Pacific Gas and
Electric Company

David H. Oatley
Vice President
Diablo Canyon Operations

Diablo Canyon Power Plant
P.O. Box 56
Avila Beach, CA 93424

805.545.4350
Fax: 805.545.4234

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U.S. Nuclear Regulatory Commission
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Docket No. 50-275, OL-DPR-80
Diablo Canyon Unit 1
Special Report 01-01: Steam Generator Condition Monitoring for Unit 1 Cycle 10

Dear Commissioners and Staff:

PG&E is voluntarily submitting the enclosed 120-day steam generator (SG) condition monitoring report described in Nuclear Energy Institute (NEI) 97-06 Revision 1, dated January 2001. When NEI 97-06 Revision 1 requirements become effective at Diablo Canyon Power Plant Units 1 and 2, a 120-day report is required when greater than one percent of inspected SG tubes exceed the established SG repair criteria. Licensee Event Report 1-2000-010, submitted in PG&E Letter DCL-00-138 dated November 3, 2000, reported this condition in SG 1-2 following tube inspections conducted during the Unit 1 tenth refueling outage.

Sincerely,

David H. Oatley

David H. Oatley

cc: Ellis W. Merschoff
David L. Proulx
Girija S. Shukla
State of California
Diablo Distribution (w/o enc.)

Enclosure

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A001

SPECIAL REPORT 01-01

STEAM GENERATOR CONDITION MONITORING FOR UNIT 1 CYCLE 10

Steam Generator Condition Monitoring for Unit 1 Cycle 10

1.0 Summary

During the Unit 1 tenth refueling outage (1R10), greater than 1 percent of inspected tubes in steam generator (SG) 1-2 were defective and required plugging. If greater than 1 percent of inspected tubes in any SG exceed the repair criteria, Nuclear Energy Institute (NEI) 97-06, Revision 1, requires that a Condition Monitoring (CM) report be submitted to the NRC within 120 days after returning the SG to service. This report provides a SG tube CM assessment for Unit 1 Cycle 10 based on 1R10 tube inspection results.

For degradation subject to alternate repair criteria (ARC), PG&E follows the tube integrity assessment requirements of Diablo Canyon Power Plant (DCPP) technical specifications (TS) and NRC-approved licensing basis. The W* ARC report and voltage-based ARC report were submitted in a 90-day report to the NRC in PG&E letter DCL-01-010 dated February 5, 2001. For all other degradation, PG&E follows the tube integrity assessment guidance provided in Electric Power Research Institute (EPRI) Report TR-107621, "Steam Generator Integrity Assessment Guidelines," Revision 1, dated March 2000.

NEI 97-06, Revision 1, structural and leakage performance criteria were satisfied at the end of Unit 1 Cycle 10 (EOC10). This conclusion is based on assessing the 1R10 as-found conditions of the tubing on a degradation-specific basis. Unit 1 Cycle 10 had an actual duration of 1.49 effective full power years (EFPY). Each degradation was assessed to demonstrate that NEI 97-06, Revision 1, structural integrity performance criteria and accident-induced leakage performance criteria were satisfied at EOC10.

- Structural integrity performance criteria: $3\Delta P_{NO}$ (4329 psi) and $1.4\Delta P_{SLB}$ (3584 psi) are the burst margin requirements for free span degradation and degradation confined to tube support plate (TSP) crevice, respectively. The $3\Delta P_{NO}$ value of 4329 psi is based on the minimum Cycle 10 calculated steam pressure of 807 psia at the top of tubesheet where the maximum pressure differential occurs.

- Accident-induced leakage performance criteria: For degradation subject to ARC, the maximum allowable steam line break (SLB) induced leak rate limit is 12.8 gpm in a faulted SG for ARC application, based on an analysis which uses current licensing basis assumptions and approved by the NRC in License Amendment (LA) 124/122. Per Table 12 of this submittal for ARC degradation, the limiting EOC10 post-SLB leak rate is 0.1983 gpm in SG 1-2, much less than the 12.8 gpm limit. For degradation not subject to ARC, the maximum allowable SLB-induced leak rate is 1 gpm in a faulted SG per NEI 97-06, and no non-ARC SLB-induced leakage is postulated at EOC10.

In addition to establishing structural and leakage integrity performance criteria, NEI 97-06, Revision 1, also establishes an operational leakage performance criterion, such that primary-to-secondary leakage through any one SG shall be limited to 150 gallons per day (gpd). This limit is reflected in DCPP TS. A small leak was detected in Unit 1 Cycle 10, ranging from about 1 to 3 gpd, which is well below the 150 gpd limit. Therefore, the performance criterion of the DCPP TS and NEI 97-06 were satisfied for Cycle 10.

2.0 Introduction

Steam Generator Background

DCPP Units 1 and 2 use Westinghouse Model 51 SGs with explosively expanded (WEXTEX) transitions. The SGs contain Alloy 600 Mill Annealed (MA) tubing. The nominal outside diameter of the tubing is 0.875 inch with a 0.050-inch nominal wall thickness. The DCPP SGs have operated with a nominal hot leg temperature (T_{hot}) of 603° F. Unit 1 Cycle 11 will operate at a T_{hot} of 605°F due to an uprate. The commercial operation dates for Units 1 and 2 are May 1985 and March 1986, respectively.

Both units have historically operated on 18-month fuel cycles. However, starting with DCPP Unit 2 Cycle 8 and Unit 1 Cycle 9, the cycle lengths have been extended to nominal 20-month operation. SG tube integrity assessment for Unit 2 Cycle 8 operation of 21 months and Unit 1 Cycle 9 operation of 21 months were previously submitted to the NRC.

PG&E has implemented several initiatives to minimize primary water stress corrosion cracking (PWSCC) and outside diameter stress corrosion cracking (ODSCC). Primary side initiatives include U-bend heat treatment, WEXTEX tubesheet shotpeening, and zinc injection. Secondary chemistry initiatives include: copper removal program; ethanol amine (ETA) to control pH; increased hydrazine levels, molar ratio control program to prevent excess alkalinity; boric acid addition program (including boric acid soaks at startup to mitigate denting and ODSCC at TSPs); tube sheet sludge lancing every outage; SG blowdown is maintained at 1 percent of the main steaming rate; and condensate polishers were installed and emergency (plant curtailment) procedures issued to protect against seawater condenser tube leaks.

Technical Specification Repair Criteria

DCPP TS require plugging of any tube that has degradation greater than or equal to 40 percent of the nominal tube wall thickness, unless ARC are implemented. Prior to 1R9, the DCPP TS were revised to allow implementation of ARC for (a) Generic Letter (GL) 95-05, "Voltage-Based Repair Criteria for Westinghouse Steam Generator Tubes Affected by Outside Diameter Stress Corrosion Cracking," at TSPs and (b) W* repair criteria for axial PWSCC in the WEXTEX tubesheet region. These TS changes were granted by the NRC in LA

124/122 dated March 12, 1998, in response to license amendment request (LAR) 97-03 for voltage-based ARC, and LA 129/127 dated February 19, 1999, in response to LAR 97-04 for W* ARC. These two ARC were implemented in Unit 1 in 1R9 and 1R10.

In addition to leaving cracks in service under the above ARC, validated depth sizing of axial PWSCC at dented TSP intersections was implemented in 1R9 and 1R10, such that axial PWSCC less than the TS limit of 40 percent maximum depth limit was allowed to remain in service. A 10 CFR 50.59 evaluation for leaving less than 40 percent axial PWSCC in service was performed and submitted to the NRC for information prior to 1R9 via PG&E letter DCL-99-024 dated February 23, 1999.

Other than degradation subject to GL 95-05 ARC, W* ARC, and validated axial PWSCC depth sizing at dented TSPs, all crack-like indications are required to be plugged on detection by a rotating coil probe, regardless of depth measurements. Cold leg thinning and antivibration bar (AVB) wear are sized by bobbin and allowed to remain in service if less than 40 percent.

NRC Reporting

A routine phone call with the NRC staff was made on October 24, 2000 to report on the findings from SG inspections performed during 1R10. The call was made after the majority of the tubes were inspected, and about 4 days before the all exams were completed. NRC letter to PG&E dated October 12, 2000, provided 13 discussion points for the phone call, and stated that "it is the staff's expectations that any significant results discussed during the teleconference, as well as any materials provided by your staff to assist us during the telephone conference in the understanding of the SG tube results, will be included in one of the reports required by the plant's TS." Tables 1 and 2 of this submittal were faxed to the NRC prior to the phone call to provide a description of the eddy current exam scope. PG&E provided verbal responses to the 13 points. The NRC staff identified no open items.

If greater than one percent of inspected tubes in any SG are identified as defective, DCPP TS requires that a licensee event report (LER) be submitted because the SG is Category C-3. SG 1-2 was determined to be in Category C-3 following completion of eddy current testing. Therefore, LER 1-2000-010 dated November 3, 2000, was submitted via PG&E letter DCL-00-138 to the NRC prior to the SGs return to service.

Degradation Assessment

NEI 97-06 Revision 1 requires completion of a degradation assessment (of both existing and potential degradation mechanisms) prior to each inspection. A degradation assessment, inspection/expansion plan, and tube repair plan were prepared and issued before 1R10. A summary of the inspection plan and

expansion plan is provided in Tables 1 and 2 of this submittal. The degradation assessment provides a summary of the EPRI nondestructive examination (NDE) techniques used in 1R10, including detection and sizing capabilities. Framatone Technologies Incorporated (FTI) performed a site specific technique qualification to demonstrate that the EPRI techniques are applicable for use at DCPP.

Tube Repairs

In SG 1-1 and 1-2, 43 tubes were deplugged by FTI tungsten inert gas (TIG) relaxation process and subsequently eddy current inspected for potential return to service under new repair criteria (Table 3 of this submittal). Eight tubes had Westinghouse I-690 rib plugs, and 35 tubes had FTI I-690 roll plugs. Seven tubes had been plugged due to axial ODSCC at TSPs in outages 1R7 and 1R8, prior to implementation of voltage-based ARC. Thirty-six tubes had been plugged due to axial PWSCC at dented TSPs in 1R8, prior to implementation of 40 percent depth sizing repair criteria. Tubes selected for recovery were based on an assessment of the as-left size of the plugged flaw, plus some margin for potential flaw growth during the out-of-service period of the tube. The following inspections were performed on recovered tubes:

- 100 percent bobbin inspection
- Plus Point inspection of original flawed location
- Plus Point inspection of all distorted bobbin tube support plate indications, regardless of voltage.
- Plus Point inspection of hot leg dented intersections
- Plus Point inspection of TTS region from plus 2 to minus 8 inches.

Seven of the 43 tubes required replugging because of detected degradation that was excluded by the repair criteria (6 due to combined inside diameter/outside diameter (ID/OD) degradation at TSPs, and 1 due to cracking in a wedge region). Thirty-six tubes were returned to service using the new repair criteria.

In SG 1-4, 15 Westinghouse I-690 cold leg rib plugs were removed for precautionary reasons and replugged with FTI I-690 long roll plugs.

In addition to the tubes that were deplugged and replugged, 101 additional tubes were plugged. FTI I-690 roll plugs were used in both legs.

No tube pulls were required in 1R10. Tube pulls had been previously conducted in 1R9 to satisfy GL 95-05 requirements.

Insitu Testing

To support condition monitoring, degradation was assessed for leakage and structural integrity against the screening threshold values provided in Table 11 of this submittal. The screening thresholds and supporting approximate structural

limits were provided in Westinghouse letter PGE-97-536. The screening methodology used for 1R10 was provided in EPRI Steam Generator In Situ Pressure Test Guidelines (EPRI Final Report TR-107620-R1 dated June 1999). Based on performance of the screening as documented in this report, none of the indications required insitu testing during 1R10. Nonetheless, one circumferential PWSCC indication in a Row 1 U-bend was insitu pressure tested as a precautionary measure, even though the voltage was well below the threshold value. No leakage was detected from this flaw during the test.

1R10 Damage Mechanisms

Tables 3 through 6 of this submittal provide the number of Unit 1 SG tube pluggable indications found in 1R10, historical pluggable tubes, and number of deplugged tubes.

