizer capacity can be made.

b. A recording flowmeter should be used to measure the rate of flow through each demineralizer.

c. The quantity of the principal ion(s) likely to cause demineralizer breakthrough should be calculated by:

(1) Converting the conductivity reading of the water entering the demineralizer to weight fraction (e.g., ppm or ppb) of the principal ion(s) and

(2) Integrating over time the product of concentration of this ion(s) and demineralizer flow.

The input quantity of ion(s) to the demineralizers should be determined at a frequency adequate to ensure sufficient residual ion exchange capacity in the event of a major condenser leakage to prevent exceeding reactor coolant limits.

d. Each demineralizer unit should be replaced or regenerated when the remaining capacity (calculated by subtracting the total utilization determined from conductivity and flow measurements in accordance with regulatory position 4.c from the initial capacity determined in accordance with regulatory position 3) approaches the minimum residual demineralizer capacity determined in accordance with regulatory position 2. The accuracy of the above calculation should be checked by measurements made on resin samples taken when demineralizer units are removed from service for regeneration or resin cleaning. Measurements on samples from each unit should be made at each of the first two such removals from service and at every fifth such removal from service thereafter. If appropriate, the actual measurements may be used to adjust the calculated value of residual demineralizer capacity. Such adjustment and its justification should be reported to the NRC in the annual operating report.

Discussion

Recording conductivity meters are located at the inlet and outlet of the reactor water clean-up system. They are shown on Figure X-2-1 in the FDSAR. The readings appear in the control room. Figure X-2-1 also shows a recording flowmeter. The flowmeter reading is not transmitted to the control room.

The condensate treatment system is equipped with a number of conductivity meters and flowmeters. On the common inlet to the seven demineralizer units (only six are in service at any one time with the seventh in regenerated standby) are three conductivity cells (ranges are in umho/cm: 0-1, 0-10, and 0-100). On the common outlet there are three cells with the same ranges. On the discharge of each of the seven demineralizers there are a conductivity meter and a flowmeter. The flowmeters consist of a flow element, a transmitter, and an indicator.

Estimates of condenser cooling water leakage can be made using the readings on the conductivity meters located at each condenser hotwell. The chemical composition of the cooling water to the condenser and its conductance are not measured periodically, but past experience and tables of the composition of the cooling water exist to allow calculations of condenser inleakage based upon cooling water conductivity, condensate conductivity, and the flow rate.

The quantity of the principal ions flowing through the demineralizer units is not currently being measured at Oyster Creek. The licensee believes that conductivity measurements and frequent regeneration of the resins will ensure sufficient residual ion exchange capacity in the event of a major condenser leakage. We disagree.

The condensate demineralizers should be designed and operated so as to permit an orderly shutdown of the reactor in case of serious leakage in the condenser without contaminating the reactor coolant pressure boundary or core structural components with potentially harmful constituents of the condenser cooling water. It should be noted here that Oyster Creek replaced the tubes in the main condenser from a copper-nickel alloy to titanium in the early part of 1976. Since replacement there have been no leaks aside from an initial one immediately following the fitting process.

Demineralizer capacity reduction should be considered in the design so that there is adequate capacity margin available to permit orderly shutdown of the reactor in case of a serious condenser leak. The capacity of a demineralizer unit is determined indirectly from the initial capacity of the unit and subtracting from that the calculated flow of ions through the unit.

Operation of a demineralizer unit after its ion-exchange capacity has been depleted results in the direct pass-through of ions into the reactor vessel resulting in stress-corrosion cracking, crud buildup on fuel, and a possible increase in plant radiation levels.

Simply monitoring the conductivity of the inlet and outlet water of the demineralizer units will not give an accurate measure of residual demineralizer capacity; instead, the quantity of principal ions flowing through the demineralizer must be calculated. The process of maintaining sufficient demineralizer capacity is explained in regulatory positions C.4.c and C.4.d of Regulatory Guide 1.56.

