Re: FOIA/PA-2012-0220

Group C

RECORDS BEING RELEASED IN THEIR ENTIRETY
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1.	03/29/12	Email from G. Werner, RIV to T. Blount, RIV et al. on Formal Debrief Notes and Summary Debrief Notes. (32 pages)
2.	04/20/12	Email from G. Werner, RIV to J. Rivera-Ortiz, RIV FW: Unit 2 & 3 SG Summary. (3 pages)
3.	Undated	San Onofre Unit 3 In-Situ Pressure Testing, 1 page
4.	Undated	10 CFR 50.59 Screening, Sections 1-4, 4 pages
5.	Undated	Unit 3 SG Status-In-situ Pressure Test Outline, 2 pages
6.	Undated	SONGS-2 Jan-2012 Refueling, 1 page
7.	2/13/05	SCE-SONGS Unit 3 – REPL, 6 pages
8.	2/1/07	SCE-SONGS Unit 2 – REPL Outage, 1 page
9.	2/9/12	SONGS Unit 2, Steam Generator Eddy Current Testing, 7 pages
10.	2/10/12	SONGS Unit 3, Steam Generator Inspection and Eddy Current Testing, 2 pages
11.	2/10/12	SONGS Unit 2, Steam Generator Eddy Current Testing February 10, 3 pages
12.	2/14/12	SONGS Unit 3, Steam Generator Inspection and Eddy Current Testing, 8 pages
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14.	2/27/12	SONGS Unit 3, Steam Generator Inspection and Eddy Current Testing, 10 pages
15.	3/19/12	San Onofre Unit 3, In-Situ Status Report, 9 pages

16. 4/21/09 Email from K. Kalyanam, NRR to A. Johnson, NRR FW: Indications on SONGS Unit 3 Replacement Steam Generator. (7 pages)

17. 4/21/09 Slides on U2 Divider Plate Weld NDE Results. (3 pages)

18. 5/14/09 Slides on Update on RSG Divider Plate Weld Issue. (5 pages)

Johnson, Andrew

From: Werner, Greg
Sent: Thursday, March 29, 2012 1:38 PM
To: Blount, Tom; Lantz, Ryan
Cc: Warnick, Greg; Reynoso, John; Rivera-Ortiz, Joel; Ortega-Luciano, Jonathan; Murphy, Emmett; Thurston, Carl; Johnson, Andrew
Subject: Formal Debrief Notes and Summary Debrief Notes
Attachments: SONGS AIT Debrief 3_29_12.docx; SONGS Debrief Summary Notes 3_29_12.docx

Categories: Red Category

Two files are attached. The first is for the formal debrief with SONGS senior management this afternoon at 3 pm. I did take all your comments into consideration and I believe I did use them, just had to chew on a couple for a little bit. The second file is a 2 page summary that I will use to debrief licensing and could be used and modified to debrief NRC management.

Greg Werner

San Onofre Nuclear Generating Station
Augmented Inspection Team Debrief Notes
March 29, 2012

Good Afternoon, I'm Greg Werner and I am the team leader for the augmented inspection team. I'm a branch chief in Region IV, with responsibilities for inservice and radiation protection inspections.

The team members are:

John Reynoso -> Region IV -> 4 yrs as tube integrity engineer at PV

Joel Rivera-Ortiz -> Region II -> reactor inspector for approx 10 yrs, "go to inspector in RII"

Jonathan Ortega-Luciano -> Office of New Reactors -> Recently moved to NRO from NRR. Vendor inspector with in-depth of knowledge of QA requirements.

Emmett Murphy -> Office of Nuclear Reactor Regulation -> been with the NRC since late 1970s working on S/Gs. Extremely knowledgeable on S/G operating experience – seen all of the issues with S/Gs.

Andrew Johnson -> Office of Nuclear Reactor Regulation -> Materials science background. Worked as as a materials engineer conducting varied tasks from weld failure analysis to statistical analysis of mechanical testing data on high-strength steels.

Carl Thurston -> Office of Research -> been involved with design and manufacturing of S/G since the 1990s. Background in T/H analysis of S/G designs. Used to be the Areva specialist for T/H modeling.

Joining us today are:

Greg Warnick – Senior Resident Inspector

Ryan Lantz – Branch Chief for SONGS and PV

Tom Blount – Deputy Director, Division of Reactor Safety. He is the RIV management lead for this AIT.

Tom Blount – opening comment

The results of this inspection will be documented in Inspection Report 2012-007.

This inspection was conducted in accordance with Inspection Procedure 93800, Augmented Inspection Team. The AIT effort is fact-finding and analysis to include the details of what occurred during the event and the causes and contributing factors to the event. For any event, the causes and contributing factors are the most important part. This is one of the key Charter items that will have to be completed.

This augmented inspection resulted from the unexpected steam generator tube wear during operation and failures of numerous tubes during in-situ pressure testing after Unit 3 had been shut down. The basis for this inspection was the results from our evaluation conducted in accordance with Management Directive 8.3, "NRC Incident Investigation Program." A revised risk analysis is being performed by Mike Runyan, Senior Reactor Analyst. Based on three tubes failing near Main Steam Line break differential pressure, the estimate of risk resulted in an Incremental Large Early Release Probability in of 2.0E-6. In addition, three deterministic criteria were also met.

A charter was developed for the inspection team which included a total of 11 specific tasks that the team had to accomplish here at SONGS. In

addition, there were 4 specific items associated with review of MHI information. In looking at the Charter and what we accomplished over the past 2 weeks, I believe we accomplished what was intended by the Charter. Discussions with NRC senior management will have to occur before any decision about going or not going to MHI in Japan will be made.

The team reviewed a very large amount of information, both from SONGS and MHI. In addition, the team had numerous interviews, meetings, and followup discussions with various members of SONGS, MHI, Areva, and Westinghouse staff, and various contractors supporting SONGS.

As a reminder, this is a debrief and not an exit. As with an exit, the results we are discussing today are preliminary and could change, based on management review -> for an inspection of this size and speed of response, I do expect some changes to our results.

I would like to emphasize that even though we are completing the on-site portion of this inspection, this inspection is not over. We will continue to review new information from the office. I've asked your staff to keep us

informed of updates on SONGS and MHIs cause analysis and to provide updated information on IMS as it becomes available so we can review it.

We do plan to conduct a public exit meeting in this area. The date has not been established, but it most likely will occur in early May.

I will go over each of the AIT Charter Items. I will provide a brief description of each item; summarize what the team reviewed for each item; and, our overall assessment, including unresolved item or items for each charter item. There are a few instances where I will share team thoughts and perspectives that will not be discussed at the public exit or documented in the inspection report.

1. ***Andy Johnson*** -> Develop an event chronology of significant events associated with the design, construction, shipping, installation, and operation of both Unit 2 and 3 steam generators.

Andy reviewed numerous documents, interviewed individuals, and reviewed your draft sequence of events to construct our own timeline. We did not identify any issues in this area.

As part of this charter item, we will get input from both Greg Warnick and John Reynoso specifically related to the Unit 3 rapid shutdown due to the S/G tube leak including:

a. Assess actions taken in response to the event, actions to cool the plant down, and operator actions.

b. Assess procedure use and adequacy for the Unit 3 steam generator tube leak.

c. Assess whether plant systems responded as expected. Compare the actual plant response to the applicable safety analyses.

The team requested information on Unit 3 event in which operators responded to increase readings from the air ejectors radiation monitors. The operators entered abnormal operating instructions for RCS leakage and SG tube leak. The team requested to review the results of operations trip/transient

evaluation; which requires a formal review of the operator actions and safety systems to determine if important systems responded as design. The team was told this evaluation was not required because this event was considered a planned trip. After the team discussed this with the operations supervision it was determined that the Unit 3 event was not a planned trip and not in alignment to the industry standards described in NEI 99-02, "Regulatory Assessment Performance Indicator." This issue is being reviewed as an unresolved item associated with an inadequate procedure. There were no other significant issues or findings identified with the shutdown of Unit 3.

2. ***ALL*** -> Review information to determine probable contributing causes of the event or degraded condition.

All team members participated in the discussions and review of both Mitsubishi's and SONGS' cause evaluation. In addition, the team has performed independent reviews in numerous areas -> design, manufacturing, shipping, installation, operating experience, quality assurance/control, operation, and

thermal/hydraulic modeling. We focused on the differences between the two units in an attempt to understand the drastic differences in the wear on the steam generator tubes. Although it appears that the tube-to-tube wear is a combination of factors, the focus of both SONGS and MHI's cause evaluations seem to be pointing to a design issue; however, the team has not discounted other issues such as repair of the divider plates in Unit 3 S/Gs and shipping/handling issues (SG 3E088 was the only S/G to experience simultaneous G forces recorded all three installed accelerometers. As a team we have had specific discussions about the one major difference between the units, the divider plate repair activities, essentially being minimized in your cause evaluations.

