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Manager of
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January 17, 2003

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C., 20555-0001

Subject: **Docket Nos. 50-361 and 50-362**
Response to NRC Bulletin 2002-01, "Reactor Pressure Vessel Head Degradation and Reactor Coolant Pressure Boundary Integrity," 60-Day Response for San Onofre Nuclear Generating Station, Units 2 and 3, Request for Additional Information (TAC Nos. M4575 and M4576)

References:
1) Letter from D. E. Nunn (SCE) to the Document Control Desk (NRC) Dated May 16, 2002; Subject: Docket Nos. 50-361 and 50-362, 60-day Response to NRC Bulletin 2002-01, "Reactor Pressure Vessel Head Degradation and Reactor Coolant Pressure Boundary Integrity," San Onofre Nuclear Generating Station, Units 2 and 3

2) Letter from B. M. Pham (NRC) to H. B. Ray (SCE) Dated November 14, 2002; Subject: NRC Bulletin 2002-01, "Reactor Pressure Vessel Head Degradation and Reactor Coolant Pressure Boundary Integrity," 60-Day Response for San Onofre Nuclear Generating Station, Units 2 and 3, Request for Additional Information (TAC Nos. M4575 and M4576)

Dear Sir or Madam:

By letter dated May 16, 2002 (Reference 1) the Southern California Edison Company (SCE) provided the 60-day response to NRC Bulletin 2002-01 "Reactor Pressure Vessel Head Degradation and Reactor Coolant Pressure Boundary Integrity." On November 14, 2002, the Nuclear Regulatory Commission (NRC) requested additional information regarding the SCE 60-day response (Reference 2). The specific NRC questions and the SCE responses to the request for additional information are enclosed.

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The request for additional information and the responses include Alloy 600 systems and components. The Steam Generator Tubes (Alloy 600 material) are addressed in the Steam Generator Strategic Management Plan and are not included in the context of the enclosed SCE Responses.

If you have any questions or would like additional information concerning this subject, please call Mr. Jack Rainsberry at (949) 368-7420.

Sincerely,

Enclosure

cc: E. W. Merschoff, Regional Administrator, NRC Region IV
B. M. Pham, NRC Project Manager, San Onofre Units 2, and 3
C. C. Osterholtz, NRC Senior Resident Inspector, San Onofre Units 2 & 3

Enclosure

NRC Questions and SCE Responses Regarding the SCE 60-day Response to NRC Bulletin 2002-01

NRC Request

1. Provide detailed information on, and the technical basis for, the inspection techniques, scope, extent of coverage, and frequency of inspections, personnel qualifications, and degree of insulation removal for examination of Alloy 600 pressure boundary material and dissimilar metal Alloy 82/182 welds and connections in the reactor coolant pressure boundary (RCPB). Include specific discussion of inspection of locations where reactor coolant leaks have the potential to come in contact with and degrade the subject material (e.g., reactor pressure vessel (RPV) bottom head)

SCE Response

Detailed information on inspection techniques, inspection scope, extent of coverage, frequency of inspections, type and degree of insulation removal, potential for secondary corrosion, inspector qualifications applicable to Alloy 600 components and dissimilar metal (Alloy 82/182) welds and connections in the RCPB is provided in the attached table.

An overview of the programmatic controls and technical bases for inspection of Alloy 600 components and Alloy 82/182 dissimilar metal welds in the RCPB is provided below.

The Leak Management Program

The San Onofre Nuclear Generating Station (SONGS) Leak Management Program is based on the EPRI Leak Management Program Document TR-114761. The SONGS leak management program provides a process whereby leakage from plant systems or components is classified, prioritized, evaluated, and documented. The program tracks leaks from Station components including wet and dry boric acid leaks. An experienced engineer is assigned as program owner. A leak database is maintained, periodic status / trend reports are issued, and the effectiveness of corrective actions is evaluated by this program.

The Boric Acid Leakage Program

The Boric Acid Leakage Program is based on Generic Letter 88-05, "Boric Acid Corrosion Of Carbon Steel Reactor Pressure Boundary Components In PWR Plants." This program requires a visual inspection by personnel trained to know the principle locations where leaks that are smaller than the allowable Technical Specification limit can cause degradation of the RCPB by boric acid corrosion.