Areas of Concern

a. Oyster Creek has not determined the minimum capacity margin for the demineralizer units, based on the parameters listed in regulatory position 2.

b. At Oyster Creek, resin regeneration frequency for the condensate treatment system is determined by past experience and conductivity readings. Instead, frequency should be established to maintain adequate capacity margin for postulated condenser cooling water inleakage in accordance with regulatory position 2.

c. The calculations stated in regulatory position 4.c are not being performed at Oyster Creek. These calculations should be performed to ensure sufficient residual ion exchange capacity in the event of major condenser leakage.

d. Based upon the calculations of "area of concern" c., resins should be regenerated before unacceptable levels of capacity depletion are reached.

e. The accuracy of the above calculations should be checked by measurements made on resin samples taken at regeneration periods.

f. The chemical composition and conductivity of the condenser cooling water is not being periodically confirmed at Oyster Creek.

Recommendations

a. We believe that this calculation needs to be performed.

b. We believe that capacity considerations, along with conductivity measurements and past experience, should play a part in the establishment of the frequency of resin regeneration.

c.d.e. As explained in the discussion, capacity margins must be maintained to protect the reactor coolant pressure boundary in the event of major condenser leakage. It is true that major leakage is unlikely with Oyster Creek's titanium tubing in the main condenser and that Oyster Creek has one of its seven demineralizer units on standby; however, we note that Oyster Creek uses salt water from Barnegat Bay thereby exposing the tubing to a harsh medium. More significantly, areas c., d., and e. involve only calculations and moderate procedural changes. No hardware needs to be changed or added. In light of the importance of capacity calculations and the moderate effort required of the licensee in this respect, we believe that the calculations and procedures outlined in regulatory positions C.4.c and C.4.d should be implemented.

f. Past experience and tables exist as to the chemical composition of the cooling water. We believe that calculations of condenser inleakage can be adequately performed with that information. Water quality in Barnegat Bay is unlikely to change significantly.

V. Regulatory Position 5.

The conductivity meter(s) located at the inlet and outlet of the demineralizer(s) of the condensate treatment system and the reactor water cleanup system should be set to trigger alarms in the control room when, as a minimum, either of the following conductivity levels is reached (values of which should be determined by the licensee):

a. The level that indicates marginal performance of the demineralizer systems.

b. The level that indicates noticeable breakthrough of one or more demineralizers.

Discussion

Alarms from conductivity meters to the control room are in place for the reactor water clean-up system and the condensate treatment system. The alarms at the influent to the condensate demineralizers are set at .3 umho/cm to indicate marginal performance of the demineralizer systems and at 50 umho/cm to indicate gross leakage in the condenser. At the effluent of the condensate demineralizers, the alarms are set at .25 umho/cm and at 50 umho/cm. In addition, an alarm set at .15 umho/cm is located on the outlet of each of the seven demineralizer units.

Areas of Concern

None.

Recommendations

Oyster Creek meets this regulatory position.

VI. Regulatory Position 6.

The chloride content in the reactor vessel water should be maintained as low as practical. The ionic equilibria of the reactor vessel water should be controlled to ensure a neutral pH. The licensee should establish limits for conductivity, pH, and chlorides in the reactor vessel water and should specify procedures to be used for their determination. Acceptable reactor water chemistry limits are given in Table 1 of the appendix to this guide. If the limiting values of the conductivity, pH, or chloride content are exceeded, appropriate corrective actions as defined in the plant technical specifications should be taken.

Discussion

Technical Specification 3.3.E.1 sets a limit of .1 ppm chloride for steaming rates to the turbine-condenser of less than 100,000 lbs/hr. Regulatory Guide 1.56 sets a limit of .1 ppm for steaming rates of less than one percent of rated steamflow. Technical Specification 3.3.E.2 sets a limit of 1.0 ppm chloride for steaming rates of at least 100,000 lbs/hr. Regulatory Guide 1.56 sets a maximum limit of .5 ppm for steaming rates greater than one percent of rated steamflow.

The limit of 1.0 ppm chloride for power operation is explained in Technical Specification Bases 3.3, as follows:

"Chloride stress corrosion tests on stressed 304 stainless steel specimens have been reported (Licensing Application Amendment 11, Question VI-4). According to the data, allowable chloride concentrations could be set over an order of magnitude higher than the established limit of 1.0 ppm at the oxygen concentration (0.2-0.3 ppm) that will be present during power operation. Oxygen is maintained at low levels by the turbine-condenser off-gas system. Zircaloy does not exhibit similar stress corrosion failures."