Specific unresolved items related to the causes will be discussed in their specific sections as I debrief them.

3. ***John Reynoso and Carl Thurston ->*** Assess whether operational activities could have contributed to the unexpected tube wear. Focus on differences in configuration and operation

between Units 2 and 3 (differences in operation of the units – temperature, pressures, steam flow, etc.).

In this area, John and Carl looked at a number of operational differences. Carl evaluated differences from a thermal/hydraulic perspective and John reviewed other operational differences, including loose parts monitoring alarms that occurred on numerous occasions on Unit 3 while at steady state conditions. There were a number of instances where the loose parts monitor alarms were treated as nuisance alarms. Upon further review, Westinghouse determined the alarms to be valid.

This will be an unresolved item that we will require additional followup of the loose parts monitor detector alarms, including evaluation and disposition of those alarms.

Carl reviewed differences in operational data for past 3 months for Units 2 and 3 and ran a number of different scenarios for temperature, pressures, and steam flows as part of his thermal/hydraulic assessments and did not identify anything

that would cause him to suspect that operational differences between the units would have caused the issues with the steam generator tubes in Unit 3. His modeling showed very negligible differences in thermal hydraulic behavior at T_{hot} of 603°F (Unit 3) vs 598°F (Unit 2).

4. ***Joel Rivera-Ortiz and Emmett Murphy (Andy will be assisting)*** **->** Collect and assess differences in steam generator design and manufacturing between Units 2 and 3. Review all design and manufacturing changes to ensure they were properly reviewed and approved in accordance with procedures, including the review of MHI actions following the weld issue for the divider plate. In addition, review and assess the adequacy of the 50.59 evaluation for the new steam generators. (Our review of this area included the AIT MHI Charter Item 1.)

This area was probably one of the most challenging charter items that required review of numerous design documents, design changes packages, 50.59 evaluations, nonconformance

reports, cause evaluations, supplier deviation requests, and UFSAR. In addition, numerous interviews were conducted as well as observing various SONGS and MHI engineering meetings.

Currently, there are three unresolved items identified:

1. MHI did not consider the full spectrum of vibration mechanisms for the retainer bar during the design stage. As demonstrated by further evaluation, the retainer bars could be susceptible to turbulence-induced vibration. This vibration resulted in tube to retainer bar interaction and required a number of tubes to be plugged in each S/G as well as precautionary plugging of approximately 94 tubes per S/G.

2. MHI potentially did not properly control original design dimensions as a result of improvements in roundness of the tube, thickness/flatness of the AVBs, and other improvements in the manufacturing process. As part of

the cause evaluation, this is a factor that could influence the likelihood of tube vibration.

3. MHI did not perform a comprehensive evaluation to assess the impact of the divider plate repairs on the integrity of the tube bundle. For example, MHI did not assess if the additional rotations and additional heat-adding activities such as flame cutting and PWHT could impact the configuration of the SG. Additionally, MHI did not perform dimensional checks to ensure the repair activities caused no damage to the bundle.

The team identified an observation regarding MHI manufacturing procedures. In reviewing a number of the procedures, there was little guidance contained within the procedures. Most of the steps were general and left specifics up to "skill of the craft." One procedure in particular that was extremely difficult to follow, was the verification of tube clearance. Many of the steps were not clearly articulated and the flow chart was extremely difficult to follow. I was not able to

follow the flow chart and it took Joel a fairly long time to figure out how to accomplish the measurements.

5. ***Jonathan Ortega-Luciano*** -> Review quality assurance/quality control findings, self-assessments, and audits done by SONGS and MHI during manufacturing of both steam generators. Review a sample of nuclear notifications associated with the steam generators. (This area corresponds to the AIT MHI Charter Item 4.)

Jonathan reviewed numerous documents from both San Onofre Nuclear Generating Station and Mitsubishi Heavy Industries (including sub-contractors, such as Sumitomo) during design and manufacturing of both steam generators. He reviewed a sample of Mitsubishi Heavy Industries nonconformance reports (NCRs), all SONGS condition action requests (CARs), stop work orders, and supplier deviation requests associated with the design and manufacturing of the steam generators

After performing a thorough review and working closely with both SONGS and MHI personnel, Jonathan determined that both programs were strong and did a good job of identifying issues and then taking corrective actions to address those issues. As an example, initially SONGS identified issues with MHI design changes and actions did not appear to be effective, so SONGS conditionally qualified MHI and had a number of additional requirements needed for review and acceptance. This conditional qualification remained in place for approximately 14 months. Another example is MHI put in a stop work order at Sumitomo on September 27, 2006, for inadequate control of lot during Final Mill Annealing. MHI evaluated the adequacy of the corrective actions implemented by Sumitomo and released the Stop Work Order on October 3, 2006.

Currently, we do not have any unresolved items for this charter item.

6. ***Emmett Murphy*** -> Reviewed how SONGS and MHI evaluated and implemented steam generator generic communications, such as Information Notices, Generic Letters, Bulletins, internal and external operating experience. (This area corresponds to the AIT MHI Charter Item 3.)

Both SONGS and MHI did extensive reviews of the available information and selected those items which appeared to be the best available technology. The team found that the design of the replacement steam generators took advantage of operating experience in incorporating a number of improvements to address life limiting problems that occurred with the original steam generators; notably including improved materials for the tubing and supports, reduced tube sheet crevice depth, improved blowdown features, and improved SG access into the secondary side. In addition, the team finds that the licensee addressed world-wide operating experience from a variety of sources, including NRC generic communications, in its design and manufacturing specifications and in its program for managing steam generator tube integrity.

Currently, there are no unresolved items for this charter item.

7. ***John Reynoso*** -> Receipt inspections of steam generators.

John reviewed SONGS receipt acceptance criteria. He evaluated if critical attributes were appropriately specified and if SONGS had the ability to assess acceptability of meeting those acceptance criteria.

John also reviewed packaging, shipping, and handling of the steam generators from MHI to SONGS. Include a review of accelerometers used as part of the shipping package.

John reviewed a variety of information including shipping and handling specifications developed by SONGS. He compared those requirements against information contained in ANSI 45.2 "Quality Assurance Program Requirements for Nuclear Facilities." Section14, "Handling, Storage, and Shipping," specified critical measures be taken to protect equipment. These measures include criteria such as O2 concentration,

humidity, and maintaining inert gas or nitrogen pressure. In addition, SONGS had specified other criteria such as "G" loading and tube bundle support.

Three unresolved items were identified in this area:

1. Unit 3 RSGs were not shipped in accordance with procedure that referenced ANSI N45.2 requirements. Unit 3 RSG's nitrogen pressure, dew point and oxygen content were not controlled or monitored.
2. Tube bundle support was specified in shipping specifications but no tube bundle support was identified or used during shipment and handling, contrary to the shipping specification.
3. Unit 3 SG E088 accelerometers indicated up to a 1.23 G spike recorded on all three installed instruments. MHI provided an evaluation of the forces which showed loads were within allowable stress limits but exceeded stress for an operating basis earthquake. The team was not able to determine if this was properly considered in the licensee's cause evaluations. Based on John's review, it was not

readily apparent that the accelerometers were functioning properly -> For example, in Unit 2 steam generator 2A, two of the accelerometers located on the upper skid recorded zero "hits" compared to steam generator 2B had over sixty "hits". In addition, Unit 3 steam generator 3B (3e088) recorded over eighty "hits", more than any other steam generator.

8. ***Carl Thurston*** with help from Andy Johnson-> Review thermal/hydraulic and flow induced vibration modeling for steam generators.

Assess the adequacy of the steam generator models in predicting flow and vibration characteristics in the steam generators. Review how the models were verified and validated.

Carl was able to rapidly put together a basic model of the SONGS S/Gs and he ran two bounding design cases, including one with T_{hot} of 598°F and one with T_{hot} of 611°F, along with

associated changes in T_{cold}, RCS flow, steam pressure, and steam flow. Carl shared his findings with members of SONGS engineering staff and with Areva personnel that are validating MHI inputs used for their thermal/hydraulic model. The bounding cases identified a concern with the area of the tube-to-tube wear and partly addresses other trends noted in tube support plate and AVB wear. The overlapping area is where the code predicts high void fraction and high steam velocities, which together will cause a higher probability of fluid elastic instability; however, Carl does not have a dynamic model for FIV , so he was not able to evaluate output of the ATHOS code for assessment of margins to fluid elastic instability or tube stability ratios. Based on Carl's expertise in this area, he indicated that the ATHOS results would need to be further analyzed. He also indicated that based on the pattern of wear in the Unit 3 S/Gs, essentially a rectangular pattern, the thermal/hydraulic model does not explain all of the wear. Carl has a concern that in addition to thermal/hydraulic conditions in this area, there may very well be a manufacturing and/or

assembly defect of some kind that is contributing to the wear pattern.