The boric acid leakage program provides a process to ensure boric acid leaks are identified, documented, and evaluated as to potential impact on the leaking component and on neighboring systems, structures or components. The Boric Acid Leakage Program applies to RCPB systems and components containing boric acid, which include Alloy 600 penetrations, Alloy 690 penetrations and dissimilar metal Alloy 82/182 welds. Normally, the RCPB is examined with the reactor in MODE 3. Examinations are conducted if the containment is accessible, the outage is expected to last for more than 4 days, and 30 days have elapsed since the last boric acid inspection. Examinations may be conducted or deferred with senior management approval. Engineers experienced with the reactor coolant system and familiar with the evidence of boric acid leaks conduct the examination often with the assistance of personnel from other Station organizations. Insulation is not removed for this examination but the examination looks specifically for evidence (boric acid crystal deposits, rust or discolored spots on insulation or structures) of boric acid leakage. Where evidence of leakage is found, insulation is removed, as necessary, to facilitate a thorough evaluation of the situation. Previous inspection reports and past experience are used as a guide for the examination. Wet (evidence of active leakage) and dry (the presence of more than trace amounts of boric acid crystal deposits) boric acid leaks are documented and the source of the leakage and its potential impact are evaluated.

Additionally, examinations are also normally conducted with the reactor coolant system pressurized to 350 psig and 2250 psig (normal operating pressure) during unit return to service.

<u>The Alloy 600 Inspection Program</u>

The Alloy 600 Inspection Program (for locations other than the reactor pressure vessel head, which was addressed in the Southern California Edison (SCE) 15-day response to Bulletin 2002-01) provides a focused inspection requirement for Alloy 600 components in the RCPB. The Alloy 600 inspection program requires the visual inspection of Alloy 600 nozzles every refueling outage. Two individuals (normally engineers) familiar with the Alloy 600 locations, the installation configuration, and the effects and the indications of boric acid leakage, including very small amounts of leakage, inspect each Alloy 600 RCPB penetration. Historically, SCE has assigned an engineer with both site and industry experience related to boric acid corrosion and PWSCC to participate in these inspections. SCE has recently created an Alloy 600 inspector qualification standard to formalize this practice.

Insulation and other obstructions are removed so that an effective visual examination of the crevice between the Alloy 600 nozzle and the base metal may be performed during these Alloy 600 inspections. The examination is conducted with the plant in mode 5 or 6 when insulation may be safely removed. This inspection program is procedurally controlled and includes location sketches and listings of Alloy 600 locations. Where a mechanical nozzle seal assembly (MNSA) has been installed, the location is inspected but the MNSA assembly is not removed for the inspection.

The technical basis for establishing the inspection requirements of Alloy 600 RCPB components are described below:

1. Reactor Vessel Head penetrations are examined as reported in the SCE 15-day response to Bulletin 2002-01.

2. Small bore Alloy 600 nozzles including pressurizer heater sleeves and instrument penetrations are examined and independently verified with a bare metal visual inspection of external surfaces. Since the primary stresses are oriented circumferentially, cracking within the stress field is predicted to be in the axial direction. Based on engineering judgment and industry operating experience, the probability of developing a circumferential flaw that might result in nozzle separation is acceptably small, provided that refueling interval inspection for through wall (axial) leakage is performed.

3. Small bore Alloy 600 nozzles which have had the pressure boundary location converted from the attachment weld to a MNSA are visually inspected and independently verified on a refueling interval consistent with other small bore Alloy 600 nozzles. Each MNSA is periodically inspected for MNSA component performance as required by the associated ASME Code Relief Request. These Alloy 600 nozzles are mechanically secured to the RCS base metal such that separation due to a circumferential flaw is not possible thus ensuring that inspection for through wall leakage on a refueling interval is adequate to ensure safety.

4. Small Bore RCPB penetrations that were originally designed with Alloy 600 nozzle material, and have been modified to incorporate an Alloy 690 half nozzle with an external Alloy 152 attachment weld are not considered susceptible to Primary Water Stress Corrosion Cracking (PWSCC). However, these nozzles are inspected under both the Boric Acid Leakage Program and the Alloy 600 Inspection Program.

The ASME Section XI In-service Inspection Program (ISI)

The ASME Section XI In-service Inspection Program supplements the Boric Acid Inspection program for monitoring of Alloy 82/182 dissimilar metal RCPB welds. The ASME Section XI program has been established and is executed according to the requirements of Section XI of the ASME code. Dissimilar metal welds are inspected in accordance with the program on a 10-year interval. Welds on piping greater than or equal to 4 inches nominal piping size (NPS) are volumetrically (Ultrasonically Tested) and surface examined (Penetrant Testing (PT)). Welds on piping less than 4 inches NPS and greater than or equal to 1 inch receive a surface (PT) exam. Welds on piping less than 1 inch NPS are exempted from examination (PT & UT). By necessity, insulation is removed to perform these examinations.

