STEAM GENERATOR TUBE INSPECTION DISCUSSION POINTS

PREPARED BY THE OFFICE OF NUCLEAR REACTOR REGULATION

PACIFIC GAS AND ELECTRIC COMPANY

DIABLO CANYON POWER PLANT, UNIT 2

DOCKET NO. 50-323

The following discussion points have been prepared to facilitate the phone conference arranged with Pacific Gas and Electric to discuss the results of the SG tube inspections to be conducted during the upcoming Diablo Canyon Power Plant, Unit 2 refueling outage 13. This phone call is scheduled to occur towards the end of the planned SG tube inspection interval, but before the unit completes the inspections and repairs.

The staff plans to document a brief summary of the conference call as well as any material that is provided in support of the call.

1. *Discuss any trends in the amount of primary-to-secondary leakage observed during the recently completed cycle.*

PG&E Response: In Unit 2 Cycle 13, a small leak (0.4 gpd) was detected and measured in the steam jet air ejector, based upon the presence of noble gas. Chemistry determined that SG 2-4 had the highest relative leak rate. A similar small leak rate was also detected in Unit 2 Cycle 12.

2. *Discuss whether any secondary side pressure tests were performed during the outage and the associated results.*

PG&E Response: No secondary side pressure tests were performed.

3. *Discuss any exceptions taken to the industry guidelines.*

PG&E Response: There are no deviations to industry guidelines, with the exception of one minor deviation of “shall” requirements of Revision 6 of the Secondary Water Chemistry Guidelines. Tables 5-2 and 5-3 of the Guidelines establish limits for exceeding 5% power. Diablo Canyon Units 1 and 2 apply these limits to 8% power.

4. *For each steam generator, provide a description of the inspections performed including the areas examined and the probes used (e.g., dents/dings, sleeves, expansion-transition, U-bends with a rotating probe), the scope of the inspection (e.g., 100% of dents/dings greater than 5 volts and a 20% sample between 2 and 5 volts), and the expansion criteria.*

PG&E Response: Table 1 provides a summary of all inspections performed, and expansion criteria.

5. *For each area examined (e.g., tube supports, dent/dings, sleeves, etc), provide a summary of the number of indications identified to-date of each degradation mode (e.g., number of circumferential primary water stress corrosion cracking indications at the expansion transition). For the most significant indications in each area, provide an estimate of the severity of the indication (e.g., provide the voltage, depth, and length of the indication). In particular, address whether tube integrity (structural and accident induced leakage integrity) was maintained during the previous operating cycle. In addition, discuss whether any location exhibited a degradation mode that had not previously been observed at this location at this unit (e.g., observed circumferential primary water stress corrosion cracking at the expansion transition for the first time at this unit).*

PG&E Response: Table 2 provides the 2R13 Repairable indications and Tube Status Report as of 5-2-06 at 1800, and provides the number of indications identified to date of each degradation mode and steam generator tube location. Table 3 provides a list of the most significant indications of each damage mechanism. For SCC, the largest voltage indications are listed. As noted in Tables 2 and 3, in SG 2-2, ding ODSCC was detected by bobbin in a free span ding of 3.78 volts. Plus Point confirmed the bobbin indication as ding ODSCC. This is the first occurrence of this damage mechanism in DCPP Units 1 and 2.

6. *Describe repair/plugging plans.*

PG&E Response: Table 2 provides the number of tubes to be plugged as of 5-2-06. All repairs are performed by tube plugging at both hot and cold legs. Tubes being plugged with circumferential indications are evaluated for stabilization in accordance with vendor criteria.

7. *Describe in-situ pressure test and tube pull plans and results (as applicable and if available).*

PG&E Response: To date, there are no indications that require in-situ pressure testing or tube pull.

8. Provide the schedule for steam generator-related activities during the remainder of the current outage.

PG&E Response: SG inspections are scheduled to be complete on May 3 at about 1800, with plugging to be completed shortly after.

9. Discuss the following regarding loose parts:

- *what inspections are performed to detect loose parts*
- *a description of any loose parts detected and their location within the SG, and if the loose parts were removed from the SG*
- *indications of tube damage associated with the loose parts*
- *the source or nature of the loose parts if known*

PG&E Response:

Inspections performed to detect loose parts. 100% of the bobbin data is reviewed for possible loose part (PLP) indications. In addition, a special in-depth analysis is performed for PLP indications along the full length of rows 1 to 3 and the outer 3 peripheral tubes. Also, at the cold leg top of tubesheet for the outer 3 peripheral tubes (including tube lane), a special in-depth analysis for tube wear is performed using a turbo mix of the bobbin data. For the hot leg top of tubesheet, Plus Point data is reviewed for PLP during the 100% TTS exams.