We understand that the current plans are to have Westinghouse complete an independent customized thermal/hydraulic ATHOS model of the steam generator design and a comparison with the MHI proprietary thermal/hydraulic model, with the estimated completion date of sometime in mid-April. Once you have completed the modeling runs and comparisons, we would like to have Carl look at your results and have discussions with your staff. Our team is in alignment with your staff, that before any root cause can be completed, a thorough review and independent verification of the thermal/hydraulic and flow induced vibration results are necessary.

A potential causal feature noted by MHI for the Unit 3 tube leak, "Flowering", was characterized as an elastic deformation of tube and AVB structure, which should have been considered as a normal part of the design of the steam generators since these

deflections are from dynamic fluid forces from normal 100% power operation. We need to understand why this flowering was not considered during the initial design and we plant to review this during our assessment of your final root cause.

We identified one unresolved item for this area dealing with the adequacy of the MHI thermal/hydraulic model to appropriately model void fractions and steam velocities. As indicated earlier, Carl has expertise in running ATHOS, and he did a number of different runs that showed a much higher void fraction (one of the 3 factors that both SONGS and MHI are focusing in on) (.99 on ATHOS vs. .94 on MHI T/H Model). In addition, steam velocities were relatively high in an overlapping area. With high steam velocities and high void fraction in the same location, this can lead to higher likelihood of elastic instability and requires additional analysis. Both of these conditions are shown to exist in the ATHOS model in the same area as the tube-to-tube vibration.

9. ***Mike Runyan ->*** Collect data to support an independent assessment of the risk significance of the event. Work with Region IV senior reactor analysts to determine information that needs to be collected.

Mike Runyan has had discussions with your PRA staff and is in the process of collecting needed information to finalize a risk assessment, if needed. This will become important as part of the followup to this AIT when the unresolved items are reviewed and closed out.

As discussed earlier, with three tubes failing near main steam line break differential pressure, the incremental conditional large early release probability is 2.0E-6, but could change based on additional inputs into the risk model. Mike Runyan is waiting on your staff to provide a realistic primary-to-secondary leak rate assuming three ruptured tubes.

10. ***All*** -> Assess the results of the charter items above to determine whether there were issues with quality assurance, radiological controls, or safety culture components.

As discussed above under Charter Item 5, we determined that your quality assurance oversight of the S/G replacement project was very good. From a radiological perspective, there was a Radiation Protection team onsite, shortly after the event and they reviewed your offsite exposure estimate and did not find any issues.

Currently, the team did not identify any unresolved items for this charter item.

11. ***Greg Werner (assist from Carl in running the T/H model) ->*** Given results of inspection activities, identify differences between Units 2 and 3 steam generators. Promptly report differences impacting restart of Unit 2 back to Region IV.

Initially, the team did have a concern with increasing RCS temperature . Your current plans are to raise Tcold from 541 F to 550 F, which will also increase Thot (to about 608°F). We initially thought the void fraction and steam velocities would increase and could possibly make tube vibration worse in Unit 2. As stated above, Carl did run the ATHOS model with Thot at 611°F. The results showed a very slight decrease in void fraction and steam velocities due to the increased S/G pressure, so in fact, the likelihood of vibration was slightly decreased. In addition, you indicated that in conjunction with the increase in Thot to 608°F, you would reduce reactor power to 98 percent, which would also tend to cause S/G pressures to increase and likely also further decrease the void fraction and steam velocities, thereby further increasing the margin to conditions conducive to tube vibration. At this time, the team did not identify any differences that would negatively impact restart of Unit 2.

It will be important that once you have independently verified your T/H model, you will need to analyze the impact of tube

plugging in the area of tube-to-tube vibration concern. Extensive plugging will cause local changes in velocity flow patterns, void fraction, and other parameters that will need to be checked and verified prior to restart.

12. As part of the charter, there were also items related to MHI, which we were able to accomplish onsite as described above in the discussion of the previous charter items.

In summary, the 9 Unresolved Items are as follows:

1. Charter Item 1 (Chronology) – URI to determine the adequacy of the post trip/transient procedure.

2. Charter Item 3 (Unit operational differences) – URI to determine if Unit 3 loose parts monitor alarms were properly evaluated and dispositioned.

3. Charter Item 4 (Manufacturing and Design Differences) – 3 URIs:

    a. Review design of retainer bar and not reviewing for potential vibration impacts.
    b. Review control of original design dimensions -> one of your potential causes for in-plane vibration.
    c. Review adequacy of evaluation and controls for divider plate repair.

4. Charter Item 7 (Receipt Inspection, Shipping and Handling) – 3 URIs

    a. Unit 3 replacement S/Gs not shipped in accordance requirements.

b. Both units S/Gs did not have tube bundle support as specified in shipping specifications.

c. Review control of accelerometers and evaluation and disposition of recorded data.

5. Charter Item 8 (S/G Modeling) – URI to review adequacy of MHIs thermal/hydraulic model.

From an overall perspective, nothing to date either from your review or the NRC's team independent review can clearly show why we are only seeing the tube-to-tube wear in Unit 3. There are potential causes that your staff developed, but in looking at the information, the NRC team could not see a distinct link. As discussed in Charter Item 4 above, the only clearly distinct difference is the extensive repair and rework of Unit 3 S/Gs divider plate, which both SONGS and MHI have discounted as a potential cause. We believe that additional reviews need to be conducted by both SONGS and MHI in this area.

The unresolved items will be followed up at a future date. The AIT inspection report will have more detail than a "normal" NRC inspection report. The AIT report will contain narrative and discussion of our

inspection activities in order to help whoever comes back to close out the unresolved items. To reiterate, the AIT inspection is not over and we will continue to review your cause evaluations. Although the onsite portion of this inspection is completed, it is important that you keep Region IV informed of new developments concerning your review of the causal factors. It would be appreciated if you could send updated information to both me and Ryan Lantz. Between the two of us and senior management, we will work together to review and assess the new information.

We requested a lot of information and interviews and your team provided great support and quick turnarounds. In addition, all the individuals that we interacted with this week were very responsive and open. The NRC team never got the sense that you were holding anything back from our team. I appreciated SONGS and MHIs openness and understanding, especially this week, when all of our requests took on an extra sense of urgency and priority. Not to point out anyone in particular, but I will. Michael Stevens was fantastic at tracking our requests and keeping the team up-to-date on status of requested items.

Thanks again to the entire SONGS and MHI staff that we interacted with during these past 2 weeks.

That finishes my prepared remarks, are there any questions?

Tom Blount would like to make some closing remarks.

Thank you for your time.

Debrief Notes:

- Completed all sections of the AIT Charter, including MHI charter specific items.

- No decision made as to need to go to Japan

- ONLY the onsite portion of the inspection is finished at this time. Additional reviews are planned. As discussed, you will continue to provide us new information for both SONGS and MHIs cause evaluations. As needed, we can discuss the need for periodic conference calls to discuss new information.

- Once you have completed your T/H and FIV model reviews, we would like to have access to the raw data and your evaluation as to the differences found and how you have accepted or discounted the differences. Carl will most likely be the individual following up on this item.

- Identified 9 URIs:

  Charter Item 1 (Chronology) – URI to determine the adequacy of the post trip/transient procedure.

  Charter Item 3 (Unit operational differences) – URI to determine if Unit 3 loose parts monitor alarms were properly evaluated and dispositioned.

  Charter Item 4 (Manufacturing and Design Differences) – 3 URIs:

  a. Review design of retainer bar and not reviewing for potential vibration impacts.
  b. Review control of original design dimensions -> one of your potential causes for in-plane vibration.
  c. Review adequacy of evaluation and controls for divider plate repair.

  Charter Item 7 (Receipt Inspection, Shipping and Handling) – 3 URIs

  a. Unit 3 replacement S/Gs not shipped in accordance requirements.
  b. Both units S/Gs did not have tube bundle support as specified in shipping specifications.
  c. Review control of accelerometers and evaluation and disposition of recorded data.

  Charter Item 8 (S/G Modeling) – URI to review adequacy of MHIs thermal/hydraulic model.

Observations:

1. Both SONGS and MHI QA programs were strong and did a good job of identifying issues and then taking corrective actions to address those issues.

2. In reviewing a number of the MHI manufacturing procedures, there was little guidance contained within the procedures. Most of the steps were general and left specifics up to "skill of the craft." One procedure in particular that was extremely difficult to follow, was the verification of tube clearance. Many of the steps were not clearly articulated and the flow chart was extremely difficult to follow. I was not able to follow the flow chart and it took Joel a fairly long time to figure out how to accomplish the measurements.