Each refueling, the reactor coolant system is subject to a system leakage and VT-2 test as described in section IWB-5221 of the ASME code. For systems borated to control reactivity, insulation is removed from pressure retaining bolted connections for the examination. For other components, insulation is not removed for the inspection. In these situations, evidence of boric acid leakage (deposits, residue, discoloration) is the object of the examination.

NDE Personnel performing ASME Section XI In-service Inspections are qualified per IWA-2300, Appendix VII, and revised 10 CFR 50.55a(g)(6)(ii)(C)(1) as applicable.

The ASME Code established the examination interval and Station experience to date indicates this interval is adequate.

In summary, there are multiple programs governing boric acid leak and Alloy 600 inspection at the San Onofre Nuclear Generation Station. SCE monitors industry experience and, as demonstrated on reactor head nozzles, would increase the scope and extent of these inspections as necessary to ensure public health and safety. The multiple programs provide defense in depth that leaks associated with the reactor coolant pressure boundary would be identified, documented, and evaluated to ensure safe operation.

NRC Request

2. Provide the technical basis for determining whether or not insulation is removed to examine all locations where conditions exist that could cause high concentrations of boric acid on pressure boundary surfaces or locations that are susceptible to primary water stress corrosion cracking (Alloy 600 base metal and dissimilar metal Alloy 82/182 welds). Identify the type of insulation for each component examined, as well as any limitations to removal of insulation. Also include in your response actions involving removal of insulation required by your procedures to identify the source of leakage when relevant conditions (e.g., rust stains, boric acid stains, or boric acid deposits) are found.

SCE Response

The following provides the technical basis for insulation removal for the leak management program, the boric acid leak inspection program, the Alloy 600 inspection program, and the ASME Section XI In-Service Inspection Program. If boric acid deposits or other evidence of boric acid leakage is identified during any of these inspections, the Boric Acid Leakage Program requires that an evaluation of any potential corrosion effects be performed. Insulation is removed as necessary to complete the evaluation and to clean affected areas.

The Leak Management Program

The leak management program provides a process whereby leakage from plant systems or components is classified, prioritized, evaluated, and documented. This program is used after a leak is found. Therefore, the presence or absence of insulation does not apply.

The Boric Acid Leak Inspection Program

The Boric Acid Leak Inspection Program does not require the removal of any insulation to perform inspections. The majority of the components such as valves, flanges, and thermowells are accessible for inspection. Piping system welds (including the dissimilar metal Alloy 82/182 welds) are insulated. Those components that are insulated are inspected for any dry boric acid residue or active leakage on the insulation. If indications of leakage are present, the inspection procedure requires that the source of the leak be identified. This would require the removal of insulation as necessary. The RCPB insulation installed at SONGS is removable.

A very small leak would result in significant boric acid buildup that would be visible on or around the section of mirror insulation. Using the EPRI Boric Acid Corrosion Guidebook, 100 gallons of leakage of 1000 ppm boron would produce approx 4.5 lbs (90 cu. in.) of boric acid crystals. A leakrate of 0.01 gpm would produce this amount of crystals in approximately 7 days. Since a normal operating cycle is over 500 days, if a very small leak existed for the entire cycle, it would result in significant boric acid buildup that would be easily identified (0.001 gpm leak of 1000 ppm boron would result in 700 gallons of leakage in 500 days and a buildup of approximately 25 lbs of boric acid crystals with a volume of about 450 cu. in.).

The Alloy 600 Inspection Program

Insulation is removed as necessary to permit an effective visual inspection of the Alloy 600 RCPB penetrations. The RCPB insulation installed at SONGS is removable.

The ASME Section XI In-Service Inspection Program

The entire reactor coolant pressure boundary is subject to a System Leakage test (IWB-5221), Visual VT-2 Pressure test per ASME XI Examination Category B-P, each refueling outage. Examination personnel are qualified per IWA-2300. For insulated components Visual VT-2 examination is performed per IWA-5242. For systems borated for the purpose of controlling reactivity, insulation is removed from pressure retaining bolted connections for visual VT-2. For other components, visual examination VT-2 is conducted without the removal of insulation by examining the accessible and exposed surfaces and joints of the insulation.