The following damage mechanisms detected in 1R10 are assessed for SG tube integrity:

- Axial PWSCC at dented TSP intersections
- Circumferential PWSCC at dented TSP intersections
- Circumferential ODSCC at dented TSP intersections
- Axial ODSCC at TSP intersections (voltage-based ARC)
- Axial PWCC in WEXTEX tubesheet region (W* ARC)
- Circumferential PWSCC in WEXTEX tubesheet region
- Circumferential ODSCC at WEXTEX top of tubesheet region
- Volumetric indication at WEXTEX top of tubesheet region
- Cold leg thinning
- AVB wear
- Circumferential PWSCC in Row 1 U-bends

In addition to the damage mechanisms addressed above, this report provides inspection results of the following potential damage mechanisms that were not detected:

- Axial PWSCC in Rows 1 and 2 U-bends
- Suspected TSP ligament thinning
- Stress corrosion cracking (SCC) at free span dings
- Tube damage due to loose parts and foreign objects
- SCC in I-690 mechanical plugs

Lastly, this report provides an assessment of cycle-related activities that could affect tube integrity:

- Primary-to-secondary leakage during operation
- Effect of increased lithium on PWSCC degradation
- Effect of zinc injection on PWSCC degradation

3.0 PWSCC at Dented TSP Intersections

Over 12,000 dented intersections have been detected in Unit 1 SG (Table 9 of this submittal), and over 6,000 dented intersections were inspected using Plus Point in 1R10 (Table 10 of this submittal). The 1R9 dent calls were used to establish the 1R10 dent inspection plan. The 1R9 dents were called using manual analysis, with no lower dent voltage threshold, such that about 8,000 dents were called below 2 volts. The 1R10 dents were called using computerized data screening (CDS) analysis, and the dent calling threshold was established at 2 volts.

Plus Point inspections of dents

- SG 1-1 and SG 1-4: 100 percent of dents from 1H to 3H, 20 percent at 4H. Note: Expansion of the dent inspection program was required in SG 1-1 because axial PWSCC was detected by bobbin and confirmed by Plus Point at 4H, requiring 100 percent dent inspection at 4H, plus 20 percent at 5H. No further PWSCC was detected in the expanded scope.

- SG 1-2: 100 percent of dents from 1H to 6H, 20 percent at 7H. Note: SG 1-2 1H dents located in the pressure pulse cleaning (PPC) zone were inspected after PPC.

- SG 1-3: 20 percent of dents at 1H. Note: SG 1-3 1H dents located in the PPC zone were inspected after PPC.

- Where 100 percent inspections are not required, the following greater than 5 volt dent inspection requirements were satisfied: Inspect at least 20 percent of greater than 5 volt dents up to 7H in each SG (and at least 50 dents, or 100 percent if less than 50 dents).

- Inspect 100 percent of new greater than or equal to 2 volt dents called in 1R10. New dents are referred to as previously unidentified dents (PUDs).

- Forty-three tubes in SG 1-1 and SG 1-2 were deplugged in 1R10 for return to service. In deplugged tubes, all hot leg dented intersections were inspected using Plus Point.

Tables 7 and 8 provide the number of PWSCC and circumferential indications at dented TSP intersections identified in 1R10 and prior Unit 1 outages. No PWSCC was detected in SG 1-3, as in the past. In SG 1-1, 1-2, and 1-4, PWSCC extended to 4H, 6H, and 3H, respectively. The 4H PWSCC in SG 1-1 reflects an upward change from prior inspections. The majority of PWSCC

indications are confined to 1H and 2H, thereby confirming that temperature is the driving factor for PWSCC initiation.

3.1 Axial PWSCC at Dented TSP Intersections

Validated depth sizing of axial PWSCC at dented TSP intersections was implemented in 1R10, such that axial PWSCC less than 40 percent maximum depth was allowed to remain in service.

One hundred forty two axial PWSCC (SAI) indications were detected and sized by the Plus Point probe. The line by line sizing files were processed through the Westinghouse PWSCC software to obtain a corrected crack profile, using the techniques documented in WCAP-15573. The techniques are similar to the techniques in EPRI ETSS 96703, except that additional adjustments to the maximum depth are performed to account for low voltage indications. The PWSCC software results are attached in Table 13.

The following observations are made with respect to axial PWSCC at TSPs:

- One hundred forty-two SAI were detected in 130 tubes, 101 SAI in active tubes and 41 SAI in tubes deplugged in 1R10. The 101 active SAI are subject to CM.
- Of the 101 active SAI, 60 were new and 41 were repeat SAI that were left in service in 1R9. One repeat SAI and 12 new SAI (in 10 tubes) exceeded 40 percent maximum depth (MD) in 1R10; thus 11 tubes required plugging. Six intersections had ID/OD axial flaws at the same intersection, 3 SAI (2 tubes) were in the wedge region, and 1 SAI had another defect at the top of tubesheet (TTS); thus 9 tubes required plugging due to exclusions.
- All 41 deplugged SAI were less than 40 percent MD. However, 6 intersections had ID/OD axial flaws at the same intersection, requiring plugging. An additional tube was plugged due to ODSCC in a wedge region at another TSP.
- A total of 111 SAI (in 103 tubes) were left in service because they were less than 40 percent MD and not restricted by exclusion criteria. This included 5 SAI that extended outside the TSP.
- One hundred forty-three distorted support indications (DIS) were called by bobbin, and 72 confirmed as PWSCC SAI by Plus Point.
- Most of the SAI were located in small dents. Six SAI were in greater than 5-volt dents.

As noted above, a total of 12 dented intersections contained ID/OD axial flaws, 6 of which were in active tubes and subject to CM. Based on review of the terrain maps for all 12 intersections, the SAI are separated by ligament gaps. Therefore, the flaws are treated independently for structural and leakage integrity.

Consistent with EPRI Insitu Guidelines Appendix E, insitu testing is only relevant for axial flaw extensions outside the TSP. If insitu threshold values are exceeded for flaws inside the TSP crevice, analytical models are required to demonstrate structural and leakage integrity.

For structural integrity, the ordered screening parameters are (1) flaw length, (2) maximum depth, and (3) average depth (AD) as a function of length. The critical axial flaw length for a through-wall indication in a tube with lower tolerance limit (LTL) material properties is 0.57 inch and 0.44 inch for $1.4\Delta P_{SLB}$ (total flaw length) and $3\Delta P_{NO}$ (free span length), respectively. The longest free span SAI was 0.2 inch long, much less than the 0.44 inch threshold value. One SAI contained within a TSP exceeded the 0.57-inch threshold value: SG 1-2 R11C80 at 5H was 0.60 inch, 51 percent MD, and 44 percent AD. However, the measured MD was less than the 67 percent threshold value, which is the uniform average depth for a long (greater than 1 inch) axial crack that could burst at $1.4\Delta P_{SLB}$. Since an average depth limit is being applied to the maximum depth NDE screening parameter, it is not necessary to reduce the threshold value to account for NDE uncertainty. Therefore, all SAI flaw sizes were less than the threshold values, thereby demonstrating structural integrity at EOC10.

For leakage integrity, the ordered screening parameters are (1) maximum rotating pancake coil (RPC) voltage and (2) maximum depth. Maximum Plus Point voltages were compared to a critical voltage (4 volts) and a threshold voltage (3 volts). No SAI exceeded 3 volts. The bounding SAI had a maximum voltage of 2.47 volts, and this SAI was confined to the TSP. The bounding free span SAI had a maximum voltage of 0.65 volts. Therefore, all SAI flaw sizes were less than the threshold values, and leak testing was not required. Screening against maximum depth was not required. The largest measured maximum depth was 61 percent, less than the 80 percent threshold value, accounting for NDE uncertainty. Therefore, leakage integrity was satisfied for these indications, and no leakage should be postulated in a faulted SG following a SLB at EOC10.

WCAP-15573 Monte Carlo Methodology

As described above, a deterministic assessment demonstrates that structural and leakage performance integrity for CM are satisfied for axial PWSCC at dented TSP intersections. To supplement this assessment, single indication Monte Carlo was conducted for CM using the methodology in WCAP-15573, Revision 0. The Westinghouse burst model and the Argonne National Laboratory (ANL) ligament tearing leakage model were used for CM. All

indications detected in 1R10 were assessed, including those that were deplugged in 1R10 and not subject to CM. The results of the CM Monte Carlo are provided in Table 13 of this submittal.

For CM, no leakage is predicted and all indications exceeded burst margin for free span and total length. The limiting indication is SG 1-2 R11C80 at 5H, for which the Westinghouse model calculates a burst pressure of 5675 psi, exceeding the $1.4\Delta P_{SLB}$ limit of 3584 psi. An additional Monte Carlo simulation using the ANL ligament tearing burst model was performed, and all indications once again had burst pressures that exceeded the $1.4\Delta P_{SLB}$ limit. Therefore, all established performance criteria were satisfied at EOC 10 for both leakage and structural integrity.

None of the axial PWSCC indications detected in 1R10 exceeded flaw sizes that were projected by the Unit 1 Cycle 10 deterministic operational assessment (OA), with one exception: the 0.6 inch flaw in R11C80 was longer than bounding length projected in the OA. R11C80 was a new flaw, detected by bobbin coil at a previously unidentified dented intersection (0.99 dent voltage) at TSP 5H, which was above the established 4H critical zone. As such, this intersection was not inspected using Plus Point in 1R9. As discussed above, this flaw satisfied CM.

3.2 Circumferential PWSCC at Dented TSP Intersections

Detection of circumferential PWSCC at dented intersections using Plus Point is qualified per EPRI ETSS 96508. Sizing of circumferential PWSCC is qualified at the tubesheet region per ETSS 96702 (phase) and 96701 (amplitude), and these NDE sizing techniques may be used at TSP intersections in an "extended" manner. For 1R10, PG&E used ETSS 96701 amplitude sizing techniques.

Two PWSCC circumferential (SCI) indications were detected using Plus Point at dented 1H TSP intersections, as listed in Table 14: SG 1-1 R36C34 and SG 1-2 R4C59. The fairly large dent voltages of 3.95 and 5.69 volts are consistent with previous experience regarding SCI at dented intersections. The smallest dent voltage at which circumferential cracking has been detected is 2.4 volts.

R4C59 also contained an ODSCC SCI, such that the intersection contained PWSCC SCI and ODSCC SCI. Based on review of the terrain maps, the SCI are located at different axial elevations and are separated by ligament gaps. Therefore, the flaws are treated independently for structural and leakage integrity.

Consistent with EPRI Insitu Guidelines Appendix E, insitu testing is only relevant for SCI located outside of the TSP, or at the TSP edges. If insitu threshold values are exceeded for flaws inside the TSP crevice, analytical models are required to demonstrate structural and leakage integrity.

The structural integrity ordered screening parameters are (1) crack angle and (2) percent degraded area (PDA). The largest arc length of 35 degrees was much less than the 218 degree threshold value based on $3\Delta P_{NO}$ burst limits, including NDE uncertainty. As such, structural integrity limits were satisfied at EOC10.

The leakage integrity ordered screening parameters are (1) maximum voltage and (2) maximum depth. Both SCI were shallow as evidenced by a small maximum voltage of 0.68 volts, much less than the threshold value of 1.5 volts. Therefore, leakage integrity was satisfied for these indications, and no leakage should be postulated in a faulted SG following a SLB at the EOC10.

None of the circumferential PWSCC indications detected in 1R10 exceeded flaw sizes projected by the Unit 1 Cycle 10 deterministic OA, thus validating the conservative OA methodology.

4.0 ODSCC at Tube Support Plates

4.1 Circumferential ODSCC at Dented Tube Support Plates

Detection of circumferential ODSCC at TSPs using Plus Point is qualified per EPRI ETSS 20409. For circumferential ODSCC at expansion transitions and dented TSP intersections, line by line phase analysis sizing was performed using techniques equivalent to Appendix A of EPRI TR-107187, "Depth-based Structural Analysis Methods for SG Circumferential Indications."

Seven circumferential ODSCC indications at dented intersections were detected using Plus Point during the dent inspection program. This was the first detected occurrence of this damage mechanism in Unit 1, but has been predicted to occur due to experience at DCPP Unit 2, North Anna, and Sequoyah Unit 1. Table 14 provides the location, flaw size, and dent voltages. As would be expected, the dent voltages were large (greater than 5 volts). The SCI were located at lower TSP elevations: 6 at 1H and 1 at 2H.

Four ODSCC SCI were located in separate intersections. One intersection contained two ODSCC SCI, and one intersection contained ODSCC SCI and PWSCC SCI. Based on review of the terrain maps, the SCI are located at different axial elevations and are separated by ligament gaps. Therefore, the flaws are treated independently for structural and leakage integrity.

All SCI were located within 0.31 inches of the TSP centerline, such that they were confined to the 0.75 inch TSP crevice region. Consistent with EPRI Insitu Guidelines Appendix E, if insitu threshold values are exceeded for flaws inside the TSP crevice, analytical models are required to demonstrate structural and leakage integrity.

For burst integrity, the ordered screening parameters are (1) crack angle and (2) PDA. The bounding flaw had an arc length of 41 degrees (4.5 PDA), much less

than the 218 degree threshold value based on $3\Delta P_{NO}$ burst limits, including NDE uncertainty. As such, structural integrity performance criteria were satisfied at EOC10.