3. The acceptance criteria for tube-to-tube clearance in the U-bend region did not consider in-plane tube vibration. MHI's assembly procedures allow a tube-to-tube minimum clearance of 0.130-inch in the U-bend region at cold condition. This criterion may not be adequate in light of the observed tube-to-tube wear in Unit 3 caused by in-plane vibration. Your staff may want to review for Unit 2 that had one location with a clearance of only 0.11 inches, because the accept-as-is indicated no concerns with in-plane vibration.

4. There is a design feature specific to these generators that could contribute to reduced margins to fluid elastic instability. That is that the tube indexing in the bundle fabrication is very small. This results in a tighter and the closer proximity of tubes in the U-bend region and higher volumetric heat fluxes. Didn't see this discussed anywhere. May want to consider.

5. The only significant difference between the two units is the divider plate repair. However, this difference has been eliminated by both SONGS and MHI. We believe that this should be re-evaluated. The other differences are very minor and from what has been reviewed, don't have supporting quanitative data – all qualitative.

SONGS is actively searching for the causes. Lots of external expertise has been brought in to assist SONGS from other S/G manufacturers, consultants, other nuclear power plants, and academia. SONGS is sparing no resources to determine what is causing the tube-to-tube wear and what needs to be done to correct/minimize the wear mechanism.

Great support from SONGS staff. MHI has done a good job interacting with the NRC. Good working relationship with your team and good open communication from all involved.

Johnson, Andrew

From: Werner, Greg
Sent: Friday, April 20, 2012 12:43 PM
To: Rivera-Ortiz, Joel; Thurston, Carl; Ortega-Luciano, Jonathan; Murphy, Emmett; Johnson, Andrew; Reynoso, John
Cc: Warnick, Greg
Subject: FW: Unit 2 & 3 SG Summary
Attachments: SONGS Unit 2 SG Summary.docx; SONGS Unit 3 SG Summary.docx

Importance: High

Categories: Red Category

FYI.

From: Werner, Greg IRIV
Sent: Friday, April 20, 2012 11:34 AM
To: Collins, Elmo
Cc: Bloodgood, Michael; Lantz, Ryan; Blount, Tom
Subject: FW: Unit 2 & 3 SG Summary
Importance: High

Good Morning Elmo,

Here is the additional information for Unit 3 and a modified Unit 2 summary. For both units, right now for plugging and stabilizing, the only good numbers are the Unit 2, with additional plugging occurring as a preventative measure based on Unit 3 information. For Unit 3, we do know that all 94 retainer bar tubes will be plugged (not sure about stabilization). From the meeting this week, the plugging for Unit 3 tube-to-tube and Unit 2 preventative plugging the plans (emphasis on plan – close to being final, but not approved and signed off yet) are as follows:

Unit 2 SGE0-88 -> 101 tubes
Unit 2 SGE0-89 -> 205 tubes

Unit 3 SGE0-88 -> 313 tubes
Unit 3 SGE0-89 -> 277 tubes

For Unit 3, there is a plan to add some additional tubes along the boundary for Unit 3. Don't know the numbers, but based on discussions, not more than 12 additional tubes, based on location and I believe it is only for SG88, but NOT sure.

Greg

From: Anchondo, Isaac IRIV
Sent: Friday, April 20, 2012 9:52 AM
To: Werner, Greg; Bloodgood, Michael
Cc: Lantz, Ryan; Blount, Tom
Subject: Unit 2 & 3 SG Summary

Greg,

Attached are the SG summaries for both Unit 2 and 3. The tables included should provide the essential information of what/why tubes were plugged. If you guys think of any additional information please let me know.

C/2

SONGS Unit 2 Steam Generators
Plugging/Stabilization Summary

Steam Generator SG2E88	Tubes Plugged	Tubes Stabilized
Anti-Vibration Bar (AVB)	4	4
Tube Support Plate (TSP)	0	0
Retainer Bar (RB)	2	2
RB Preventive	92	12
Foreign Object	0	0
TOTAL	**98**	**18**

Steam Generator SG2E89	Tubes Plugged	Tubes Stabilized
Anti-Vibration Bar (AVB)	0	0
Tube Support Plate (TSP)	0	0
Retainer Bar (RB)	4	4
RB Preventive	90	11
Foreign Object	0	0
TOTAL	**94**	**15**

Total Wear	Tubes Plugged	Tubes Stabilized
Steam Generator 2E88	98	18
Steam Generator 2E89	94	15
Both Steam Generators	**192**	**33**

SONGS Unit 2 Steam Generators
Wear Depths Summary

Anti-Vibration Bar SG 2E88	%Through-Wall	Stabilized
Row 112 Column 88	35%	Yes
Row 133 Column 91	35%	Yes
Row 120 Column 92	32%	Yes
Row 128 Column 94	32%	Yes

Retainer Bar	SG	%TW	Stabilized
Row 124 Column 48	E88	47%	Yes
Row 125 Column 49	E88	58%	Yes
Row 118 Column 44	E89	30%	Yes
Row 119 Column 133	E89	90%	Yes
Row 120 Column 132	E89	28, 30%	Yes
Row 127 Column 127	E89	38%	Yes

AVB Wear	Average %TW	Upper 95th	Maximum %TW
SG 2E88	10.1	19.2	35
SG 2E89	9.8	18	29

TSP Wear	Average %TW	Upper 95th	Maximum %TW
SG 2E88	9.7	14	17
SG 2E89	10.7	16	20

Tube-Tube Wear	Location	Length	%TW
SG 2E89	Row 111, Column 81	~6 inches	<15%
SG 2E89	Row 113, Column 81	~6 inches	<15%

SONGS Unit 3 Steam Generators
Plugging Summary

Wear Type	SG 88 Tubes Plugged	SG 89 Tubes Plugged
U-Bend Freespan (All)	69	67
TSP (≥35%)	73	83
AVB (≥35%)	2	0
Retainer Bar (All)	94	94
Total	**238**	**244**

Failed In-Situ Testing Summary
Steam Generator 3E88

Tube location	Max Pressure Reached	Percent Wear (%)	Length of Wear (in)
***Row 106 Column 78**	**2874**	**100**	**28**
Row 102 Column 78	3268	99	23
Row 104 Column 78	3180	99	27
Row 100 Column 80	4732	81	28
Row 107 Column 77	5160	80	34
Row 101 Column 81	4889	78	26
Row 98 Column 80	4886	72	28
Row 99 Column 81	5026	72	27

*** Leaking tube**

SONGS Unit 3 Steam Generators
Wear Depths Summary

Steam Generator SG2E88	Anti-Vibration Bar	Tube Support Plate	U-Bend Freespan	Total
TW ≥ 50%	0	48	26	**74**
35 - 49%	2	25	18	**45**
20 - 34%	48	14	18	**80**
10 - 19%	298	55	7	**360**
TW ≤ 10%	346	11	0	**357**
TOTAL	**694**	**153**	**69**	**916**

Steam Generator SG2E89	Anti-Vibration Bar	Tube Support Plate	U-Bend Freespan	Total
TW ≥ 50%	0	44	16	**60**
35 - 49%	0	39	29	**68**
20 - 34%	14	20	13	**47**
10 - 19%	243	27	9	**279**
TW ≤ 10%	423	9	0	**432**
TOTAL	**680**	**139**	**67**	**886**

San Onofre Unit 3 In-Situ Pressure Testing (All Information is Preliminary)

Date	Shift	Row	Col	Leak Rate @ NODP (gpm)	Leak Rate @ MSLB (gpm)	Leak Rate @ Max Press (gpm)	Max Press Reached	Condition Monitoring Probability of Burst	Condition Monitoring Burst Pressure (calculated PSIG)	Best Estimate Burst Pressure (PSIG)	Status (Pass, Fail, Incomplete, Indeterminent)
3/14/12	Days	106	78	0.072	N/A	> 0.5	2884	1.0	137	3006	Fail
3/14/12	Days	102	78	0	> 0.5	> 0.5	3268	1.0	375	2714	Fail
3/14/12	Days	104	78	0	> 0.5	> 0.5	3180	1.0	419	3100	Fail
3/15/12	Days	100	80	0	0	> 0.5	4732	1.0	1426	3767	Fail
3/15/12	Days	107	77	0	0	> 0.5	5160	1.0	1442	3782	Fail
3/15/12	Days	101	81	0	0	> 0.5	4889	1.0	1826	4047	Fail
3/15/12	Days	98	80	0	0	> 0.5	4886	1.0	1853	4087	Fail

10 CFR 50.59 SCREENING
(SCN 070800358-54)

SECTION I: GENERAL INFORMATION

1. Primary Document Number and Title: 800074957 (070800358-52); Temporary SGR Facilities Outside PA

2. Description of Proposed Activity

The Industrial Area is being modified to add facilities required for the Unit 2 and 3 Steam Generator Replacement Outages. The Industrial area contains open yard space that functions as space available for miscellaneous plant use. The facilities being added are the Original Steam Generator Staging Facility (OSGSF), the Decontamination Facility, and multiple trailers and sea vans for miscellaneous equipment storage. All these facilities will be installed prior to the start of the Unit 2 SGR Outage and will be dismantled after they are no longer needed at the end of the Unit 3 SGR Outage. In all cases, each installed facility will be in place longer than 90 days and no permanent plant changes will exist after these facilities are removed.