Description of any loose parts detected and their location within the SG, and if they were removed from the SG. No PLP have been detected.

Indications of tube damage associated with the loose parts. No tube degradation or tube wear has been detected that could have resulted from loose parts.

10. Discuss the results of any secondary side inspections.

PG&E Response: The SG hand hole covers were not removed in 2R13. No secondary side inspections (FOSAR) were performed, and no sludge lancing was performed.

11. Discuss any unexpected or unusual results.

PG&E Response: There were no unexpected or unusual results.

Table 1 – 2R13 Eddy Current Inspection and Expansion Plan				
Item	Area	Probe	Inspection Criteria	Expansion Criteria
1	Full Length	Bobbin	100% (Except Rows 1 and 2 U-bend)	N/A
2	WEXTEX TTS Region	+Point	100% of hot leg TTS	If a C-3 condition is identified in the hot leg TTS inspection, inspect 20% of the cold leg TTS region in the affected SG in the current or subsequent outage. The 20% inspection should be biased to an area where degradation has the greatest potential to occur.
				If cold leg TTS cracking is detected, then either: Inspect 100% of the cold leg TTS region in the affected SG, plus 20% cold leg sample in the other SGs. If cracking is detected in the 20% sample, then inspect 100% of the cold leg TTS in the affected SGs. OR Define a critical area (CA) and buffer zone and inspect 100% of the tubes in the CA and buffer zone in the affected SG, plus 20% of the cold leg CA sample in the other SGs.
				If cold leg TTS non-crack-line indications are detected, then either: Define a critical area (CA) and buffer zone and inspect 100% of the tubes in the CA and buffer zone in the affected SG, plus 20% cold leg CA sample in the other SGs. OR For Category C-2 cold leg results, inspect an additional 20% cold leg sample in the affected SG. For Category C-3 cold leg results, inspect 100% of the cold leg TTS region in the affected SG, plus 20% cold leg sample in the other SGs.
3		+Point	Hot leg WEXTEX inspection extent is from +2” to -8”. Cold leg WEXTEX region extent is +2” to -8.5”.	If initial inspection extent is less than flexible W* length, increase inspection extent.
4		+Point	100% of hot leg WEXTEX anomalies (NTE anomaly extent is +2” to tube end)	If crack-like indications are detected in hot leg WEXTEX anomalies, then inspect 100% of the cold leg WEXTEX anomalies.
5		+Point	100% of previous W* indications within the W* length	N/A
6		+Point	100% of bobbin distorted tubesheet signals (DTS) in the W* length	N/A
7	Low Row U-bends	+Point	100% of Rows 1 and 2	N/A
8	High Row U-bends for Circ PWSCC	+Point	100% of Rows 3 to 10	If circ PWSCC detected in Rows 9 or 10, expand to Row 20 at 100%.
				If circ PWSCC detected in Rows 11 through 14, redefine critical area (CA) and buffer zone based on review of Figure 10 of WOG U-Bend report and application of a factor of two reduction in longitudinal strain, and inspect 100% of the new CA and buffer zone in the affected SGs.
				If circ PWSCC detected in Rows 15 through 20, expand to 100% of all remaining rows in the affected SGs.
9	High Row U-bends for Axial PWSCC	+Point	100% of Rows 3 to 10	If axial PWSCC is detected in Rows 3 to 8 with NDD in Rows 9 and 10, then in the affected SG inspect 100% of Rows 11 to 16, 50% of Row 17, and 20% of Row 18.
				If axial PWSCC is detected in Rows 9 to 10, then inspect 100% of Rows 11 to 25 in the affected SGs.
				If axial PWSCC is detected in Rows 11 to 25, then review Figure 5 of the WOG U-Bend report to define a critical area and buffer zone based on tube ovality data, and inspect 100% of the CA and buffer zone in the affected SGs.
				If axial PWSCC is detected in greater than Row 25, then inspect 100% of all rows in the affected SGs.
10	≥ 5 Volt Dented TSP	+Point	100%	N/A