For leakage integrity, the ordered screening parameters are (1) maximum voltage and (2) maximum depth. The peak measured voltage (0.27 volts) was much less than the threshold value of 1.0 volts for ODSCC circumferential flaws. Therefore, no leakage should be postulated in a faulted SG following a SLB at EOC10.

Because 1R10 was the first time that circumferential ODSCC at dented TSP intersections was detected in Unit 1, the Unit 1 Cycle 10 OA did not assess this potential damage mechanism. However, the Unit 2 Cycle 10 OA provided an assessment of circumferential ODSCC at dented TSP intersections because this damage mechanism was detected in 2R9. None of the circumferential ODSCC indications detected in 1R10 exceeded flaw sizes projected by the Unit 2 Cycle 10 deterministic OA (after corrections for different cycle lengths between Unit 1 Cycle 10 and Unit 2 Cycle 10), thus validating the conservative OA methodology.

4.2 Axial ODSCC at Tube Support Plates

In 1R10, voltage-based ARC was implemented for the second time in Unit 1. No tube pulls were required to support the ARC. Distorted support signals (DOS) called by bobbin were evaluated for Plus Point inspection using the criteria of GL 95-05 as supplemented by PG&E commitments to the NRC. Over 450 DOS indications in active tubes were reported, and about 30 percent of these required Plus Point inspection. Three tubes exceeded the 2 volt repair limit and were plugged. Nine tubes were plugged because of ODSCC confirmed in the wedge region exclusion zone. Six tubes were plugged due to ODSCC confirmed (not detectable by bobbin) at a dented intersection greater than 5 volts. Six tubes were plugged due to Plus Point confirmation of ID/OD axial flaws at the same intersection.

There were also 15 DOS in deplugged tubes, and all were inspected using Plus Point. Six tubes had to be replugged due to Plus Point confirmation of ID/OD axial flaws at the same intersection, and one tube had to be replugged due to ODSCC confirmed in the wedge region exclusion zone.

As noted earlier, based on review of the terrain maps for all 12 intersections containing ID/OD axial flaws, the SAI are separated by ligament gaps. Therefore, the flaws are treated independently for structural and leakage integrity.

A detailed description of the 1R10 voltage-based ARC inspection results and tube integrity assessment is provided in the 90-day report that was submitted to the NRC via PG&E letter DCL-01-010 dated February 5, 2001. Monte Carlo techniques in accordance with GL 95-05 were used to assess structural and

leakage integrity. The projected EOC11 probability of burst for the worst case faulted SG was 4.9E-5, much less than the NRC-mandated limit of 1E-2. Leak rates for all SGs are listed in Table 12 and were submitted in the 90-day report. The EOC10 SLB leak rate for the worst case faulted SG was 0.15 gpm, much less than the 12.8 gpm limit, and less than the EOC10 leak rate projected in the Unit 1 Cycle 10 OA (thus demonstrating the conservatism of the OA leak rate methodology). The projected EOC11 SLB leak rate for the worst case faulted SG was 0.5 gpm, which is much less than the 12.8 gpm limit.

5.0 WEXTEX Tubesheet Region

W* ARC was implemented for the second time in 1R10. A 100 percent Plus Point hot leg TTS inspection was performed, with an inspection extent of plus 2 to minus 8 inches to support W* inspection requirements. All Plus Point indications in the WEXTEX region were evaluated under W* ARC to determine the need for repair.

5.1 Axial PWSCC in WEXTEX Region

A detailed description of the 1R10 W* ARC inspection results and tube integrity assessment is provided in the 90-day report which was submitted to the NRC via PG&E Letter DCL-01-010 dated February 5, 2001. Nine tubes (containing a total of 10 axial PWSCC indications) are categorized as W* tubes and left in service. Leak rates for all SGs are listed in Table 12 and were submitted in the 90-day report. The EOC10 W* leak rate for the worst case faulted SG was 0.07 gpm, much less than the 12.8 gpm limit, but slightly greater than the 0.03 bounding EOC10 W* leak rate projected by the Unit 1 Cycle 10 OA. The higher as-found leak rate is due to two new indications detected in SG 12. The projected EOC11 W* leak rate for the worst case faulted SG was 0.03 gpm, which is much less than the 12.8 gpm limit.

5.2 Circumferential PWSCC in WEXTEX Region

Detection and sizing of circumferential PWSCC at the tubesheet region is qualified per ETSS 96702 (phase) and 96701 (amplitude). For 1R10, PG&E used ETSS 96701 amplitude sizing techniques.

There were 2 circumferential PWSCC indications in the WEXTEX region detected using Plus Point in 1R10, as listed in Table 14. The indications were not eligible for W* ARC because they were not located below the W* region, and thus required plugging. One SCI was located below BWT, in the tubesheet constraint, and one SCI was located above BWT, in the transition region. For purposes of this tube integrity assessment, it is conservatively assumed that both SCI are not constrained by the tubesheet crevice.

The structural integrity ordered screening parameters are (1) crack angle and (2) PDA. The arc length of both SCI were 31 degrees was much less than the

218 degree threshold value based on $3\Delta P_{NO}$ burst limits, including NDE uncertainty. As such, structural integrity limits were satisfied at EOC10.

The leakage integrity ordered screening parameters are (1) maximum voltage and (2) maximum depth. The peak voltages were 1.26 volts (SCI located below BWT) and 0.54 volts (SCI located above BWT), less than the threshold value of 1.5 volts. In addition, the bounding maximum depth was 68 percent, less than the 80 percent threshold value. Therefore, leakage integrity was satisfied for these indications, and no leakage should be postulated in a faulted SG following a SLB at the EOC10.

Circumferential PWSCC in the WEXTEX region was detected in Unit 1 in 1R8, but not 1R9, and thus the Unit 1 Cycle 10 OA did not assess this potential damage mechanism. However, the Unit 2 Cycle 10 OA provided an assessment of circumferential PWSCC in the WEXTEX region because this damage mechanism was detected in 2R9. None of the circumferential PWSCC indications detected in 1R10 exceeded flaw sizes projected by the Unit 2 Cycle 10 deterministic OA (after corrections for different cycle lengths between Unit 1 Cycle 10 and Unit 2 Cycle 10), thus validating the conservative OA methodology.

5.3 Circumferential ODSCC in WEXTEX Region

Detection of circumferential ODSCC in the WEXTEX region using Plus Point is qualified per EPRI ETSS 20409. Line by line phase analysis sizing was performed using techniques equivalent to Appendix A of EPRI TR-107187, "Depth-based Structural Analysis Methods for SG Circumferential Indications."

There were 9 circumferential ODSCC indications in the WEXTEX transition region detected using Plus Point in 1R10, as listed in Table 14. The indications were not eligible for W* ARC because they were not located below the W* region, and thus required plugging. All SCI were located above BWT, near the top of tubesheet. Six SCI were located just below the TTS, and 3 were located at or just above the TTS. For purposes of this tube integrity assessment, it is conservatively assumed that the SCI are not constrained by the tubesheet crevice.

Two ODSCC SCI had been detected and plugged in 1R9. This degradation represents an upward trend in numbers. All SCI have been located in WEXTEX Zone 4 of the tubesheet (center region). Zone 4 is noted to have the most TTS tube scale buildup. This scale build up acts like a collar around the tube.

For burst integrity, the ordered screening parameters are (1) crack angle and (2) PDA. The bounding flaw had an arc length of 99 degrees (21 PDA), much less than the 218 degree threshold value (for Zone 4) based on $3\Delta P_{NO}$ burst limits, which includes NDE uncertainty. As such, insitu pressure testing was not required, and structural integrity performance criteria were satisfied at EOC10. The PDA of this bounding 1R10 flaw was smaller than the worst case PDA

projected by the Unit 1 Cycle 10 deterministic OA, thus validating the conservative OA structural integrity methodology.

For leakage integrity, the ordered screening parameters are (1) maximum voltage and (2) maximum depth. The peak measured voltage (0.33 volts) was much less than the threshold value of 1.0 volt for ODSCC circumferential flaws. Therefore, insitu leak testing was not required, and no leakage should be postulated in a faulted SG following a SLB at EOC10.

5.4 Volumetric Indications in WEXTEX Region

One OD volumetric indication (SVI) located just above the hot leg top of tubesheet (0.86 inch) was confirmed using Plus Point and plugged. Table 15 of this submittal provides Plus Point sizing summary. There is no EPRI Plus Point sizing technique for volumetric flaws. Plus Point sizing was performed to facilitate insitu screening assessment. The maximum depth is the depth at the maximum signal amplitude as determined by phase analysis. The length and width are determined by from-to measurements.

The SVI indication is a possible precursor to ODSCC. Four SVI above TSH were also detected and plugged in 1R9.

EPRI insitu guidelines state that if the flaw length is greater than 0.125 inch and the crack angle is greater than 30 degree, then the flaw should be evaluated as volumetric. Based on the 1R10 SVI flaw dimensions (0.22 inch axial length, 0.34 inch/47 degree circumferential length, 35 percent MD), the SVI is treated as volumetric.

For insitu leak and pressure testing, EPRI insitu guidelines require a screen of the measured maximum depth against appropriate maximum depth threshold values. The SVI dimensions are bounded by specimen dimensions used in development of the cold leg thinning (CLT) structural model (Westinghouse letter PGE-96-614), which show that indications with a length of 0.7 inch and a depth of about 78 percent in tubes with LTL material properties may be expected to meet the requirements of $3\Delta P_{NO}$. Therefore, for pressure testing, the MD threshold value is 78 percent, less Plus Point sizing uncertainty (not formally quantified). The maximum depth of the SVI was estimated at 35 percent, leaving a large margin for sizing uncertainty. As such, insitu pressure testing was not required, and structural integrity performance criteria were met for the volumetric indication at EOC10.

To determine a MD threshold value for leak testing, the CLT model shows that indications with a length of 0.7 inch and a depth of about 90 percent in tubes with LTL material properties may be expected to withstand a burst margin of 2560 psia (SLB pressure differential). Therefore, 90 percent is the threshold depth for the onset of leakage at SLB conditions, less NDE uncertainty. Because the SVI maximum depth of 35 percent is much less than the 90 percent depth threshold,

a large margin exists for an undefined Plus Point sizing uncertainty. Therefore, insitu leak testing was not required, and leakage at SLB conditions at EOC10 would not be expected.

6.0 Cold Leg Thinning

CLT degradation in operating plants is discussed in EPRI Report NP-5140. CLT is caused by surface wastage (corrosion) and occurs principally within the confines of the lower cold leg TSPs on the periphery of the tube bundle. CLT degradation has never caused an unscheduled outage in the industry, and the risk of leak during operation is small.

CLT indications are detected by bobbin probes as part of the 100 percent full-length bobbin inspection. The bobbin coil is qualified to size CLT indications, per EPRI ETSS 96001. CLT indications are plugged if bobbin indicates a depth greater than or equal to 40 percent through-wall.

In 1R10, bobbin indications at cold leg TSPs were called as DOS signals. If the intersection had no prior Plus Point history, it was then inspected using Plus Point. Volumetric indications confirmed using Plus Point (either in 1R10 or a prior outage) in the CLT region required bobbin sizing by resolution analysts. If Plus Point did not confirm the indication, the indication was left in service (and not included in voltage-based ARC calculations).

In 1R10, 139 CLT indications were detected and sized by bobbin, of which 12 were greater than or equal to 40 percent and plugged. Nine new CLT indications were detected. This represents a decline from the 53 new indications detected in 1R9. All indications were limited to 1C and 2C.

The structural limit for a defective tube with CLT has historically been 65 percent through-wall, conservatively based on uniform thinning. Based on the 65 percent structural limit, the CLT repair limit is 40 percent, thereby allowing for NDE uncertainty and growth rate of progression. This structural limit is based on burst strength of tubing for uniform thinning around the circumference of the tube. Since CLT is a localized phenomenon contained within the confines of the TSP, the structural limit for a CLT indication would be expected to be greater than 65 percent. As a result, the structural limit of actual CLT degradation was investigated by PG&E in 1996. In order to more accurately define the tube structural integrity limits for CLT defects, Westinghouse profiled the worst case CLT defects identified by NDE at DCPP Unit 1 during 1R7. Specimens were fabricated with simulated degradation and burst tests were performed. A CLT structural model was developed, showing that the CLT indications with a length of 0.7 inch and a depth of 84 percent in tubes with LTL material properties may be expected to meet the requirements of $1.4\Delta P_{SLB}$. The testing also showed that pressurization of CLT defects within a TSP does not result in burst and, therefore, $1.4\Delta P_{SLB}$ is demonstrated to be the appropriate structural limit. The

CLT structural report is documented in Westinghouse letter PGE-96-614 dated October 8, 1996.