The OSGSF consists of a fabric and steel frame tent structure that is large enough to accommodate storage of two OSGs at one time and to accommodate the work activities required to cut up and package OSG segments for shipment off site and final disposal.

The Decontamination Facility consists of a fabric and steel frame tent structure that is large enough to accommodate all planned decontamination activities and to house the Containment construction opening linerplate cut segment, should the facility be used to prepare the linerplate segment for replacement and weld-back within the construction opening. Roll up doors with flaps will be provided to allow enclosed transfer of decontamination products from and to sea vans.

The multiple trailers and sea vans will be positioned in available space throughout the Industrial Area and will be used to contain materials and equipment required to support the SGR Outage.

3. Design Function(s) and/or Methods of Evaluation:

The design function of the various facilities are as follows:

UFSAR Section 3.3.2.3 states that the design of all permanent non-Seismic Category I structures, systems, and components not designed for tornado loadings ensures that: (1) these structures, systems, and components cannot produce missiles,

C/4

during a tornado, that have more severe effects than the tornado-generated missiles listed in Table 3.5-6, and (2) their failure will not affect the integrity of adjacent Seismic Category I structures.

UFSAR Section 2.4.2.3 states that storm drainage in the Unit 1 power block will not flow to Units 2 and 3 because of the elevation differential; Unit 1 is at Elevation 20 feet and Units 2 and 3 are at 30 feet.

The OSGSF provides an enclosed space for the OSGs to contain contamination while they are being cut-up and the segments packaged for shipment off site.

The Decontamination Facility provides an enclosed space to contain any contamination during decontamination activities and during any liner plate preparation processes.

The trailers and sea vans provide enclosed storage space that shelters material and equipment from the weather and marine environment.

SECTION II: 50.59 SCREEN CONCERNS

State if the proposed activity:

1. Changes an SSC in a manner that adversely affects the UFSAR/DSAR design function(s) or has an adverse affect on the method of performing or controlling UFSAR/DSAR design function(s).

The OSGSF and Decontamination Facilities are metal frame / fabric covered structures that are anchored for 100 MPH wind loads (Ref.: NECP 070800358,
Block C). These structures are not designed for seismic or tornado loads. Per the NECP, their framing and fabric covering are light weight components that would not produce missiles during a tornado that have more severe effects than the tornado-generated missiles listed in UFSAR Table 3.5-6, so their failure would not affect the integrity of adjacent Quality Class I or II structures.

The trailers and sea vans are not designed for tornado loads. Per the NECP, they would not produce missiles during a tornado that have more severe effects then the tornado-generated missiles listed in UFSAR Table 3.5-6, so their failure would not affect the integrity of adjacent Quality Class I or II structures.

These facilities and trailers will be located in the Unit 1 Industrial Area. As described in UFSAR Section 2.4.2.3, this

site is approximately 10 feet lower than plant grade surrounding Unit 2 and 3, so the installation of these facilities will not affect plant flooding from the effects of local intense precipitation. The facilities are also located so that they will not interfere with normal site drainage in the area.

Based on the above, these changes will not change the design function of any SSC nor have an adverse effect on the method of performing or controlling design functions as described in the UFSAR / DSAR.

2. Changes a procedure in a manner that adversely affects how UFSAR/DSAR described SSC design function(s) are performed or controlled.

The addition and subsequent removal of temporary facilities in the Industrial Area does not involve any procedure changes.

3. Involves revising or replacing a UFSAR/DSAR described method of evaluation that is used in establishing the design bases or used in the safety analyses in an adverse manner.

The addition and subsequent removal of temporary facilities in the Industrial Area does not involve any method of evaluation changes.

4. Involves a test or experiment not described in the UFASR/DSAR, where an SSC is utilized or controlled in a manner that is outside the reference bounds of the design for that SSC, or is inconsistent with the analysis or descriptions in the UFSAR/DSAR.

The addition and subsequent removal of temporary facilities in the Industrial Area does not involve any test or experiment.

5. Requires a change to the Technical Specifications.

The addition and subsequent removal of temporary facilities in the Industrial Area does not require any change to the technical specification or licensee controlled specifications.

SECTION III: SCREEN CONCLUSION

Based on the responses in Section II, the proposed activity is:

___X___ NOT adverse

_____ Adverse, record the 50.59 Evaluation (SE) AR assignment:

NEW-PAGE

SECTION IV: REFERENCES

DSAR Section 3.1, Facility Description
UFSAR Section 2.4.2.3, Effects of Local Intense Precipitation
UFSAR Section 3.3.1.1, Design Wind Velocity
UFSAR Section 3.3.2.3, Effect of Failure of Structures or Components not Designed for Tornado Loads
UFSAR Table 3.5-6, Tornado-Generated Missiles Considered in Design of Safe Shutdown Structures
UFSAR Section 9.1.5, Independent Spent Fuel Storage Installation (ISFSI)
Drawing 25221-000-C0-1000-00001, SGRP Temporary Facilities, Sheet 1
Drawing 25221-000-C0-1000-00002, SGRP Temporary Facilities, Sheet 2
Drawing 25221-000-C0-1000-00003, SGRP Temporary Facilities Outside Protected Area - Layout

SECTION V: SUMMARY

Unit 3 SG Status

In-situ Pressure Test Outline

In-situ Pressure Test Scope (Preliminary)

San Onofre Unit 3 In-Situ Pressure Testing (All Information is Preliminary)

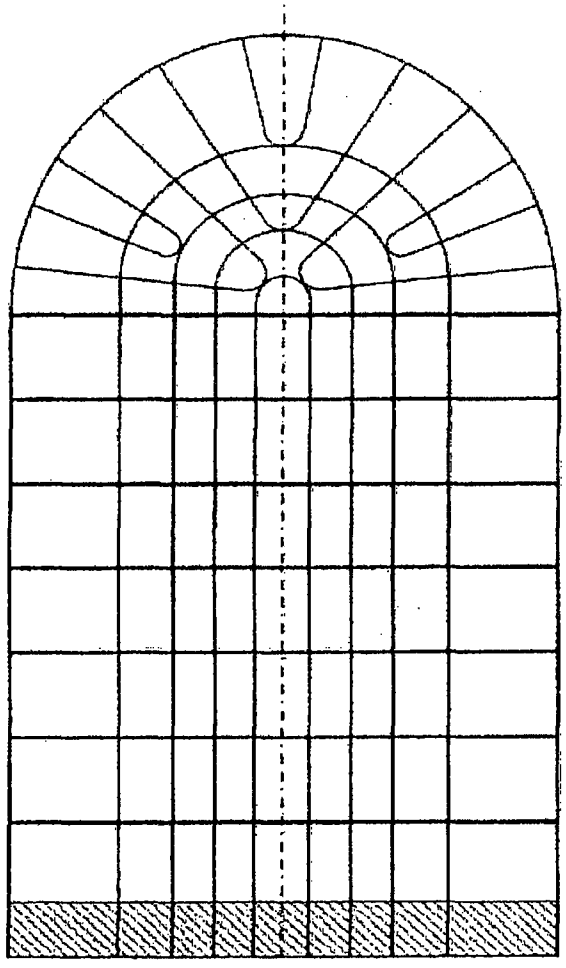
Date	Shift	Row	Col	Leak Rate @ NODP (gpm)	Leak Rate @ MSLB (gpm)	Leak Rate @ Max Press (gpm)	Max Press Reached	Condition Monitoring Probability of Burst	Condition Monitoring Burst Pressure (calculated PSIG)	Best Estimate Burst Pressure (PSIG)	Status (Pass, Fail, Incomplete, Indeterminent)
3/14/12	Days	106	78	0.072	N/A	> 0.5	2874*	1.0	375	3006	Fail
3/14/12	Days	102	78	0	> 0.5	> 0.5	3268	1.0	137	2714	Fail
3/14/12	Days	104	78	0	> 0.5	> 0.5	3180	1.0	419	3100	Fail
3/15/12	Days	100	80	0	0	> 0.5	4732	1.0	1426	3767	Fail
3/15/12	Days	107	77	0	0	> 0.5	5160	1.0	1442	3762	Fail
3/15/12	Days	101	81	0	0	> 0.5	4889	1.0	1826	4047	Fail
3/15/12	Days	98	80	0	0	> 0.5	4886	1.0	1853	4087	Fail
3/16/12	Days	99	81	0	0	> 0.5	5026	1.0	2034	4305	Fail