NRC Request

3. Describe the technical basis for the extent and frequency of walkdowns and the method for evaluating the potential for leakage in inaccessible areas. In addition, describe the degree of inaccessibility, and identify any leakage detection systems that are being used to detect potential leakage from components in inaccessible areas.

SCE Response

The scope of the inspection programs described above is comprehensive and there are no inaccessible areas with the potential for leakage.

NRC Request

4. Describe the evaluations that would be conducted upon discovery of leakage from mechanical joints (e.g., bolted connections) to demonstrate that continued operation with the observed leakage is acceptable. Also describe the acceptance criteria that was established to make such a determination. Provide the technical basis used to establish the acceptance criteria. In addition,

    a. if observed leakage is determined to be acceptable for continued operation, describe what inspection/monitoring actions are taken to trend/evaluate changes in leakage, or

    b. if observed leakage is not determined to be acceptable, describe what corrective actions are taken to address the leakage.

SCE Response

The boric acid leak program, the operability assessment program, and the non-conformance (NCR) program are used to manage boric acid leaks from mechanical joints. Boric acid leaks, wet or dry, receive an evaluation of the affected and surrounding components to determine if any materials are susceptible to boric acid corrosion. If any materials are deemed to be susceptible, an evaluation of the component material condition is performed. This evaluation may include: 1) visual examination, 2) measurement of the amount of degradation (e.g. bolt diameters, piping/vessel wall thickness), 3) NDE of the material to determine the amount of degradation or 4) component stress analysis. Acceptance criteria are determined in accordance with applicable Code requirements.

A review of the component leak history is performed. For components with an unacceptable leak history, an evaluation of the component design is conducted. This includes a review of the joint loading requirements and material configuration (e.g., bolting, gasket, packing etc.). In cases where these requirements are not met, design changes are performed. Typical changes include: use of different gasket material, packing material or configuration, use of higher strength corrosion resistant bolting material, or coating of materials susceptible to boric acid corrosion.

Some cases may warrant continued operation with an active leak. An operability assessment is performed for these cases. The operability assessment (OA) requires the degradation be described as well as the impact on the component and equipment affected. The safety function of the affected system, sub-system, or component (SSC) and the technical basis for operability must be defined (flow, pressure, mechanical integrity, accuracy, etc). The generic impact and the potential for continued degradation are also assessed. The OA program requires that if continued degradation is a possibility the point at which operability may be impacted is identified. Re-inspections and or monitoring would be required to extend operation beyond a time when continued Operability would be impacted. Typically, boric acid leaks are evaluated to determine the corrosive effects of the leakage on the structural integrity of the leaking component and any SSC that may come in contact with the leaking fluid. Corrosion susceptibility and corrosion rates are taken from industry reference materials including EPRI guidance on boric acid corrosion. Based upon the materials impacted by the leakage and the nature (e.g., temperature and leak rate) of the leakage, a determination of continued operability is made. Generally, periodic monitoring of leakage from mechanical joints has not been found to be necessary where continued leakage has been accepted, as the components affected are not susceptible to corrosion by boric acid attack. Where continued leakage is not acceptable, the leakage is either eliminated or the component/system removed from service. It is expected that leakage identified prior to or during an outage is repaired and the boric acid is removed from the surface prior to returning the unit to service.

NRC Request

5. Explain the capabilities of your program to detect the low levels of reactor coolant pressure boundary leakage that may result from through-wall cracking in the bottom reactor pressure vessel head incore instrumentation nozzles. Low levels of leakage may call into question reliance on visual detection techniques or installed leakage detection instrumentation, but has the potential for causing boric acid corrosion. The NRC has had a concern with the bottom reactor pressure vessel head incore instrumentation nozzles because of the high consequences associated with loss of integrity of the bottom head nozzles. Describe how your program would evaluate evidence of possible leakage in this instance. In addition, explain how your program addresses leakage that may impact components that are in the leak path.

SCE Response

This question is not applicable to SONGS Units 2 and 3 because the bottom reactor pressure vessel heads do not contain incore instrumentation nozzles or any other penetrations.