The deepest indication identified in 1R10 was 49 percent through-wall. In accordance with EPRI ETSS 96001, sizing of CLT with bobbin coil (400/100 differential mix) has an NDE standard regression error of 16.46 percent at 90/50 confidence. Standard error for analyst uncertainty is 0.89 percent times 1.28 equals 1.14 percent at 90/50 confidence (reference "Appendix G Generic NDE Information from CM/OA," extracted from "Capabilities of Eddy Current Analysts to Detect and Characterize Defects in SG Tubes," Doug Harris, presented at November 1996 EPRI NDE workshop). The combined NDE system uncertainty (SRSS) of the analyst and technique uncertainties is 16.5 percent. Adding total NDE uncertainty to the bounding indication results in a CLT flaw of 65.5 percent, which is less than the CLT structural limit of 84 percent. Therefore, the structural integrity performance criteria were satisfied for this bounding indication at EOC10. Because CLT was not through-wall, no leakage is postulated in a faulted SG following a SLB at EOC10. The bounding 1R10 flaw size was less than the bounding flaw size projected in the Unit 1 Cycle 10 OA, demonstrating the conservatism of the OA methodology.

7.0 Antivibration Bar Wear

The population of tubes affected by AVB wear is limited based on industry experience with similar AVB wear degradation. About 69 percent of the tubes in a Model 51 SG are in contact with AVBs, and only tubes with the least support will experience AVB wear. AVB wear tends to initiate near the center of the tube bundle after a few operating cycles. Some larger radius tubes develop multiple wear initiation sites, which tends to reduce the growth rate at the deepest indications.

AVB wear indications are detected by bobbin probes during the 100 percent full-length bobbin inspection. The bobbin coil is qualified to size AVB wear indications, per EPRI ETSS 96004. AVB wear indications are plugged if bobbin indicates a depth greater than or equal to 40 percent through-wall.

In 1R10, bobbin identified 265 AVB wear indications. Four AVB wear indications (in 3 tubes) were greater than or equal to 40 percent and plugged. Twenty-three new indications were detected.

The structural limit for a defective tube with AVB wear is 71.4 percent based on WCAP-15147. The AVB wear repair limit is 40 percent, thereby allowing for NDE uncertainty and flaw growth progression.

The deepest indication identified in 1R10 was 42 percent through-wall. In accordance with EPRI ETSS 96004, sizing of AVB wear with bobbin coil (400/100 differential amplitude technique) has an NDE standard regression error of 5.74 percent at 90/50 confidence. Standard error for analyst uncertainty is

0.86 percent times 1.28 equals 1.10 percent at 90/50 confidence (reference "Appendix G Generic NDE Information from CM/OA," extracted from "Capabilities of Eddy Current Analysts to Detect and Characterize Defects in SG Tubes," Doug Harris, presented at November 1996 EPRI NDE workshop). The combined NDE system uncertainty is SRSS of the analyst and technique uncertainties, 5.8 percent. Adding total NDE uncertainty to the bounding indication results in a AVB wear flaw of 47.8 percent, which is less than the AVB wear structural limit of 71.4 percent. Therefore, the structural integrity performance criteria were satisfied for this bounding indication at EOC10. Because AVB wear was not through-wall, no leakage is postulated in a faulted SG following a SLB at EOC10.

8.0 PWSCC in Row 1 and 2 U-Bends

Detection of PWSCC in short radius U-bends using rotating coils is qualified per EPRI ETSS 96511. Sizing is not qualified, but could be "extended" from ETSS 96702 (phase) and 96701 (amplitude) qualified sizing of circumferential PWSCC at top of tubesheet. PG&E used 96701 amplitude sizing techniques in 1R10.

Unit 1 SG tubes in Rows 1 and 2 U-bends were heat treated following two cycles of operation to relieve stresses and mitigate the potential for PWSCC in this location. One hundred percent of Rows 1 and 2 U-bends have been inspected each refueling outage. Starting in 1R8, a Plus Point probe was used to inspect Rows 1 and 2 U-bends.

In 1R10, 100 percent of Rows 1 and 2 U-bends in all SGs were inspected by 0.680 mid range (MR) Plus Point probe. In light of lessons learned from the Indian Point (IP2) U-bend tube failure event, new data quality requirements were implemented. If questionable data was collected from the 0.680 MR, the U-bend was reinspected with a 0.680 high frequency (HF) Plus Point probe. If questionable data was subsequently collected with the 0.680 HF, the U-bend was reinspected with a 0.620 MR Plus Point probe. If acceptable data was not obtained with any of these probes, then the tube was plugged for precautionary measures. This resulted in 23 tubes being plugged. In addition to the above exams, 40 random exams in SG 1-2 and SG 1-4 (80 exams total) were performed using the 0.680 HF probe to obtain a further understanding of the detection capability of this probe as compared to 0.680 MR probe.

A cause of the IP2 U-bend tube failure was flow slot hour-glassing at the upper TSP. In 1R10, all available flow slots were visually inspected, including flow slot number 1 at the seventh TSP in an area of denting. No flow slot hour-glassing or irregularities could be detected. In addition, no measurable increase of dent voltages at the seventh TSP have been calculated, thus supporting the conclusion that existing dents are not growing, new dents are not initiating, and DCPP U-bends are not susceptible to rapid tube failure.

8.1 Circumferential PWSCC in Row 1 and 2 U-Bends

Four circumferential PWSCC indications (SCI) were detected at row 1 U-bend tangent points in 1R10. Table 14 of this submittal provides sizing information of these flaws. Three SCI were initially detected with the 0.680 MR Plus Point probe, and also confirmed with 0.680 HF Plus Point probe. One SCI was initially detected by the 0.620 MR Plus Point, and was not detectable by the 0.680 MR or 0.680 HF due to questionable data quality. No flaws were detected by the 0.680 HF probe that were not detected by the 0.680 MR; therefore, it was concluded that the detection capability of the two probes are similar.

For burst integrity, the ordered screening parameters are: (1) crack angle and (2) PDA. The arc length of the bounding SCI was 35 degrees, much less than the 218 degree threshold value based on $3\Delta P_{NO}$ burst limits, which includes NDE uncertainty.

For leakage integrity, the ordered screening parameters are: (1) maximum voltage and (2) maximum depth. The maximum voltage of the bounding SCI was 0.65 volts, much less than the threshold value of 1.5 volts, and a maximum depth of 37 percent, much less than the threshold value of 80 percent that includes NDE uncertainty.

Therefore, insitu leak and pressure testing was not required, and it was concluded that structural integrity limits were satisfied at EOC10, and that no leakage should be postulated in a faulted SG following a SLB at EOC10. To validate this conclusion, and in light of the IP2 U-bend tube failure, the largest voltage SCI was insitu leak and pressure tested as a precautionary measure. SG 12 R1C36 was full length pressure tested in accordance with EPRI insitu guidelines. The test sequence consisted of differential pressures associated with the following conditions, with appropriate vendor correction factors: normal operating; SLB; 500 psi increments above SLB, and 3 times normal operating. Pressurization rates were maintained less than 200 psi/sec, with hold times of 2 minutes at each pressure. No leakage or tube failure occurred at any test condition.

No circumferential indications in Rows 1 and 2 U-bends were detected in 1R9. Nonetheless, this potential degradation mechanism was assessed in the Unit 1 Cycle 10 OA. The bounding flaw size projected in the Unit 1 Cycle 10 OA is much larger than the flaws detected in 1R10, thus demonstrating the conservative OA methodology.

8.2 Axial PWSCC in Row 1 and 2 U-Bends

For the second consecutive inspection, no axial PWSCC in low row U-bends were detected in 1R10. From 1R3 to 1R8, 26 tubes in Unit 1 were plugged due to axial PWSCC in rows 1 and 2 U-bends. The cause of the decrease is attributed to slow defect growth rate and third time use of Plus Point. It is

believed that the number of cracks identified to date have slowly developed from crack sites that initiated prior to heat treatment.

Because axial PWSCC was not detected in 1R10, this degradation is not considered active and condition monitoring is not required.

9.0 Tube Support Plate (TSP) Integrity Inspections

In 1R8, 1R9 and 1R10, PG&E performed eddy current inspections to detect degradation of steam generator TSPs. A summary of this program was previously reported to the NRC in response to GL 97-06 (PG&E Letter DCL-98-046 dated March 27, 1998). Visual inspections performed in 1R8 confirmed several missing TSP ligaments. Westinghouse has concluded that the missing TSP ligaments are related to suspected TSP drilled hole manufacturing anomalies. The TSP manufacturing practices employed at the time that the DCPP steam generators were produced used a stacked drilling procedure. Several TSPs were clamped together and drilled simultaneously. A review of the SLC locations indicates distinct location patterns, indicative of manufacturing anomalies of the automatic drilling equipment.

The eddy current inspection program consists of several steps: bobbin inspection to detect suspect ligament cracks (SLC) using computerized data screening; Plus Point sample inspection of existing Plus Point confirmed "baseline" indications; and Plus Point inspection of newly detected bobbin SLC indications. The following provides a summary of the 1R10 inspection results.

Baseline Inspection and Results

To satisfy 20 percent inspection recommendations in the EPRI guidelines and to ensure that the current TSP condition is not changing, Plus Point inspection of 20 percent of the 255 baseline indications was required (approximately 51 inspections). This 20 percent sample requirement was satisfied by performing Plus Point inspection of 100 percent of baseline indications in SG 1-2 and SG 1-3, 160 inspections. Pressure pulse cleaning (PPC) was performed in these SGs, and Plus Point inspections were conducted following PPC to ensure that potential PPC-induced propagation of existing indications would be identified.

All but 5 baseline indications were confirmed using Plus Point. Plus Point confirmed indications are called LIC indications. The PG&E Lead Level III analyst reviewed all LIC indications for potential TSP ligament gaps, and added an associated ligament gap call (LIG) along with a gap measurement in degrees (0 degrees if no gap was noted). Based on a review of the gap data, the back-to-back gap measurements did not indicate significant change. Most of the gaps had negative growth, reflecting uncertainty in the sizing technique. The largest gap increase was 17 degrees. Therefore, it is concluded that the current TSP condition is stable. Because active degradation was not detected in the 20 percent baseline inspection, the Plus Point inspection did not require

expansion to 100 percent of the baseline population in all SGs. Active degradation is defined as service-induced TSP ligament erosion-corrosion and/or cracking.

Inspection for New Indications

CDS was performed on 100 percent of the 1R10 bobbin data to identify SLC indications. In addition, bobbin production analysts were instructed to make SLC calls. Four new SLC indications were detected using these methods, all were inspected using Plus Point, and 1 confirmed as a new LIC indication. There was no gap in this new indication. The PG&E Lead Level III analyst reviewed the preservice inspection (PSI) bobbin data for the new indication, and the signal was traceable to PSI data.

The new LIC indication was not located in the wedge zone. Therefore, the existing TSP structural analysis (due to missing TSP ligaments) performed by Westinghouse was not impacted.

Assessment of Plugging Criteria

The largest missing gap was 76 degrees, which is less than the 146 degree threshold gap; therefore, tube plugging was not required.

Axial ODSCC indications at TSPs that were subject to voltage-based repair criteria were reviewed for LIC/LIG indications. Also, axial PWSCC indications at TSPs were reviewed for LIC/LIG indications. No LIC/LIG indications were reported at any of these intersections. As such, no axial PWSCC or ODSCC indications at TSPs were excluded from being left inservice due to potential missing TSP ligaments.

10.0 <u>Free Span Ding Inspections</u>

Plus Point inspection was performed on a 20 percent sample (in SG critical areas) of greater than 2 volt free span dings identified in 1R9 to verify that no PWSCC is occurring in free span ding signals similar to TSP dented intersections. The entire length of free span between the support structures was inspected. The 20 percent sample of free span dings was inspected up the highest TSP where PWSCC has been found in that SG, as follows:

- SG 1-1 and 1-4: 20 percent of free span dings from TSH to 3H
- SG 1-2: 20 percent of free span dings from TSH to 6H
- SG 1-3: 20 percent of free span dings from TSH to 1H

Approximately 33 free span ding Plus Point inspections were conducted to satisfy the 20 percent sampling requirement, and no PWSCC was detected.

11.0 Possible Loose Part (PLP) Inspections

The bobbin data was reviewed for possible loose part (PLP) indications at the tube sheet in rows 1 and 2 and the outer 2 peripheral rows and columns. In addition, a foreign object search and removal (FOSAR) visual examination of the tube sheet annulus and blowdown lane regions was performed to identify loose parts.