* the test pressure previously communicated (2884) has been revised to 2874 to account for pressure drop due to flow

SONGS-2
Jan-2012 Refueling

Distribution of Indications
SG88 Bobbin Data

	<10	10-19	20-29	>=30
B06	131	151	19	1
B05	108	104	16	
B04	85	29	1	
B03	29	6		
B02	2	1		
B01	1			
07H	5	7		
06H	6	6		
05H	9	8		
04H	21	14	1	
03H	9	4		
02H	4			
01H				
TSH				



>=30	20-29	10-19	<10	
1	21	136	163	B07
1	14	122	130	B08
1	7	85	86	B09
	1	29	64	B10
		1	7	B11
			2	B12
		6	3	07C
		2	3	06C
			4	05C
		1	4	04C
			1	03C
			1	02C
				01C
				TSC

>=30	20-29	10-19	<10	
4	80	712	878	TOTAL INDICATIONS
2068				TOTAL INSPECTED

SCE-SONGS Unit 3 - REPL
Leaker Outage 2/12
Acquired/Completed

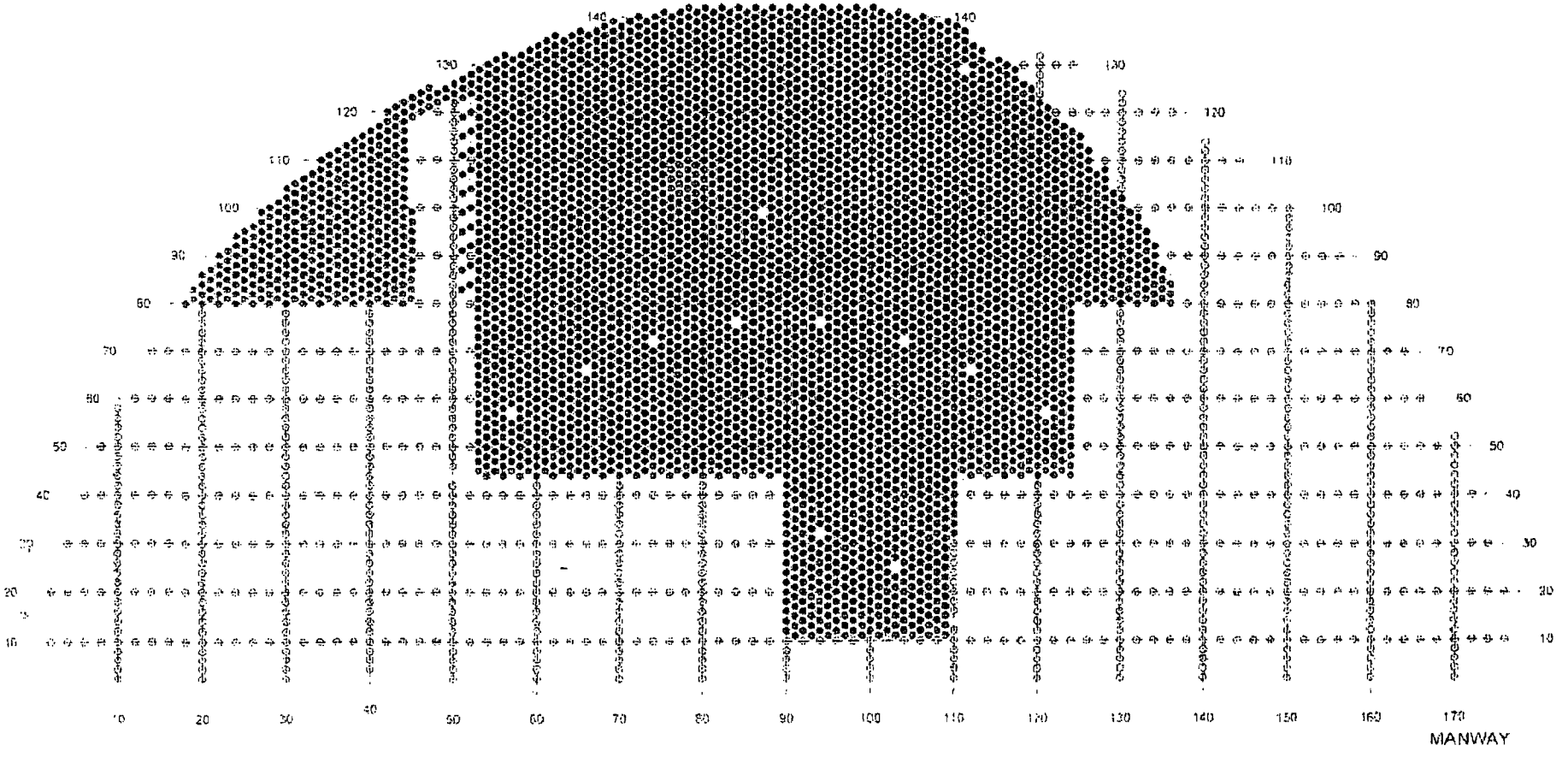
GROUP	TUBES
Tube Leaker	1
Leaker Bounded By Scope	12
+ All Scopes(Completed)	3582
C All Scopes-Acquired	4119

SCALE: 0.066571 X
Mon Feb 13 05:40:24 2012

SG 68 Repl 35
HOT
PRIMARY FACE

TOTAL TUBES: 9727
SELECTED TUBES: 4222
OUT OF SERVICE (#) NA

NOZZLE



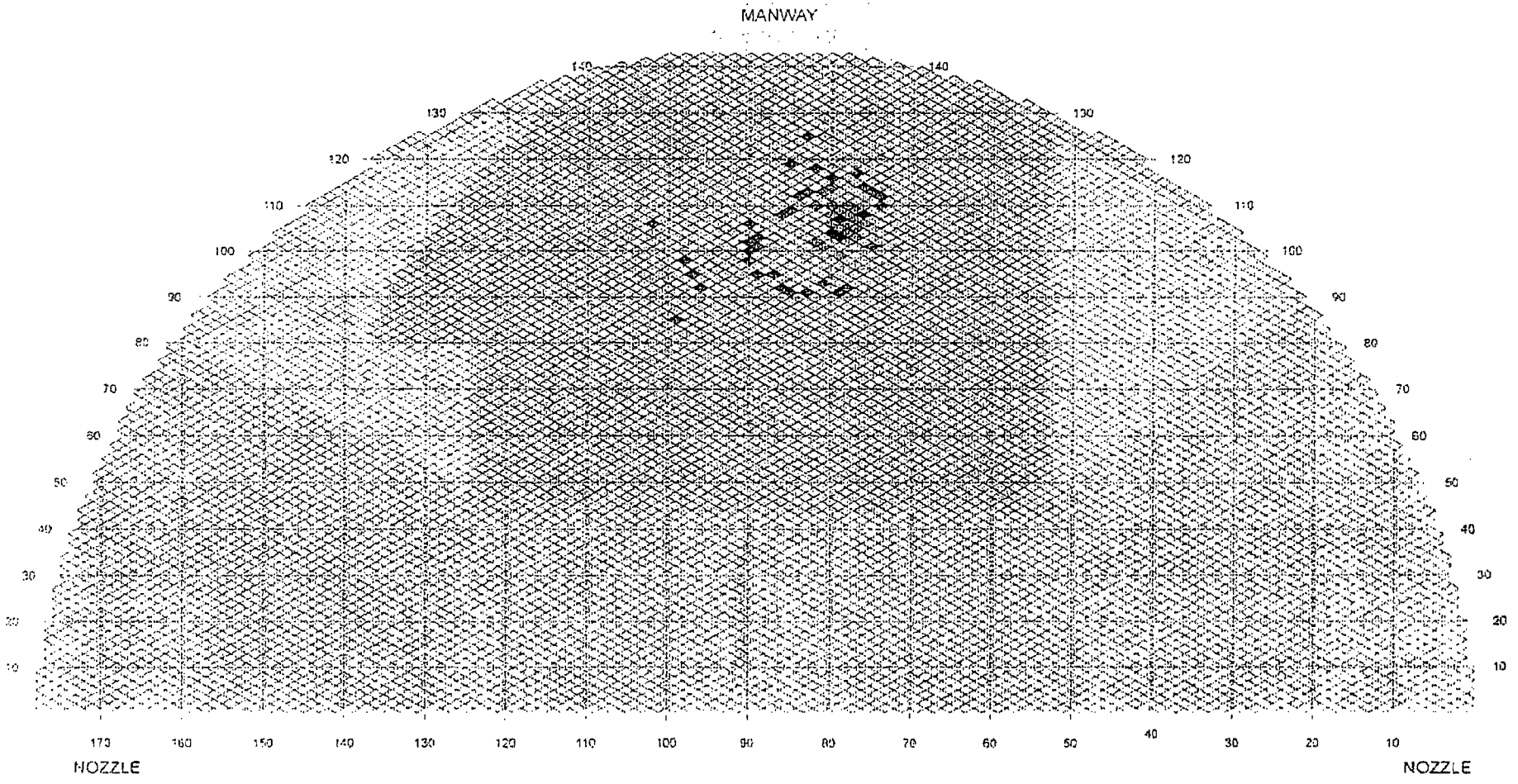
SCE-SONGS Unit 3 - REPL
TSP Wear by Depth Bin and Tubes Inspected