NRC Request

6. Explain the capabilities of your program to detect the low levels of reactor coolant pressure boundary leakage that may result from through-wall cracking in certain components and configurations for other small diameter nozzles. Low levels of leakage may call into question reliance on visual detection techniques or installed leakage detection instrumentation, but has the potential for causing boric acid corrosion. Describe how your program would evaluate evidence of possible leakage in this instance. In addition, explain how your program addresses leakage that may impact components that are in the leak path.

SCE Response

Historically at San Onofre, personnel performing visual inspections have identified very small leaks from Alloy 600 piping. Inspection personnel are experienced in the identification of Alloy 600 nozzle leaks. Some of the past Alloy 600 nozzle leaks were not detected by the leakage detection systems during normal power operation (e.g., containment normal sump level instrumentation, containment gaseous and particulate monitors, containment humidity and temperature indications, etc) but were found while performing inspections during an outage. Most nozzle leaks have been very small such that no significant buildup of boric acid residue or wastage of carbon steel had occurred. On one occasion, a pressurizer side shell nozzle started leaking during a return to service and produced a small steam plume that was easily identified. If this leak had occurred with the unit online it should have been able to be identified by increased leakage to the containment normal sump and possibly the containment airborne radiation monitors. Since the nozzles are accessible, leakage should be identified during the inspection walkdowns.

Leakage detection systems, such as the containment normal sump level, have detected changes in the RCS inventory on the order of 0.05 gpm. This system was used to identify a thermowell failure in Unit 3 in 1996 and a hot leg sample line isolation valve bonnet leak in 1994 and 2001.

Leakage detection systems such as the containment airborne gaseous radiation monitors are very sensitive to leakage from the steam space of the pressurizer. Steam leaks as small as 0.01 gpm have been identified using this system.

As discussed in the response to question 2 above, a leakrate of 0.001 gpm would result in significant boric acid buildup over the course of an operating cycle. A significant buildup of boric acid should be identified during the walkdowns performed under the current SONGS inspection programs.

Low levels of leakage should produce significant amounts of boric acid crystals and if carbon steel wastage occurs, additional amounts of residue would be present. Leakage also could produce white or rust colored stains on the O.D. surface of the piping or vessel. If any of these indications were present, the inspection procedure requires that the source of the leak be identified. This would prompt the removal of insulation as necessary.

NRC Request

7. Explain how any aspects of your program (e.g., insulation removal, inaccessible areas, low levels of leakage, evaluation of relevant conditions) make use of susceptibility models or consequence models.

SCE Response

As described in our response to previous questions, our Boric Acid, Alloy 600 and ASME In-Service Inspection Programs are based on industry guidance, SONGS and industry experience, and engineering judgment such that the potential for safety significant consequences from PWSCC and boric acid corrosion would be prevented. However, these programs do not make use of any formal susceptibility models or consequence models.

NRC Request

8. Provide a summary of recommendations made by your reactor vendor on visual inspections of nozzles with Alloy 600/82/182 material, actions you have taken or plan to take regarding vendor recommendations, and the basis for any recommendations that are not followed.

SCE Response

The following is a summary of the recommendations made by the SONGS reactor vendor regarding visual inspections of nozzles with Alloy 600/82/182 material:

(1) inspect pressurizer small diameter Alloy 600 nozzles and heater sleeves during each refueling outage for signs of primary coolant leakage,

(2) inspect Alloy 600/82/182 nozzles with the insulation in place or removed (either approach is acceptable). The presence of boric acid deposits or corrosion products should be assumed to be an indication of leakage until proven otherwise and appropriate actions taken to stop the leakage, and

(3) inspect low alloy steels exposed to boric acid and promptly repair primary coolant leaks.

At SONGS Units 2 and 3, visual inspections of the Alloy 600 penetrations installed in the pressurizer, steam generators, hot legs, and cold legs have been performed every refueling outage since 1993. These visual inspections were performed without interference from insulation and exceeded the reactor vendor's recommendations.

NRC Request

9. Provide the basis for concluding that the inspections and evaluations described in your responses to the above questions comply with your plant Technical Specifications and Title 10 of the Code of Federal Regulations (10 CFR), Section 50.55(a), which incorporates Section XI of the American Society of Mechanical Engineers (ASME) Code by reference. Specifically, address how your boric acid corrosion control program complies with ASME Section XI, paragraph IWA-5250 (b) on corrective actions. Include a description of the procedures used to implement the corrective actions.

SCE Response

The plant Technical Specifications commit the Station to implementing Section XI of the ASME code and further establish limits on reactor coolant system leakage (10 gpm identified leakage, 1 gpm unidentified leakage and no pressure boundary leakage).