One PLP was detected and confirmed using Plus Point, located between SG 1-1 R30C78 and R31C78, 3 inches above the cold leg top of tubesheet. This PLP was previously detected in 1R8 and 1R9, but was not detectable by FOSAR. 1R10 inspection by bobbin and Plus Point (conducted both prior to and after 1R10 sludge lancing) once again confirmed the PLP. Bounding Plus Point inspections were performed on adjacent tubes as required by procedure. This area was specifically reviewed by FOSAR, but no foreign object was identified. Based on this result, the PLP may be an anomalous eddy current trace pattern on the secondary side of the tube wall (conductive sludge, for example). No tube wear was noted in the Plus Point data. Eddy current inspections will be performed on this location again in 1R11, along with FOSAR examinations to detect and remove any potential loose parts. Continued operation during Unit 1 Cycle 11 is acceptable because no tube wear was detected by eddy current.

12.0 I-690 Mechanical Plug Inspections

A visual inspection of all existing plugs was performed to verify they are intact and show no signs of leaking. Detailed visual examination identified boron rings and stains on the surface of the tubesheet adjacent to several Westinghouse I-690 rib plugs. Light boron rings are not abnormal for rib plugs, as small amounts of borated water running from the cavities of the rib plug may leave a light white ring. However, irregular or large boric acid residue on the tubesheet could be indicative of an unacceptable leaking rib plug, as primary water behind the plug provides a much larger supply of boric acid. In SG 1-4, PG&E decided that 15 Westinghouse I-690 cold leg rib plugs should be removed and replaced due to large boron rings on the tubesheet, indicative of a potential leaking plug. The 15 plugs selected for removal were in tubes that had been plugged due to AVB wear greater than or equal to 40 percent through-wall. The plugs were removed by TIG relaxation and replaced with I-690 FTI long roll plugs. The hot leg plugs were not removed as they did not have abnormal boron stains. Following deplugging, no columns of water were released behind the plugs in these 15 tubes, as is normally the case in tubes that are deplugged. Several tubes were inspected by bobbin probes through the U-Bend section. In one tube, a 100 percent through-wall defect was detected by bobbin in the U-Bend where the AVB contacts the tube. Westinghouse letter PGE-00-550 provided an evaluation of the deplugged tubes and determined that U-bend stabilization was not required in 1R10.

In addition to the visual inspection of all plugs, Plus Point inspection was performed on a 20 percent sample of existing FTI I-690 roll plugs that were installed in 1R8 and 1R9. Inspections were performed even though there has been no industry experience with SCC in I-690 plugs. The inspection was limited to hot leg plugs due to temperature dependence of SCC. Thirty-nine roll plugs were inspected using Plus Point, 100 percent in SG 1-3 and SG 1-4, and 20 percent in SG 1-1. There are a total of 191 FTI roll plugs currently installed in DCPP Unit 1 hot legs from 1R8 and 1R9. Therefore, inspection of 39 hot leg plugs satisfied the 20 percent sample inspection requirement of the EPRI ISI Guidelines. No Plus Point indications were detected, and no further action was required.

13.0 Primary-to-Secondary Leakage during Plant Operation

A primary-to-secondary leak was initially detected in Unit 1 Cycle 9 on August 5, 1998. The initial leak rate was 0.3 gpd, averaging about 0.5 gpd. The leak rate was well below the 150 gpd performance criterion. SG blowdown sampling indicated a leak in SG 1-4. During comprehensive 1R9 eddy current inspections in February 1999, no through-wall defects in inservice tubes were identified that would have allowed a primary to secondary leak during Unit 1 Cycle 9. Plus Point voltages of all indications were less than threshold voltage values required for tube leakage. Forty tubes that were deplugged and reinspected also did not contain through-wall defects. Visual inspection of tube plugs did not identify leaking plugs. The small leak continued during Unit 1 Cycle 10, ranging from about 1 to 3 gpd during the cycle, well below the 150 gpd performance criterion. The Unit 1 Cycle 10 OA assumed that the small operational leakage was most likely due to primary coolant leakage past a mechanical plug and defective tube wall.

During 1R10 in October 2000, SG 1-4 consistently showed the presence of tritium, confirming that SG 1-4 was responsible for the majority of the calculated leakage. Once again, comprehensive 1R10 eddy current inspections did not detect through-wall defects in inservice tubes. Plus Point voltages of all indications were less than threshold voltage values required for tube leakage. Because leakage from inservice tubes was improbable based on the 1R9 and 1R10 inspections, 15 cold leg plugs in SG 14 were removed and replaced because of suspected plug leakage, as discussed earlier. In one tube, a 100 percent through-wall defect was detected by bobbin in the U-Bend where the AVB contacts the tube. It is postulated that a small primary-to-secondary leak path could have existed past a defectively installed rib plug through the 100 percent through-wall tube defect.

During Unit 1 Cycle 11, the small leakage continued after reaching steady-state conditions following 1R10. The most recent sample of Unit 1 Steam Jet Air Ejector was collected on February 28, 2001, and the calculated leak rate was 1.28 gpd. This cycle 11 leak rate is consistently lower than the cycle 10 leak

rate. Therefore, it is concluded that a portion of the leakage was eliminated due to the SG 1-4 cold leg plug replacements.

14.0 Effects of Increased Lithium on PWSCC Degradation

Implementing the proposed chemistry regime with a pH of between 7.05 and 7.1 at DCPP Unit 1 requires a lithium concentration of greater than 2.2 ppm for a longer period of time than during previous operating cycles. Up to 21-month extended cycle operation began in Unit 1 Cycle 9, and required increased lithium concentration in the primary coolant to control primary coolant pH from the BOC to about 8 months. In cycles 9 and 10, the maximum analyzed lithium concentration was 2.94 ppm, experienced for less than a month of full power operation. In cycle 11, lithium concentrations were further increased up to maximum of 3.5 ppm to maintain a higher primary coolant pH. Higher pH operation minimizes the rate of crud deposition, resulting in lower doses.

Implementing the cycle 11 chemistry regime requires a lithium concentration of greater than 2.2 ppm for a longer period of time than during previous operating cycles. Before operation above 2.2 ppm lithium for extended periods (i.e., greater than 3 months), the EPRI PWR Primary Water Chemistry Guidelines recommend a plant-specific fuel and materials review. Such an assessment of the effect of elevated lithium on the steam generators, balance of reactor coolant and auxiliary systems components was performed by Westinghouse in SECL-00-143. The evaluation included the possible reduction of resistance to PWSCC of Alloy 600 SG tubing by operating at increased levels of lithium concentration in the primary coolant.

The Westinghouse evaluation reaches the same conclusion as EPRI Primary Water Chemistry Guidelines, that is, chemistry regimes with initial lithium concentrations up to 3.5 ppm should not cause a significant increase in Alloy 600 crack growth rates.

15.0 Effects of Zinc on PWSCC Degradation

A program to inject zinc acetate into the RCS was implemented for the first time during Unit 1 Cycle 9 as a means to decrease the incidence of PWSCC in SG tubes. Laboratory testing and analytical programs conducted under Westinghouse and the Westinghouse Owners Group (WOG) demonstrated the value of ionic zinc in concentrations of 20 to 120 ppb as a means for reducing the general corrosion of primary system materials and to partially inhibit PWSCC of alloy 600 components.

Cycle 9 injection for 7 months maintained an RCS zinc concentration of 25-40 ppb. Cycle 10 injection for 10 months maintained an RCS zinc concentration of 20-25 ppb. Cycle 11 zinc injection is planned for 16 months to maintain an RCS zinc concentration of 10-20 ppb.

The general aspects and benefits of zinc addition are well established and accepted. Zinc has a positive effect by retarding general corrosion due to forming a corrosion resistant oxide layer, and lowering radiation fields due to displacing nickel and cobalt. It also appears to inhibit the initiation of PWSCC in Alloy 600. As noted in the EPRI Primary Water Chemistry Guidelines, the effect of zinc on PWSCC is being monitored under an EPRI/PG&E sponsored program.

Table 1
1R10 SG Tube Inspection and Expansion Criteria

	Area	Probe	Inspection Criteria	Expansion Criteria
1.	Full Length	Bobbin	100%	N/A
2.	Short Radius U-Bends	+Point	100% - Rows 1 and 2 U-bends	If PWSCC found in Row 2, inspect 20% of Row 3 in affected SG. Continue until a flaw free 20% sample is obtained.
3.	WEXTEX TTS Region - top of tubesheet - anomalies	+Point	• 100% of HL TTS • Extent is +2" to -8" • PTE/NTE anomaly extent is +2 to tube end	If C-3 condition is identified in HL TTS, inspect 20% of CL TTS in affected SG. If indications found in CL, follow EPRI Tables 3-1 and 3-2 for further expansion requirements. If cracking found in HL tubesheet anomalies, inspect 100% of CL tubesheet anomalies
4	Dented TSP Intersections	+Point	• SG 1-1, 1-4: 100% of dents from 1H to 3H, 20% at 4H • SG 1-2: 100% of dents from 1H to 6H, 20% at 7H • SG 1-3: 20% of dents at 1H • Where 100% inspections are not required, at least 20% of ≥ 5 volt dents up to 7H in each SG (and at least 50 dents, or 100% if less than 50 dents).	If PWSCC, circumferential cracking, or AONDB at dented intersection is found above critical area, then expand inspections in the affected SG as follows: inspect 100% of dents up to highest TSP where degradation found, plus 20% at the next highest TSP. Continue until a 20% sample is obtained that is free from PWSCC, circumferential cracking, or AONDB at dented intersection.
5	Suspected TSP Ligament Cracking (SLC)	+Point	• Perform + Point of 100% of existing LIC/LIG indications in SG 12 and SG 13 • Perform + Point of new SLC calls (see special interest) • Perform CDS of 1R10 bobbin data to identify potential SLC • Perform low frequency bobbin review of TSP at intersections with distorted support signals to identify potential SLC	If active degradation is detected in the 20% sample inspection, then the Plus Point inspection will be expanded to 100 percent of the baseline population. Active degradation is defined as service-induced TSP ligament erosion-corrosion and/or cracking.
6	Free Span Dings (> 2 volts)	+Point	• 1-1, 1-4: 20% TSH to 3H • 1-2: 20% TSH to 6H • 1-3: 20% TSH to 1H	If PWSCC is found in any of the 20% samples, then expand inspections in the affected SG as follows: inspect 100% of the dings up to that free span and 20% at the next highest free span. Continue until a flaw free 20% sample is obtained.
7	Mechanical Plugs	+Point	+Point inspect 100% of hot leg I-690 roll plugs in SG 13 and SG 14, 20% in SG 11. (Note - Visual of all existing plugs to verify they are intact and show no signs of leaking)	If degradation detected in sample, RPC inspect 100% of HL plugs in affected SG If C-3 condition is identified in HL, RPC inspect 20% of CL plugs in affected SG.
8	Post Pressure Pulse Cleaning (SG 1-2 and SG 1-3 only)	+Point	• 100% of 1H dents in PPC region • 100% of hot leg TTS in PPC region • 100% of baseline LIC/LIG	N/A

Table 2
1R10 Special Interest Scope

	Area	Probe	Inspection Criteria	Expansion Criteria
1.	Distorted OD bobbin signals	+Point	• DOS > 2 volts • DOS at dented intersections	N/A
2.	Distorted ID bobbin signals	+Point	• 100% DIS	N/A
3.	Mix Residuals at TSPs (SPR)	+Point	• CDS of 1R10 bobbin data to determine SPR voltage at each TSP intersection. • Inspect all HL intersections > 2.3 SPR volts	N/A
4.	TSP Exclusion Zones	+Point	Any bobbin indication in wedge region exclusion zone or 7H/7C exclusion zone.	N/A
5.	Cold Leg Thinning	+Point	New CLT indications	N/A
6.	Free Span Bobbin Indications	+Point	100% of free span bobbin indications that are new or exhibit growth or change (MBI, FSI, DNI)	N/A
7.	Loose Parts	Bobbin +Point	• Review bobbin data of row 1&2 and periphery tubes • +Point of PLP and surrounding tubes	N/A
8.	New SLC	+Point	Perform Plus Point inspection of all new SLC calls.	N/A
9.	Recovered tubes	Bobbin +Point	• 100% bobbin • +Point of all DOS/DIS, regardless of voltage. • +Point of all hot leg dents • +Point TSH, extent is +2" to -8"	N/A
10.	PUDs	+Point	100% of HL PUDs $\geq$ 2 volts	N/A

Table 3
Number of Tubes Unplugged in 1R10

Type of Plug	Reason for Unplug	SG 1-1	SG 1-2
Roll	PWSCC < 40%	8	28
Roll	95-05 ARC		2
Rib	95-05 ARC	5	
Total		13	30