GROUP	TUBES
>=60%TWD	4

S/G 88 Repl
COLD
PRIMARY FACE

TOTAL TUBES: 9727
SELECTED TUBES: 3562
OUT OF SERVICE (#): NA

SCALE: 0.066571 X
Mon Feb 13 05:00:24 2012



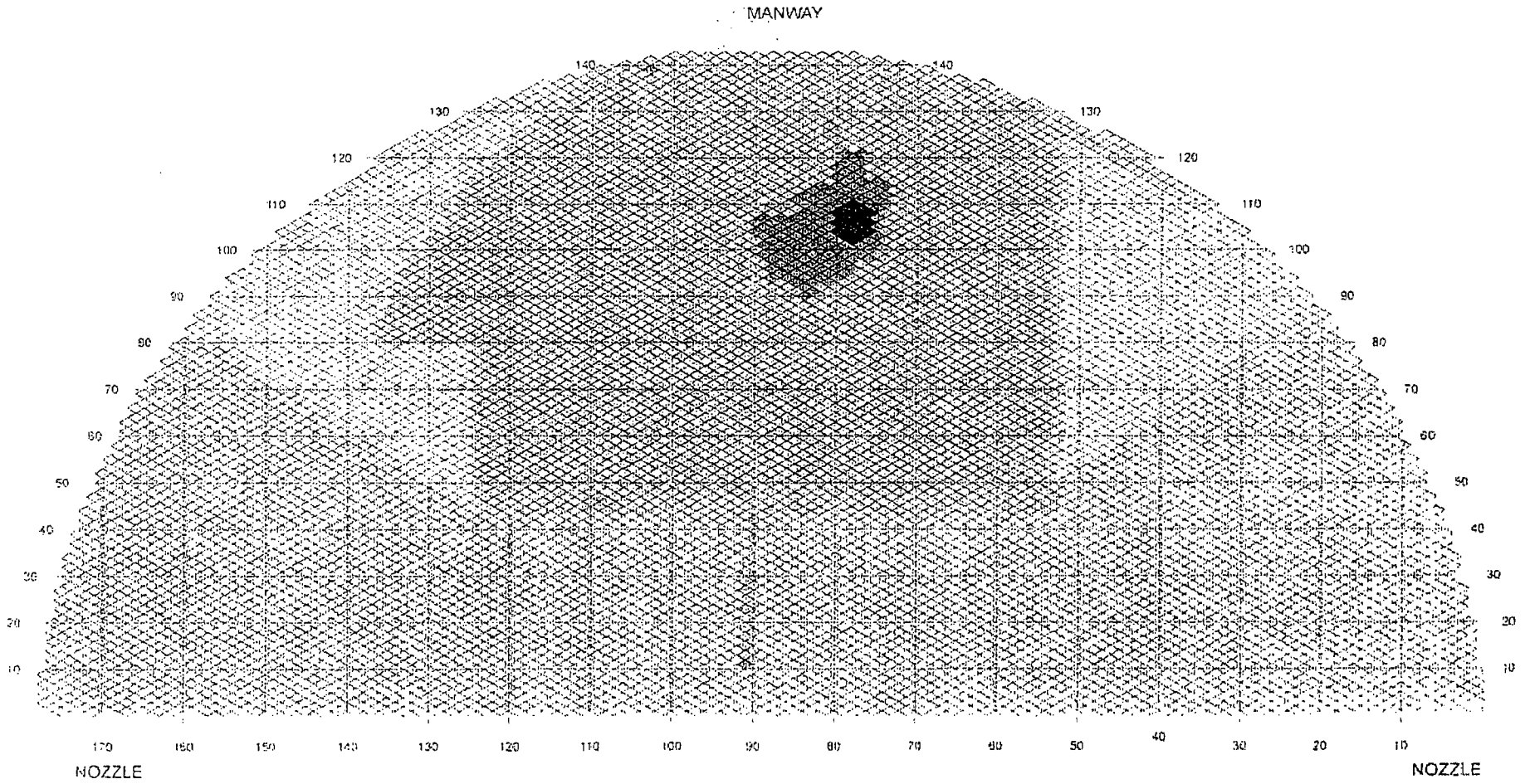
SCE-SONGS Unit 3 - REPL
Tubes Inspected/Possible Freespan/Leaker +18

GROUP	TUBES
Leaker + 18 Bounding Tubes	10

S/G 88 Repl
COLD
PRIMARY FACE

TOTAL TUBES: 9727
SELECTED TUBES: 3555
OUT OF SERVICE (#): NA

SCALE: 0.066571 X
Mon Feb 13 05:12:19 2012



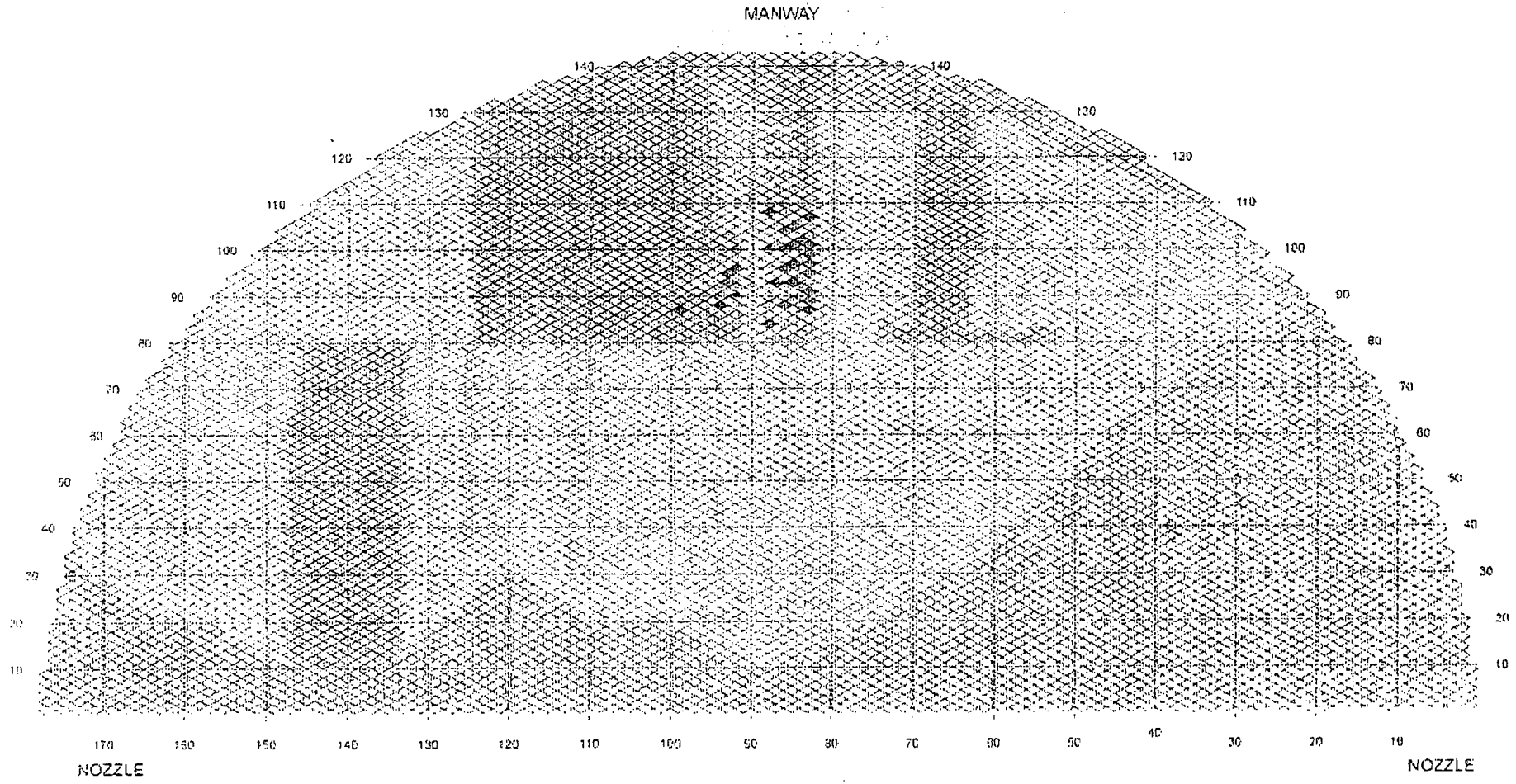
SCE-SONGS Unit 3 - REPL
TSP Wear by Depth Bin and Tubes Inspected