Table 1 – 2R13 Eddy Current Inspection and Expansion Plan				
Item	Area	Probe	Inspection Criteria	Expansion Criteria
11	> 2 Volt and <5 Volt Dented TSP	+Point	• SG 2-1: 20% of >2 and <5 volt dents at 1H • SG 2-2: 100% of >2 and <5 volt dents from 1H to 5H, 20% at 6H • SG 2-3, 2-4: 100% of >2 and <5 volt dents from 1H to 3H, 20% at 4H For any 20% sample, a minimum of 50 > 2 volt and < 5 volt dents shall be inspected. If the population of > 2 volt and < 5 volt dents at that TSP elevation is less than 50, then 100% of the > 2 volt and < 5 volt dents at that TSP shall be inspected.	If PWSCC (at any size dent), circumferential indications (at any size dent), or ≥ 2 inferred volt AONDB (at >2 and <5 volt dent) are detected at a TSP elevation where 100% inspections were not required, expand the Plus Point inspections (in a step-wise manner, 100% to affected TSP and 20% at next TSP) up through the hot leg side of the SG and down the cold leg side until a 20% sample is obtained that is free from PWSCC, circumferential cracking, or ≥ 2 inferred volt AONDB.
12	≤ 2 Volt Dented TSP	+Point	N/A Note: Bobbin is used for detection of axial PWSCC in ≤2 volt dents. +Point inspection of ≤ 2 volt dents is not required, unless dictated by expansion requirements.	Generic criteria: On a SG-specific basis, if a circ indication or ≥2 inferred volt AONDB is detected in a dent of "x" volts, where "x" is less than or equal to 2.3 volts, then expand Plus Point inspections to include 100% of dents greater than "x - 0.3" volts up to the affected TSP, plus 20% of dents greater than "x – 0.3" volts at the next higher TSP. Note: For any 20% sample, a minimum of 50 "x – 0.3" volt dents shall be inspected. If the population of "x – 0.3" volt dents at that TSP elevation is less than 50, then 100% of the "x – 0.3" volt dents at that TSP shall be inspected.
13	Repeat PWSCC ARC Indications at Dents	+Point	100%	N/A
14	DIS	+Point	100% of distorted ID support plate bobbin signals (DIS) at dented TSP	N/A
15	TSP Inspection for ODSCC ARC	+Point	100% of bobbin distorted OD support signals (DOS) at dented intersections (no lower voltage cutoff)	N/A
16		+Point	100% of DOS ≥ 1.7 volt	N/A
17		+Point	DOS with suspected TSP ligament cracking (SLC)	N/A
18		+Point	Any bobbin indication in the wedge region exclusion zone	N/A
19		+Point	DOS at 7th TSP exclusion zone	N/A
20		+Point	DOS that extend outside the TSP crevice	N/A
21		+Point	100% of hot leg intersections with >2.3 volt SPR (mixed residual signal), and minimum of 5 largest hot leg SPR per SG.	N/A
22		+Point	TSP with copper signals	N/A
23		+Point	100% of prior cycle AONDB (bounds commitment to inspect 100% of AONDB that continue to be NDD by bobbin in current inspection)	N/A
24		+Point	100% of prior cycle TSP SAI-OD that are NDD by bobbin in current inspection	N/A
25	TSP Ligament Cracking	+Point	100% of existing baseline Plus Point confirmed TSP ligament cracking (LIC or LIG) indications.	N/A
26		+Point	100% of bobbin SLC indications.	N/A

Table 1 – 2R13 Eddy Current Inspection and Expansion Plan				
Item	Area	Probe	Inspection Criteria	Expansion Criteria
27	Free Span Dings	+Point	20% of >5 volt dings in U-bend 20% of >5 volt dings in straight legs, biased to lower hot leg elevations. Note: Bobbin is credited for detection of SCC in ≤5 volt dings	If ding ODSCC is detected, inspect 100% of > 5 volt dings up/down to the coldest elevation at which degradation has been reported, plus 20% at next elevation.
28		+Point	20% of ≥ 2 volt dings in the U-bend that are coincident with AVB location	If ODSCC is detected at dings in the U-bend coincident with AVB locations, then inspect 100% of ≥ 2 volt ding indications coincident with AVB structures.
29	Free span bobbin indications (MBI, FSI, DNI)	+Point	100% of free span bobbin indications that are new or exhibit growth or change.	N/A
30	Cold leg thinning at TSP	+Point	100% of new CLT indications.	N/A
31	Possible loose parts	Bobbin or +Point	If possible loose part (PLP) indication is detected by eddy current, perform eddy current inspection to bound the loose part.	N/A