Table 4
1R10 Tubes Plugged by Mechanism and SG

LOCATION	MECHANISM	ORIENT	1-1	1-2	1-3	1-4	Total
WEXTEX Region	PWSCC	Axial		2			2
	PWSCC	Circ	2				2
	ODSCC	Circ	1		8		9
	SVI				1		1
Hot Leg TSP	PWSCC	Axial	5	7		1	13
	PWSCC	Circ	1				1
	ODSCC	Axial	5	10		4	19
	ODSCC	Circ		4		1	5
	PWSCC/ODSCC	Axial	1	11			12
	PWSCC/ODSCC	Circ		1			1
	Preventive Data Quality	PVN		1			1
Cold Leg TSP	Cold Leg Thinning		4	6		2	12
U-Bends	AVB Wear			1	1	1	3
Rows 1 U-bend	PWSCC	Circ	1	2		1	4
Rows 1 and 2 U-bend	Preventive Data Quality		1	9	4	9	23
Tubes Plugged			21	54	14	19	108
Tubes Unplugged			13	30			43
Net Plugged in 1R10			8	24	14	19	65

Table 5
Unit 1 Historical Tube Plugged by Mechanism and SG

LOCATION	MECHANISM	ORIENT	1-1	1-2	1-3	1-4	Total
WEXTEX Region	PWSCC	Axial	6	4	0	2	12
	PWSCC	Circ	2	4	0	1	7
	ODSCC	Circ	3	0	8	0	11
	SVI		3	0	5	4	12
Hot Leg TSP	PWSCC	Axial	38	166	0	15	219
	PWSCC	Circ	1	6	0	0	7
	ODSCC	Axial	13	28	2	4	47
	ODSCC	Circ		4		1	5
	PWSCC Mix Mode	Ax/Circ	0	1	0	0	1
	PWSCC/ODSCC	Axial	3	13	0	0	16
	PWSCC/ODSCC	Circ		1			1
	SVI		1	0	1	1	3
	Preventive Data Quality	PVN		1			1
Cold Leg TSP	Cold Leg Thinning		17	24	1	7	49
	SVI		2	1	1	1	5
Rows 1 and 2 U-bend	PWSCC	Axial	6	17	2	1	26
	PWSCC	Circ	7	5	0	1	13
	Preventive Data Quality		1	9	4	9	23
U-bend	AVB Wear		4	10	12	16	42
Factory Plug			0	1	0	0	1
Restriction			0	2	0	0	2
Free span	SVI or SAI scratch		1	0	2	2	5
Preventive Plugging	Fatigue (88-02)		5	0	1	0	6
Implants			12	0	0	0	12
Tubes Plugged			125	297	39	65	526
% Plugged			3.7	8.8	1.2	1.9	3.9

Table 6
Unit 1 Historical Tubes Plugged - by Mechanism and Outage

LOCATION	MECHANISM	ORIENT	Pre	1R1	1R2	1R3	1R4	1R5	1R6	1R7	1R8	1R9	1R10	UnPlug	Total
Cumulative EFPYs				1.25	2.27	3.45	4.49	5.86	7.14	8.46	9.75	11.4	12.87		
Cycle EFPY				1.25	1.02	1.18	1.04	1.37	1.28	1.32	1.29	1.62	1.49		
WEXTEX Tubesheet	PWSCC	Axial							6	2	1	1	2		12
	PWSCC	Circ								1	4		2		7
	ODSCC	Circ										2	9		11
	Volumetric	SVI								1	5	5	1		12
Hot Leg TSP	PWSCC	Axial							31	72	124	20	13	41	219
	PWSCC	Circ								3	1	2	1		7
	PWSCC MixMode	Ax/Circ										1			1
	PWSCC/ODSCC	Axial									1	3	12		16
	PWSCC/ODSCC	Circ											1		1
	ODSCC	Axial							7	9	44	10	19	42	47
	ODSCC	Circ											5		5
	Volumetric										2	1			3
Cold Leg TSP	Thinning								10	14	2	11	12		49
	SVI										1	4			5
Row 1 and 2 U-bend	PWSCC	Axial				4		13	4		5				26
	PWSCC	Circ						4		1	4		4		13
U-bend	AVB Wear					2	1	12	8	12	3	1	3		42
U-bend, straight leg	Probe restriction					1			1						2
Free Span	SVI or scratch								1			4			5
Factory Plug	Preservice		1												1
UB indication					1									1	0
Preventive Plugging	Fatigue (88-02)					5					1				6
Preventive Plugging	UB Data Quality												23		23
Preventive Plugging	TSP Data Quality	PVN											1		1
Implants										2	1	9			12
Tubes Plugged			1	0	1	12	1	29	68	117	199	74	108		
Tubes Unplugged						1						40	43		
Cum Tubes Plugged			1	1	2	13	14	43	111	228	427	461	526		
Cum Tubes Plugged(%)			0.01	0.01	0.01	0.10	0.10	0.32	0.82	1.68	3.15	3.4	3.9		

Table 7
New PWSCC and Circumferential (ID and OD) Indications Detected at Dented TSPs

TSP	1R6	1R7	1R8	1R9	1R10
1H	16	34	46	25	29
2H	13	36	41	18	21
3H	2	6	28	17	7
4H	0	1	11	4	5
5H	0	0	2	3	6
6H	0	0	3	1	1
7H	0	0	0	0	0
Total	31	77	131	68	69

Note: Does not include deplugged tubes

Table 8
1R10 PWSCC and Circumferential (ID and OD) Indications Detected at Dented TSPs

TSP	1-1	1-1 deplugged	1-2	1-2 deplugged	1-3	1-4	Total
1H	3	3	36	11		7	60
2H	13	5	17	12		3	50
3H	5	1	6	8		5	25
4H	2		4	1			7
5H			8				8
6H			1				1
Total	23	9	72	32		15	151

Table 9
Approximate DCPP Unit 1 Dented TSP Population
(based on manual dent analysis of 1R9 data, no lower dent voltage cutoff)

	SG 1-1	SG 1-2	SG 1-3	SG 1-4	TOTAL
TOTAL	1592	2797	2260	5879	12528

Table 10
Approximate Number of 1R10 Dented Intersections Planned for Inspection

TSP	SG 1-1	SG 1-2	SG 1-3	SG 1-4	TOTAL
1H	196	589	83	1238	2106
2H	237	519	4	600	1360
3H	125	348	11	792	1276
4H	24	399	7	150	580
5H	4	322	43	43	412
6H	1	181	18	52	252
7H	50	108	50	74	282
TOTAL	637	2466	216	2949	6268

Inspection Criteria:

- SG 1-1, 1-4: 100% of dents from 1H to 3H, 20% at 4H
- SG 1-2: 100% of dents from 1H to 6H, 20% at 7H.
- SG 1-3: 20% of dents at 1H.
- Where 100% inspections are not required, the following > 5 volt dent inspection requirements must be satisfied: Inspect at least 20% of > 5 volt dents up to 7H in each SG (and at least 50 dents, or 100% if less than 50 dents).

Table 11a
In-Situ Pressure Testing Screening Values

Flaw	Location	Limiting Accident Cond (Note 1)	Parameter (Note 5)	ID	OD	Basis
Axial	Straight Leg (free span)	$3\Delta P_{NO}$	• L_{STR} • $MD_{P\text{-}THR}$ • $AD_{THR\text{-}f(l)}$	• 0.44 in • 61% • f(L)	• 0.44 in • 61% • f(L)	PGE-97-536
Axial	U-bend (Row 1/Row 2)	$3\Delta P_{NO}$	• L_{STR} • $MD_{P\text{-}THR}$ • $AD_{THR\text{-}f(l)}$	• 0.69/0.65 in • 78/76% • f(L)	• 0.69/0.65 in • 78/76% • f(L)	PGE-97-536
Axial	TSP crevice	$1.4\Delta P_{SLB}$ (Note 2)	• L_{STR} • $MD_{P\text{-}THR}$ • $AD_{THR\text{-}f(l)}$	• 0.57 inch • 67% • f(L)	• 0.57 inch • 67% • f(L)	PGE-97-536
Circ	Anywhere (Note 4)	$3\Delta P_{NO}$ (Note 3)	• CA_{TWSL} • AV_{THR} • PDA_{THR}	• 218 deg • 0.4 • 49%	• 218 deg • 0.4 • 49%	PGE-97-536

Table 11b
In-Situ Leakage Testing Screening Values

Flaw	Location	Limiting Accident Cond	Parameter (Note 5)	ID	OD	Basis
Axial	Anywhere	SLB	• V_{THR} • V_{CRIT} • $MD_{L\text{-}THR}$ • L_{min}	• 2.00 • 4.00 • 80% • 0.1 inch	• 1.50 • 2.50 • 75% • 0.1 inch	PGE-97-536
Axial	W* Region	SLB	• V_{THR}	• 2.50	N/A	DCL-98-148
Axial	TSP Crevice	SLB	• V_{THR}	• 3.00	N/A	DCL-98-164
Circ	Anywhere	SLB	• VM_{THR} • VM_{PLL} • $MD_{L\text{-}THR}$ • CA_{min}	• 1.50 • 3.0 • 80% • 30 deg	• 1.00 • 3.0 • 75% • 30 deg	PGE-97-536

Note 1: The reference conditions are:

- Pressure (steam) = 787 psia
- Pressure (RCS) = 2250 psia (based on design limit)
- $3\Delta P_{NO}$ = 4389 psi. ΔP_{NO} (normal operating) = 2250 - 787 = 1463 psid.
- $1.4\Delta P_{SLB}$ = 3584 psi. ΔP_{SLB} (steam line break) = 2560 psig (pressurizer safety valve setpoint = 2485 psig + 3% uncertainty = 2560 psig primary pressure. 0 psig assumed for the secondary.

Note 2: Tube to TSP proximity precludes tube burst during normal operating conditions; therefore, an axial crack contained within a TSP will not be subjected to $3\Delta P_{NO}$ pressure. However, during a postulated MSLB, it is conservatively assumed that the TSP has the potential to deflect during blowdown, thereby uncovering the intersection and expose the axial crack to the $1.4\Delta P_{SLB}$ pressure.

Note 3: For a circumferential crack within the TSP crevice, the TSP material is assumed to not provide additional resistance to burst. Therefore, $3\Delta P_{NO}$ pressure applies.

Note 4: The critical through-wall crack angle in WEXTEX Transition Zones 3 and 4 is 218 degrees, including eddy current uncertainty. Due to vibration propagation concerns, the crack angle is reduced to 170 and 135 degrees in Zone 2 and Zone 1, respectively, per Westinghouse letter PGE-92-636.

Note 5: Screening parameters are used in the sequence listed in this column in accordance with EPRI TR-107620-R1. Parameter acronyms are defined in PGE-97-536 and EPRI TR-107620-R1.

Table 12
DCPP Unit 1 Steam Line Break Leak Rates - Alternate Repair Criteria

EOC 10 Condition Monitoring Leak Rate (gpm at room temperature)	SG 1-1	SG 1-2	SG 1-3	SG 1-4
W* ARC	0.0222	0.0699	0.0189	0.0072
Voltage-Based ARC	0.1449	0.1284	0.1074	0.0360
Aggregate ARC	0.1662	0.1983	0.1263	0.0432

EOC 11 Operational Assessment Leak Rate (gpm at room temperature)	SG 1-1	SG 1-2	SG 1-3	SG 1-4
W* ARC	0.0303	0	0.0240	0.0089
Voltage-Based ARC	0.5023	0.4440	0.3559	0.1357
Aggregate ARC	0.5323	0.4440	0.3799	0.1446