The Alloy 600 inspection program procedure, the boric acid leakage program procedure, and the leak management program procedure require that leakage be identified, documented and evaluated. Wet leaks require a formal operability assessment and in the template for performing operability assessments, technical specification impacts or requirements are addressed. The operability assessment process would also evaluate the impact of corrosion on the affected component or system. Wall thickness measurements, where appropriate, and an evaluation of stress levels would be an expected action should any significant corrosion be noted. If degraded conditions are accepted, the basis for acceptance would be documented in a non-conformance report. The Operability Assessment Program and the Non-Conformance Reporting Program have requirements to ensure boric acid leaks are considered against technical specification requirements. These programs are more conservative than the requirements of IWA-5250 in that corrosion is evaluated, even if it is less than 10 percent allowance provided in IWA-5250. The ASME In-Service Inspection Program procedure provides the requirements for conducting and evaluating results of a system pressure test, which includes the ASME Section XI Code requirements.

Boric Acid Corrosion Control Comparison Table

Component/ Scope	Inspection Technique	Inspector Qualification	Extent of Component Coverage	Minimum Inspection Frequency	Insulation Type	Insulation Removal	Potential for Secondary Corrosion
Alloy 600 pressurizer heater sleeves (All Sleeves)	Visual: Boric Acid walkdown & Inconel	Experienced Engineer	Complete	Every refueling	Metal Clad mirrored insulation.	No (Sleeves are visible without removal)	Pressurizer
	Visual system pressure test	VT-2	Complete				
Alloy 600 Steam generator primary side nozzles (All Nozzles)	Visual: Boric Acid walkdown & Inconel	Experienced Engineer	Complete	Every refueling	Metal Clad mirrored insulation.	No (Nozzles are visible without removal)	Steam generator
	Visual system pressure test	VT-2	Complete				
Alloy 600 pressurizer instrument nozzles and Alloy 600 steam generator primary side nozzles (MNSA installed) (All MNSAs)	Visual: Boric Acid walkdown & Inconel	Experienced Engineer	Complete	Every refueling	Metal Clad mirrored insulation.	No MNSAs are completely visible	Pressurizer or steam generator
	MNSA inspection procedure	VT-2 and VT-1	Complete				
All Alloy 82/182 RCPB welds attaching the RCP Suction to the RC Pipe	Visual –Boric Acid walkdown	Experienced Engineer	External Insulation Surfaces	Every refueling	Metal Clad mirrored insulation.	No	RCS Cold Leg
	Visual-System pressure test	VT-2					
	ISI-per code (volumetric and/or surface)	NDE inspector	Complete	Every 10-year ISI interval		Yes	
All Alloy 82/182 RCPB welds attaching the RCP Discharge to the RC Pipe.	Visual –Boric Acid walkdown	Experienced Engineer	External Insulation Surfaces	Every refueling	Metal Clad mirrored insulation.	No	RCS Cold Leg
	Visual-System pressure test	VT-2					
	ISI-per code (volumetric and/or surface)	NDE inspector	Complete	Every 10-year ISI interval		Yes	

Boric Acid Corrosion Control Comparison Table

Component/ Scope	Inspection Technique	Inspector Qualification	Extent of Component Coverage	Minimum Inspection frequency	Insulation Type	Insulation Removal	Potential for Secondary Corrosion
The Alloy 82/182 RCPB weld attaching the RC pipe to the pressurizer surge line	Visual –Boric Acid walkdown	Experienced Engineer	External Insulation Surfaces	Every refueling	Metal Clad mirrored insulation.	No	RCS Hot Leg
	Visual-System pressure test	VT-2					
	ISI-per code (volumetric and/or surface)	NDE inspector	Complete	Every 10-year ISI interval		Yes	
The Alloy 82/182 RCPB weld attaching the Pressurizer Surge Nozzle	Visual –Boric Acid walkdown	Experienced Engineer	External Insulation Surfaces	Every refueling	Metal Clad mirrored insulation.	No	Pressurizer
	Visual-System pressure test	VT-2					
	ISI-per code (volumetric and/or surface)	NDE inspector	Complete	Every 10-year ISI interval		Yes	
All Alloy 82/182 RCPB welds attaching the Drain Nozzles	Visual –Boric Acid walkdown	Experienced Engineer	External Insulation Surfaces	Every refueling	Metal Clad mirrored insulation.	No	RCS Cold Leg
	Visual-System pressure test	VT-2					
	ISI-per code (volumetric and/or surface)	NDE inspector	Complete	Every 10-year ISI interval		Yes	