No limits on pH are established for Oyster Creek. The close interrelationship between pH and conductivity decreases the need for an independent measure and control of pH levels. In Technical Specification Bases 3.3 the following argument is presented:

"In the case of BWRs where no additives are used in the primary coolant, and where neutral pH is maintained, conductivity provides a very good measure of the quality of the reactor water. When the conductivity is within its proper range, pH, chloride, and other impurities affecting conductivity and water quality must also be within their normal ranges. Significant changes in conductivity provide the operator with a warning mechanism so that he can investigate and remedy the conditions causing the change. Measurements of pH, chloride, and other chemical parameters are made to determine the cause of the unusual conductivity and investigate proper corrective action. These can be done before limiting conditions, with respect to variables affecting the boundaries of the reactor coolant, are exceeded."

Technical Specification 3.3.E.3 states that if limits of chloride and conductivity (according to Technical Specifications 3.3.E.1 and 2 stated above) are exceeded, the reactor will be placed in cold shutdown. Technical Specification Bases 3.3 explains further the nature of the corrective actions:

"Several techniques are available to correct off-standard reactor water quality conditions including removal of impurities from reactor water by the clean-up system, reducing input of impurities causing off-standard conditions by reducing power and placing the reactor in the cold shutdown condition. The major benefit of cold shutdown is to reduce the temperature dependent corrosion rates and thereby provide time for the clean-up system to re-establish proper water quality."

Areas of Concern

a. Oyster Creek's limit on chloride concentration exceeds that of the regulatory position.

b. Oyster Creek has no limit on pH levels in the coolant water.

Recommendations

a. We believe that the limits of Regulatory Guide 1.56 should be observed. Oyster Creek's basis for the limit of 1.0 ppm chloride for power operation depends on the maintenance of low levels of oxygen by the turbine-condenser off-gas system. In light of that fact and the recommendation of NUREG-0531 for oxygen control in BWR's, we feel that the separate limit for chloride should be observed.

b. We agree with Oyster Creek's position in that pH measurements are not required as part of periodic sampling. However, should conductivity levels exceed their normal values, pH and chloride analyses would provide substantial information regarding the source and extent of the problem. Therefore we believe such analyses should be required when conductivity levels are off-normal.

VII. Conclusion

Regulatory Guide 1.56, Revision 1, "Maintenance of Water Purity in Boiling Water Reactors" describes methods acceptable to the NRC staff for implementing General Design Criteria 13, 14, 15 and 31 of Appendix A, 10 CFR Part 50. The intent of the Regulatory Guide is to recommend procedures to minimize the probability of corrosion-induced failure of the reactor coolant pressure boundary in boiling water reactors by maintaining acceptable purity levels in the reactor coolant. This is accomplished by prescribing instrumentation for determining the condition of the reactor coolant and the coolant purification system. The provision for maintaining the water purity of the reactor coolant meets the intent of the recommendations of Regulatory Guide 1.56.

In addition, the frequent regeneration of the demineralization resins of the condensate demineralizer system, the presence of one standby demineralization unit out of the total of seven, and the retubing of the main condenser with titanium tubes exceed the intent of the regulatory recommendations.

However, we conclude from our review of the information provided by the licensee that the following areas are not resolved satisfactorily for strict compliance to the recommendations of Regulatory Guide 1.56.

I.a. Oyster Creek has no provisions for the time-related conductivity limit of 1 umho/cm.

IV.a.b.c.d.e. Oyster Creek does not calculate the quantity of principal ions flowing through the demineralizer units and thus has no accurate account of residual ion exchange capacity of the resins.

VI.a. Oyster Creek has a chloride limit of 1.0 ppm chloride for power operation which is well above the Regulatory Guide maximum limit of .5 ppm and the time-related limit of .2 ppm.

VI.b. Oyster Creek has no requirement for pH sampling, even under off-normal conditions.

However, we conclude that the licensee need take no action at this time to modify either the Technical Specification or procedures in the plant related to maintaining coolant water purity.