Table 13 - 1R10 Axial PWSCC at Dented TSPs: Adjusted NDE and Condition Monitoring 95/50 Monte Carlo Results																			
										Adjusted NDE						CM – Westinghouse Burst Model			
SG	R	C	TSP	Crack No.	Dent Volt	BC	Flaw Type	Plug 1R10	Plug Reason	L (in.)	MD (%)	AD (%)	Max Volt	From	To	FS Burst Pressure psi	FS Leakage gpm	Total Length Burst Press. psi	Total Length Leakage gpm
1	3	28	02H	1	3.06		new			0.11	21.0	13.9	0.51	-0.18	-0.07	6100	0.000	6100	0.000
1	4	41	01H	1	1.04		new			0.25	35.0	24.7	0.30	-0.17	0.08	6100	0.000	6100	0.000
1	4	46	03H	1	1.04	DIS	new	yes	MD>40%	0.29	42.0	31.5	1.32	-0.11	0.18	6100	0.000	6100	0.000
1	13	16	02H	1	0.67	DIS	new	yes	MD>40%	0.23	48.0	38.2	1.25	-0.18	0.05	6100	0.000	6100	0.000
1	14	28	02H	1	2.83		new			0.13	23.0	12.7	0.55	0.15	0.28	6100	0.000	6100	0.000
1	15	16	02H	1	1.62		new			0.15	21.0	12.6	0.38	-0.13	0.02	6100	0.000	6100	0.000
1	15	76	02H	1	0.89		deplug 00			0.08	20.0	11.4	0.44	-0.16	-0.08	6100	0.000	6100	0.000
1	19	15	03H	1	0.59	DIS	repeat			0.20	35.0	21.8	0.82	-0.09	0.11	6100	0.000	6100	0.000
1	19	26	02H	1	0.9	DIS	new	yes	MD>40%	0.33	58.0	36.9	1.50	-0.23	0.10	6100	0.000	6100	0.000
1	20	28	02H	1	3.08	DIS	deplug 00			0.43	21.0	10.2	0.72	-0.25	0.18	6100	0.000	6100	0.000
1	20	29	02H	1	0.57	DIS	deplug 00			0.18	23.0	14.3	0.69	0.05	0.23	6100	0.000	6100	0.000
1	20	33	01H	1	0.82		repeat			0.08	20.0	14.4	0.22	-0.16	-0.08	6100	0.000	6100	0.000
1	22	7	03H	1	1.55	DIS	repeat	yes	MD>40%	0.26	41.0	27.3	1.23	-0.16	0.10	6100	0.000	6100	0.000
1	22	23	02H	1	4.71		new			0.06	24.0	14.0	0.53	-0.21	-0.15	6100	0.000	6100	0.000
1	22	23	02H	2	4.71		new			0.10	20.0	15.2	0.49	0.10	0.20	6100	0.000	6100	0.000
1	22	71	02H	1	0.78	DIS	repeat			0.20	35.0	19.8	0.62	-0.08	0.12	6100	0.000	6100	0.000
1	23	14	03H	1	1.37	DIS	repeat			0.13	27.0	17.6	0.51	-0.13	0.00	6100	0.000	6100	0.000
1	24	20	02H	1	1.58	DIS	repeat			0.07	38.0	22.6	0.65	0.02	0.09	6100	0.000	6100	0.000
1	24	67	02H	1	0.87		new			0.15	24.0	13.6	0.43	-0.08	0.07	6100	0.000	6100	0.000
1	25	57	03H	1	0.53	DIS	deplug 00			0.27	20.0	10.6	0.65	-0.13	0.14	6100	0.000	6100	0.000
1	26	25	01H	1	1.4	DIS	deplug 00			0.22	23.0	14.7	0.98	0.08	0.30	6100	0.000	6100	0.000
1	27	75	02H	1	0.72	DIS	new			0.11	34.0	26.2	0.87	-0.05	0.06	6100	0.000	6100	0.000
1	28	27	01H	1	1.74	DIS	deplug 00			0.29	33.0	18.8	0.92	-0.32	-0.03	6100	0.000	6100	0.000
1	28	50	01H	1	0.35	DOS	deplug 00	yes	ID/OD	0.09	29.0	19.1	0.64	-0.11	-0.02	6100	0.000	6100	0.000
1	29	37	02H	1	3.68	DIS	deplug 00			0.24	20.0	11.0	0.66	-0.07	0.17	6100	0.000	6100	0.000
1	30	21	02H	1	2.48		repeat			0.06	20.0	11.4	0.39	-0.08	-0.02	6100	0.000	6100	0.000
1	30	67	02H	1	3.27	DIS	deplug 00			0.33	28.0	19.3	0.96	-0.21	0.12	6100	0.000	6100	0.000
1	34	24	03H	1	1.31	DIS	repeat			0.32	21.0	14.2	0.37	-0.06	0.26	6100	0.000	6100	0.000
1	36	30	02H	1	1.63	DIS	repeat			0.17	35.0	26.1	1.16	-0.25	-0.08	6100	0.000	6100	0.000
1	37	39	04H	1	0.58	DIS	new	yes	MD>40%	0.43	58.0	45.3	2.19	-0.23	0.20	6100	0.000	5789	0.000
1	38	41	04H	1	0.5		new			0.13	20.0	12.4	0.55	-0.26	-0.13	6100	0.000	6100	0.000
2	2	76	02H	1	3.2		new			0.19	20.0	8.3	0.41	-0.21	-0.02	6100	0.000	6100	0.000
2	2	78	01H	1	1.52		new			0.07	20.0	12.4	0.61	0.05	0.12	6100	0.000	6100	0.000
2	2	79	03H	1	1.26	DIS	deplug 00			0.44	20.0	9.8	0.78	-0.18	0.26	6100	0.000	6100	0.000
2	2	92	05H	1	3.49		new			0.07	20.0	10.4	0.16	-0.41	-0.34	6100	0.000	6100	0.000
2	2	92	05H	2	3.49		repeat			0.11	20.0	10.0	0.46	-0.07	0.04	6100	0.000	6100	0.000
2	2	92	05H	3	3.49		new			0.19	20.0	7.2	0.44	0.09	0.28	6100	0.000	6100	0.000
2	2	93	04H	1	0.87		new			0.13	20.0	6.1	0.24	0.09	0.22	6100	0.000	6100	0.000
2	4	57	01H	1	1.04		new			0.07	20.0	12.9	0.37	0.01	0.08	6100	0.000	6100	0.000
2	4	69	01H	1	1.19		repeat	yes	SAI TSH	0.15	20.0	11.4	0.45	-0.13	0.02	6100	0.000	6100	0.000
2	4	84	01H	1	1.47	DIS	deplug 00			0.07	21.0	12.2	0.48	-0.01	0.06	6100	0.000	6100	0.000
2	5	65	01H	1	<2	DIS	deplug 00			0.31	25.0	15.9	0.44	-0.24	0.07	6100	0.000	6100	0.000
2	5	66	02H	1	<2	DIS	deplug 00			0.09	33.0	24.0	0.62	-0.13	-0.04	6100	0.000	6100	0.000
2	5	77	05H	1	1.66	DIS	repeat			0.20	36.0	20.5	0.77	-0.29	-0.10	6100	0.000	6100	0.000
2	5	93	01H	1	2.55	DIS	deplug 00			0.11	20.0	8.9	0.50	-0.11	0.00	6100	0.000	6100	0.000
2	6	74	03H	1	3.61		new			0.19	20.0	8.9	0.38	-0.16	0.03	6100	0.000	6100	0.000
2	7	31	01H	1	1.82		repeat			0.22	20.0	11.2	0.57	-0.03	0.19	6100	0.000	6100	0.000
2	7	68	03H	1	3.82	DIS	deplug 00			0.21	36.0	24.6	0.97	0.02	0.23	6100	0.000	6100	0.000
2	8	15	02H	1	2.92		new			0.30	26.0	14.2	0.74	-0.16	0.14	6100	0.000	6100	0.000
2	8	61	02H	1	1	DIS	new			0.14	30.0	22.4	0.62	-0.26	-0.12	6100	0.000	6100	0.000
2	8	61	02H	2	1	DIS	repeat			0.21	36.0	24.0	0.41	0.04	0.25	6100	0.000	6100	0.000
2	8	66	02H	1	2.25	DIS	deplug 00			0.07	20.0	9.6	0.28	-0.31	-0.24	6100	0.000	6100	0.000
2	8	67	01H	1	1.03	DIS	new			0.09	27.0	16.8	0.65	-0.05	0.04	6100	0.000	6100	0.000
2	8	93	01H	1	0.88		new			0.11	24.0	16.8	0.47	-0.15	-0.04	6100	0.000	6100	0.000
2	9	34	02H	1	1.47	DOS	new	yes	ID/OD	0.09	21.0	13.3	0.41	-0.04	0.05	6100	0.000	6100	0.000
2	9	56	01H	1	2.1		new			0.09	22.0	15.4	0.44	-0.28	-0.19	6100	0.000	6100	0.000
2	10	67	01H	1	1.19	DIS	deplug 00			0.27	20.0	11.9	0.75	-0.27	0.00	6100	0.000	6100	0.000

Table 13 - 1R10 Axial PWSCC at Dented TSPs: Adjusted NDE and Condition Monitoring 95/50 Monte Carlo Results																			
										Adjusted NDE						CM – Westinghouse Burst Model			
SG	R	C	TSP	Crack No.	Dent Volt	BC	Flaw Type	Plug 1R10	Plug Reason	L (in.)	MD (%)	AD (%)	Max Volt	From	To	FS Burst Pressure psi	FS Leakage gpm	Total Length Burst Press. psi	Total Length Leakage gpm
2	10	85	04H	1	0.82	DIS	deplug 00			0.06	33.0	16.3	0.37	0.15	0.21	6100	0.000	6100	0.000
2	11	45	01H	1	13.03	DIS	repeat			0.36	35.0	12.5	1.04	-0.05	0.31	6100	0.000	6100	0.000
2	11	80	05H	1	0.99	DIS	new	yes	MD>40%	0.42	45.0	34.9	1.24	-0.30	0.12	6100	0.000	6100	0.000
2	11	80	05H	2	0.99	DIS	new	yes	MD>40%	0.60	51.0	43.7	2.47	-0.31	0.29	6100	0.000	5675	0.000
2	11	81	02H	1	1.61	DIS	deplug 00			0.22	36.0	16.0	0.64	0.03	0.25	6100	0.000	6100	0.000
2	12	80	03H	1	0.5	DIS	new	yes	MD>40%	0.17	42.0	26.5	0.95	-0.21	-0.04	6100	0.000	6100	0.000
2	13	10	01H	1	7.39		new			0.10	24.0	13.1	0.65	-0.45	-0.35	6100	0.000	6100	0.000
2	13	34	01H	1	1.08	DIS	new	yes	MD>40%	0.13	46.0	28.2	1.13	0.02	0.15	6100	0.000	6100	0.000
2	13	84	01H	1	0.75	DIS	repeat			0.07	20.0	9.3	0.46	-0.05	0.02	6100	0.000	6100	0.000
2	13	84	01H	2	0.75	DIS	new			0.11	20.0	8.3	0.23	-0.08	0.03	6100	0.000	6100	0.000
2	14	16	04H	1	1.22		new			0.09	21.0	13.4	0.33	-0.05	0.04	6100	0.000	6100	0.000
2	14	45	01H	1	2.82		new			0.14	20.0	12.9	0.41	-0.04	0.10	6100	0.000	6100	0.000
2	14	68	01H	1	1.27	DIS	deplug 00			0.40	20.0	11.2	0.66	-0.27	0.13	6100	0.000	6100	0.000
2	14	70	01H	1	6.39	DIS	deplug 00			0.14	20.0	12.7	0.30	-0.12	0.02	6100	0.000	6100	0.000
2	14	72	02H	1	2.92	DIS	deplug 00	yes	ID/OD	0.42	38.0	16.3	1.04	-0.23	0.19	6100	0.000	6100	0.000
2	14	72	02H	2	2.92	DIS	deplug 00	yes	ID/OD	0.07	20.0	12.0	0.58	0.24	0.31	6100	0.000	6100	0.000
2	14	82	01H	1	1.55	DIS	deplug 00	Yes	ID/OD	0.05	20.0	10.0	0.39	-0.23	-0.18	6100	0.000	6100	0.000
2	15	10	01H	1	1.76	DOS	repeat	yes	ID/OD	0.21	24.0	14.0	0.48	-0.19	0.02	6100	0.000	6100	0.000
2	16	12	05H	1	3.58		new			0.11	21.0	13.5	0.33	-0.07	0.04	6100	0.000	6100	0.000
2	16	73	01H	1	16.39	DIS	deplug 00			0.26	24.0	11.8	0.73	-0.43	-0.17	6100	0.000	6100	0.000
2	16	73	01H	2	16.39	DIS	deplug 00			0.14	20.0	8.2	0.41	-0.25	-0.11	6100	0.000	6100	0.000
2	16	76	02H	1	0.4	DIS	deplug 00			0.11	20.0	11.6	0.52	-0.14	-0.03	6100	0.000	6100	0.000
2	17	60	02H	1	2.92	DIS	deplug 00	yes	ID/OD	0.17	22.0	7.2	0.56	-0.25	-0.08	6100	0.000	6100	0.000
2	19	31	04H	1	2		new			0.11	21.0	8.3	0.36	-0.08	0.03	6100	0.000	6100	0.000
2	19	74	02H	1	0.79	DIS	repeat			0.12	25.0	16.0	0.35	-0.15	-0.03	6100	0.000	6100	0.000
2	20	48	03H	1	0.14		repeat			0.25	30.0	15.4	0.74	-0.23	0.02	6100	0.000	6100	0.000
2	20	58	01H	1	0.55	DIS	new	yes	MD>40%	0.46	61.0	37.5	2.20	-0.18	0.28	6100	0.000	6100	0.000
2	20	58	01H	2	0.55	DIS	new	yes	MD>40%	0.15	52.0	40.4	1.71	-0.05	0.10	6100	0.000	6100	0.000
2	21	60	02H	1	0.51		deplug 00			0.25	20.0	9.2	0.55	-0.28	-0.03	6100	0.000	6100	0.000
2	23	25	03H	1	2.47	DIS	new			0.22	24.0	17.3	0.86	-0.22	0.00	6100	0.000	6100	0.000
2	23	54	01H	1	2.84		new			0.16	20.0	9.9	0.28	0.00	0.16	6100	0.000	6100	0.000
2	23	82	01H	1	1.17		repeat			0.12	30.0	19.4	0.33	0.06	0.18	6100	0.000	6100	0.000
2	24	72	01H	1	1.24	DOS	deplug 00	yes	ID/OD	0.26	22.0	15.5	0.40	-0.22	0.04	6100	0.000	6100	0.000
2	24	77	01H	1	3.06		new			0.12	25.0	16.1	0.35	-0.19	-0.07	6100	0.000	6100	0.000
2	25	17	02H	1	1.7	DIS	repeat			0.21	20.0	12.2	0.70	-0.34	-0.13	6100	0.000	6100	0.000
2	25	55	02H	1	1.27	DIS	repeat			0.11	20.0	12.1	0.25	0.13	0.24	6100	0.000	6100	0.000
2	25	74	01H	1	2.95		new			0.09	30.0	18.1	0.40	-0.34	-0.25	6100	0.000	6100	0.000
2	26	39	02H	1	1.01	DIS	repeat			0.12	27.0	16.6	0.86	-0.03	0.09	6100	0.000	6100	0.000
2	26	43	02H	1	2.12	DIS	deplug 00	yes	ID/OD	0.26	30.0	15.4	0.81	-0.22	0.04	6100	0.000	6100	0.000
2	26	79	01H	1	0.93	DIS	repeat			0.21	39.0	25.0	0.72	-0.11	0.10	6100	0.000	6100	0.000
2	27	50	01H	1	1.48	DIS	repeat			0.09	32.0	17.6	0.90	-0.23	-0.14	6100	0.000	6100	0.000
2	27	56	01H	1	6.29		new			0.11	20.0	11.6	0.59	-0.22	-0.11	6100	0.000	6100	0.000
2	27	64	03H	1	2.89	DIS	deplug 00			0.07	20.0	12.4	0.41	-0.13	-0.06	6100	0.000	6100	0.000
2	27	71	01H	1	1.86	DIS	repeat	yes	ID/OD	0.23	39.0	25.4	1.12	-0.23	0.00	6100	0.000	6100	0.000
2	28	66	02H	1	1.74		new			0.06	25.0	16.0	0.25	-0.02	0.04	6100	0.000	6100	0.000
2	29	51	02H	1	0.9		repeat			0.12	30.0	18.7	0.59	-0.16	-0.04	6100	0.000	6100	0.000
2	30	16	01H	1	1.08		new			0.09	32.0	21.3	0.65	-0.04	0.05	6100	0.000	6100	0.000
2	30	62	01H	1	1.88	DIS	deplug 00			0.07	20.0	12.8	0.49	-0.15	-0.08	6100	0.000	6100	0.000
2	31	37	03H	1	0.72	DIS	deplug 00			0.08	30.0	21.0	0.70	-0.16	-0.08	6100	0.000	6100	0.000
2	31	37	03H	2	0.72	DIS	deplug 00			0.09	36.0	25.8	0.51	-0.03	0.06	6100	0.000	6100	0.000
2	31	78	05H	1	3.55		new			0.20	27.0	9.8	0.35	0.50	0.70	6100	0.000	6100	0.000
2	32	37	03H	1	1.72	DIS	deplug 00			0.09	30.0	16.1	0.47	-0.01	0.08	6100	0.000	6100	0.000
2	32	62	01H	1	3.08		new			0.16	30.0	19.1	0.40	-0.13	0.03	6100	0.000	6100	0.000
2	33	37	01H	1	2.01		new	yes	ID/OD	0.11	20.0	12.0	0.38	-0.18	-0.07	6100	0.000	6100	0.000
2	33	68	02H	1	0.82		repeat			0.06	33.0	17.3	0.38	0.02	0.08	6100	0.000	6100	0.000
2	34	36	03H	1	1.5	DIS	deplug 00			0.23	20.0	11.6	0.64	-0.17	0.06	6100	0.000	6100	0.000
2	34	51	06H	1	1.73		new			0.17	32.0	16.8	0.42	-0.03	0.14	6100	0.000	6100	0.000
2	34	65	02H	1	1.65	DIS	deplug 00			0.09	22.0	12.3	0.39	-0.05	0.04	6100	0.000	6100	0.000