Boric Acid Corrosion Control Comparison Table

Component/ Scope	Inspection Technique	Inspector Qualification	Extent of Component Coverage	Minimum Inspection frequency	Insulation Type	Insulation Removal	Potential for Secondary Corrosion
All Alloy 82/182 RCPB welds attaching the Charging Inlet Nozzles	Visual –Boric Acid walkdown	Experienced Engineer	External Insulation Surfaces	Every refueling	Metal Clad mirrored insulation.	No	RCS Cold Leg
	Visual-System pressure test	VT-2					
	ISI-per code (volumetric and/or surface)	NDE inspector	Complete	Every 10-year ISI interval		Yes	
All Alloy 82/182 RCPB welds attaching the Safety Injection Nozzles	Visual –Boric Acid walkdown	Experienced Engineer	External Insulation Surfaces	Every refueling	Metal Clad mirrored insulation.	No	RCS Cold leg
	Visual-System pressure test	VT-2					
	ISI-per code (volumetric and/or surface)	NDE inspector	Complete	Every 10-year ISI interval		Yes	
The Alloy 82/182 RCPB weld attaching the Shutdown Cooling Nozzle	Visual –Boric Acid walkdown	Experienced Engineer	External Insulation Surfaces	Every refueling	Metal Clad mirrored insulation.	No	RCS Hot Leg
	Visual-System pressure test	VT-2					
	ISI-per code (volumetric and/or surface)	NDE inspector	Complete	Every 10-year ISI interval		Yes	

Boric Acid Corrosion Control Comparison Table

Component/ Scope	Inspection Technique	Inspector Qualification	Extent of Component Coverage	Minimum Inspection frequency	Insulation Type	Insulation Removal	Potential for Secondary Corrosion
All Alloy 82/182 RCPB welds attaching the Spray Nozzles	Visual –Boric Acid walkdown	Experienced Engineer	External Insulation Surfaces	Every refueling	Metal Clad mirrored insulation.	No	Pressurizer
	Visual-System pressure test	VT-2					
	ISI-per code (volumetric and/or surface)	NDE inspector	Complete	Every 10-year ISI interval		Yes	
All Alloy 82/182 RCPB welds attaching the Pressurizer Safety Valve Nozzles	Visual –Boric Acid walkdown	Experienced Engineer	External Insulation Surfaces	Every refueling	Metal Clad mirrored insulation.	No	Pressurizer
	Visual-System pressure test	VT-2					
	ISI-per code (volumetric and/or surface)	NDE inspector	Complete	Every 10-year ISI interval		Yes	
The Alloy 82/182 RCPB weld attaching the Pressurizer Spray Nozzle	Visual –Boric Acid walkdown	Experienced Engineer	External Insulation Surfaces	Every refueling	Metal Clad mirrored insulation.	No	Pressurizer
	Visual-System pressure test	VT-2					
	ISI-per code (volumetric and/or surface)	NDE inspector	Complete	Every 10-year ISI interval		Yes	

Boric Acid Corrosion Control Comparison Table

Component/ Scope	Inspection Technique	Inspector Qualification	Extent of Component Coverage	Minimum Inspection frequency	Insulation Type & removal	Insulation Removal	Potential for Secondary Corrosion
All Alloy 82/182 RCPB welds attaching the CEDM motor housing upper end fitting and lower end fitting	ISI-per code (volumetric and/or surface)	NDE inspector	Complete	Every 10-year ISI interval	Metal Clad mirrored insulation.	Yes	RV head
Pressurizer, Steam generator manway, pressurizer safety connection (bolted) and other bolted connections (including valve bolting)	Visual-Boric Acid walkdown	Experienced Engineer	External Insulation Surfaces	Every refueling	Metal Clad mirrored insulation on most connections.	No	Pressurizer, Steam Generator or associated valve.
	Visual-System pressure test	VT-2				Yes	
All RCS and pressurizer nozzles replaced with 690	Visual-Boric Acid walkdown	Experienced Engineer	External Insulation Surfaces	Every refueling	Metal Clad mirrored insulation.	No	Pressurizer and RCS hot and cold legs
	Visual-System pressure test	VT-2					
	Inconel Inspection	Experienced Engineer	Complete			As required to see external weld	