Table 13 - 1R10 Axial PWSCC at Dented TSPs: Adjusted NDE and Condition Monitoring 95/50 Monte Carlo Results

										Adjusted NDE						CM – Westinghouse Burst Model			
SG	R	C	TSP	Crack No.	Dent Volt	BC	Flaw Type	Plug 1R10	Plug Reason	L (in.)	MD (%)	AD (%)	Max Volt	From	To	FS Burst Pressure psi	FS Leakage gpm	Total Length Burst Press. psi	Total Length Leakage gpm
2	35	52	03H	1	3.1		repeat			0.23	24.0	14.3	0.85	-0.13	0.10	6100	0.000	6100	0.000
2	35	56	02H	1	1.77	DIS	deplug 00			0.19	27.0	17.5	0.47	0.00	0.19	6100	0.000	6100	0.000
2	35	65	02H	1	1.64	DIS	new	yes	MD>40%	0.29	54.0	40.4	1.18	-0.03	0.26	6100	0.000	6100	0.000
2	36	60	04H	1	2.94		repeat			0.17	27.0	13.2	0.70	-0.23	-0.06	6100	0.000	6100	0.000
2	37	58	02H	1	<2	DIS	new	yes	wedge	0.25	31.0	25.8	1.38	-0.27	-0.02	6100	0.000	6100	0.000
2	37	58	02H	2	<2	DIS	new	yes	wedge	0.13	20.0	10.2	0.41	-0.19	-0.06	6100	0.000	6100	0.000
2	37	73	03H	1	1.87	DIS	deplug 00			0.23	27.0	17.9	0.89	-0.14	0.09	6100	0.000	6100	0.000
2	38	61	01H	1	3.91		deplug 00	yes	2H wedge	0.09	20.0	13.0	0.48	-0.13	0.00	6100	0.000	6100	0.000
2	38	63	01H	1	2.35	DIS	new	yes	ID/OD	0.14	22.0	13.9	0.78	-0.29	-0.15	6100	0.000	6100	0.000
2	38	66	01H	1	0.75	DIS	repeat			0.19	33.0	16.7	0.74	-0.01	0.18	6100	0.000	6100	0.000
2	39	64	03H	1	1.46		new	yes	wedge	0.13	28.0	18.4	0.56	-0.08	0.05	6100	0.000	6100	0.000
2	41	62	01H	1	0.95	DIS	new	yes	ID/OD	0.21	27.0	17.0	0.54	-0.14	0.07	6100	0.000	6100	0.000
2	42	28	02H	1	1.67		new			0.12	32.0	21.2	0.70	-0.06	0.06	6100	0.000	6100	0.000
4	17	24	01H	1	0.71		repeat			0.07	20.0	10.4	0.34	0.29	0.36	6100	0.000	6100	0.000
4	20	25	01H	1	7.05	DIS	repeat			0.17	20.0	13.3	0.26	-0.69	-0.52	6100	0.000	6100	0.000
4	21	70	03H	1	4.65		new	yes	MD>40%	0.10	48.0	29.1	0.44	-0.41	-0.31	6100	0.000	6100	0.000
4	21	76	01H	1	3.35		repeat			0.14	34.0	22.6	0.40	-0.15	-0.01	6100	0.000	6100	0.000
4	21	84	01H	1	1.06	DIS	deplug 99			0.18	31.0	23.2	0.67	-0.11	0.07	6100	0.000	6100	0.000
4	35	36	02H	1	0.55		deplug 99			0.14	20.0	13.3	0.45	0.14	0.28	6100	0.000	6100	0.000
4	35	56	03H	1	0.68	DIS	new			0.10	25.0	13.3	0.27	-0.16	-0.06	6100	0.000	6100	0.000
4	35	56	03H	2	0.68	DIS	repeat			0.07	20.0	10.0	0.37	0.01	0.08	6100	0.000	6100	0.000
4	35	61	02H	1	2.11		new			0.12	22.0	15.6	0.45	-0.11	0.01	6100	0.000	6100	0.000
4	35	68	03H	1	2		repeat			0.18	35.0	24.9	0.34	-0.17	0.01	6100	0.000	6100	0.000
4	38	69	02H	1	1.52		new			0.11	28.0	19.8	0.49	-0.02	0.09	6100	0.000	6100	0.000
4	39	48	03H	1	1.84	DIS	deplug 99			0.20	20.0	14.4	0.34	0.04	0.24	6100	0.000	6100	0.000
4	39	58	01H	1	3.25	DIS	deplug 99			0.33	20.0	11.7	0.86	-0.01	0.32	6100	0.000	6100	0.000
4	46	42	01H	1	2.14		repeat			0.34	31.0	15.1	0.43	-0.31	0.03	6100	0.000	6100	0.000

Table 14
1R10 Circumferential Indications (sorted by Location)

SG	Row	Col	Ind	Elev	Inch	Location	ID/ OD	Probe	TS Zone	Pulser Zone	Stabilize	Dent Volt	+Point Volt	MD %	FLDA	PDA	ARC deg
11	36	34	SCI	1H	0.05	Dented TSP	ID	720+P				3.95	0.68	24	10.2	1.0	35
12	4	59	SCI	1H	-0.17	Dented TSP	OD	720+P			YES	5.69	0.21	49	33.5	2.9	30
12	4	59	SCI	1H	0.04	Dented TSP	ID	720+P			YES	5.69	0.43	48	33.2	3.2	34
12	14	73	SCI	1H	0.22	Dented TSP	OD	720+P				16.3	0.25	66	38.7	4.5	41
12	3	79	SCI	1H	0.29	Dented TSP	OD	720+P		YES	YES	3.5	0.27	17	9.1	0.3	11
12	3	81	SCI	1H	-0.3	Dented TSP	OD	720+P		YES	YES	27.9	0.24	20	5.8	0.5	30
12	3	81	SCI	1H	0.28	Dented TSP	OD	720+P		YES	YES	27.9	0.15	57	27.3	2.3	30
14	2	68	SCI	1H	-0.21	Dented TSP	OD	720+P		YES	YES	6.75	0.18	17	9.8	0.6	20
12	2	83	SCI	2H	-0.09	Dented TSP	OD	720+P				6.05	0.26	41	28.9	3.4	41
11	1	24	SCI	7H	9.74	Tangent	ID	680+P					0.62	23	10.0	0.7	23
12	1	36	SCI	7H	9.78	Tangent	ID	680+P					0.65	37	17.9	1.5	30
12	1	51	SCI	7H	9.05	Tangent	ID	620+P					0.48	33	11.0	1.1	35
14	1	68	SCI	7H	10.05	Tangent	ID	720+P					0.52	29	16.8	1.5	31
11	17	17	SCI	TSH	-3.12	Below BWT	ID	720+P	4				1.26	64	41.4	3.6	31
11	15	44	SCI	TSH	-0.11	Above BWT	ID	720+P	4				0.54	68	46.8	4.1	31
11	13	66	SCI	TSH	0.02	Above BWT	OD	720+P	4				0.14	18	--	--	28
13	30	38	SCI	TSH	-0.02	Above BWT	OD	720+P	4				0.32	86	58.3	7.6	47
13	29	45	SCI	TSH	-0.02	Above BWT	OD	720+P	4				0.22	59	46.9	4.9	37
13	24	46	SCI	TSH	0.04	Above BWT	OD	720+P	4				0.24	34	21.8	2.8	46
13	9	54	SCI	TSH	-0.02	Above BWT	OD	720+P	4				0.19	80	70.0	8.9	45
13	9	55	SCI	TSH	0	Above BWT	OD	720+P	4				0.16	85	61.8	6.2	36
13	12	69	SCI	TSH	-0.08	Above BWT	OD	720+P	4		YES		0.31	91	76.5	21.2	99
13	13	72	SCI	TSH	-0.1	Above BWT	OD	720+P	4				0.33	95	81.7	15.7	69
13	10	75	SCI	TSH	-0.03	Above BWT	OD	720+P	4				0.11	60	29.0	1.5	19

Note:
For circumferential ODSCC at dented TSP intersections and WEXTEX top of tubesheet region, the non-qualified line by line phase sizing analysis reports several deep maximum depths associated with small peak voltages. In the absence of qualified sizing techniques, peak voltage is the best indication of leakage integrity.

Table 15
1R10 SVI Indication

SG	Row	Col	Ind	Elev	Inch	Loc	Probe	Orient	Max Volts	MD %	Axial length, inch	Circ extent (width), inch	Circ extent (width), degree	EPRI flaw treatment
13	38	31	SVI	TSH	0.86	Above BWT	720+P	OD	0.16	35	0.22	0.34	47.3	Volumetric