GROUP	TUBES
A 89TSP_GE60	0

S/G 89 Repl
COLD
PRIMARY FACE

TOTAL TUBES: 9727
SELECTED TUBES: 1755
OUT OF SERVICE (#): NA

SCALE: 0.066571 X
Mon Feb 13 05:03:40 2012



SCE-SONGS Unit 3 - REPL
Tubes Inspected/Possible Freespan

GROUP TUBES

S/G 89 Repl
COLD
PRIMARY FACE

TOTAL TUBES 9727
SELECTED TUBES 1755
OUT OF SERVICE (#): NA

SCALE: 0.066571 X
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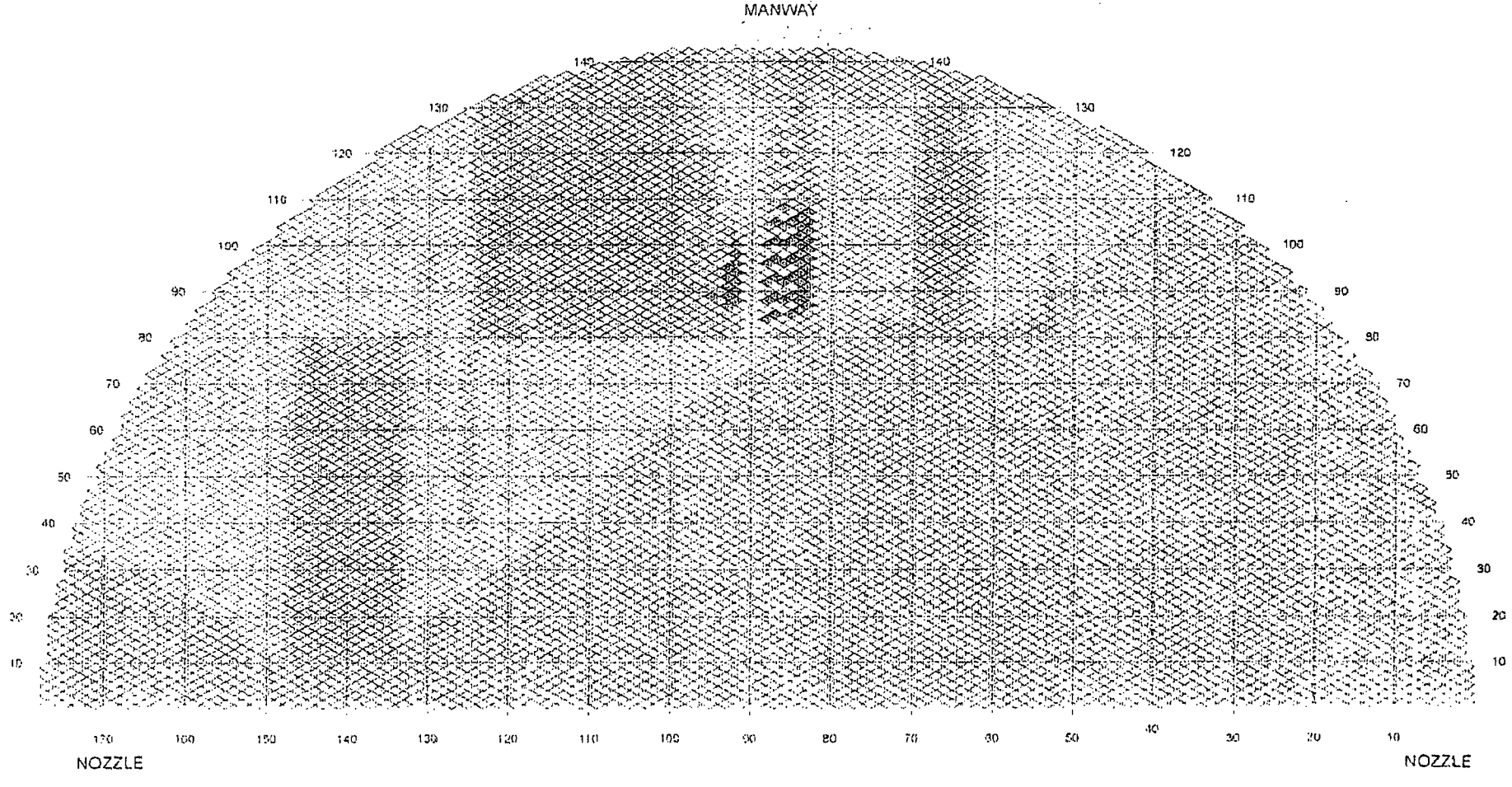
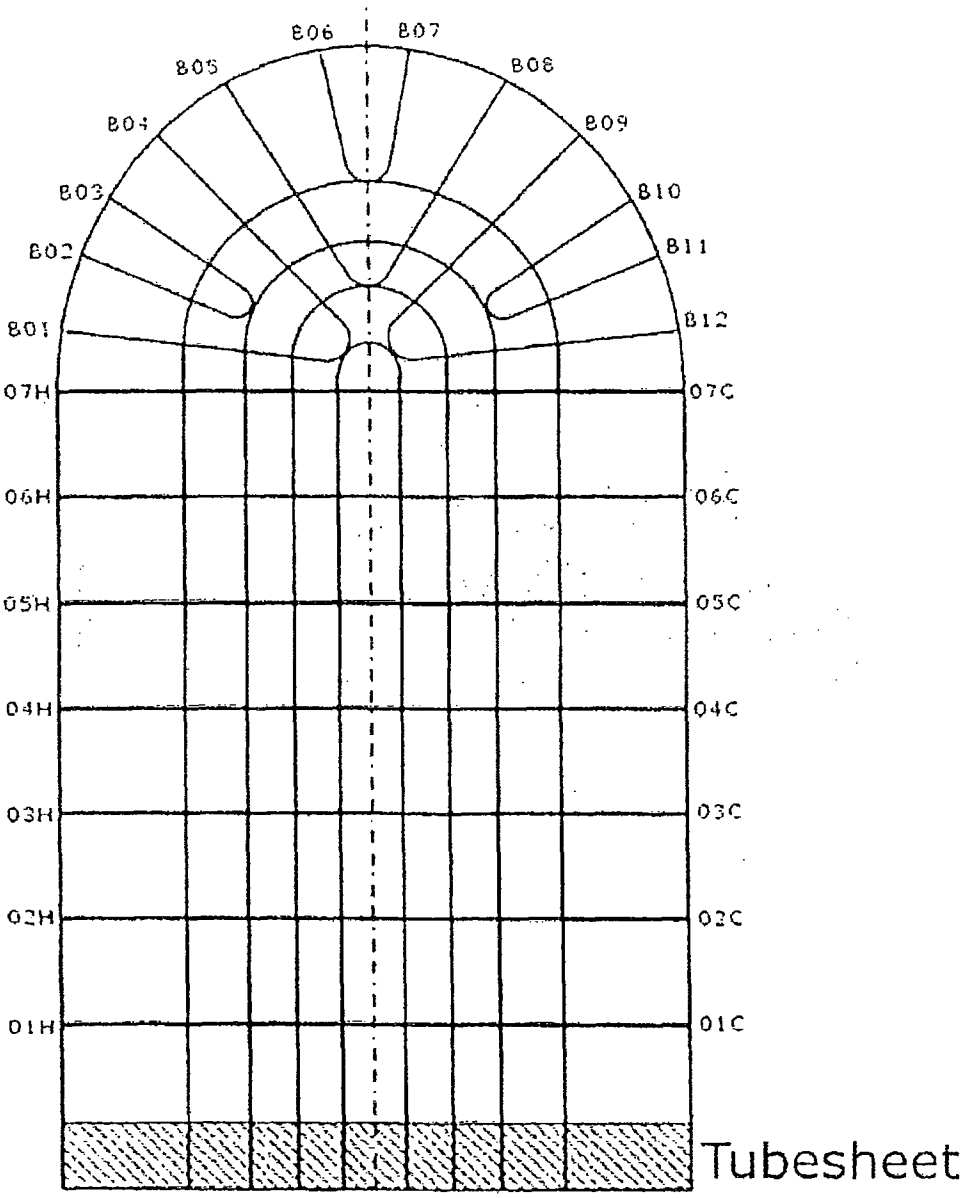


Steam Generator Layout



C/8

5t leg

SCE-SONGS Unit 2 - REPL
Outage

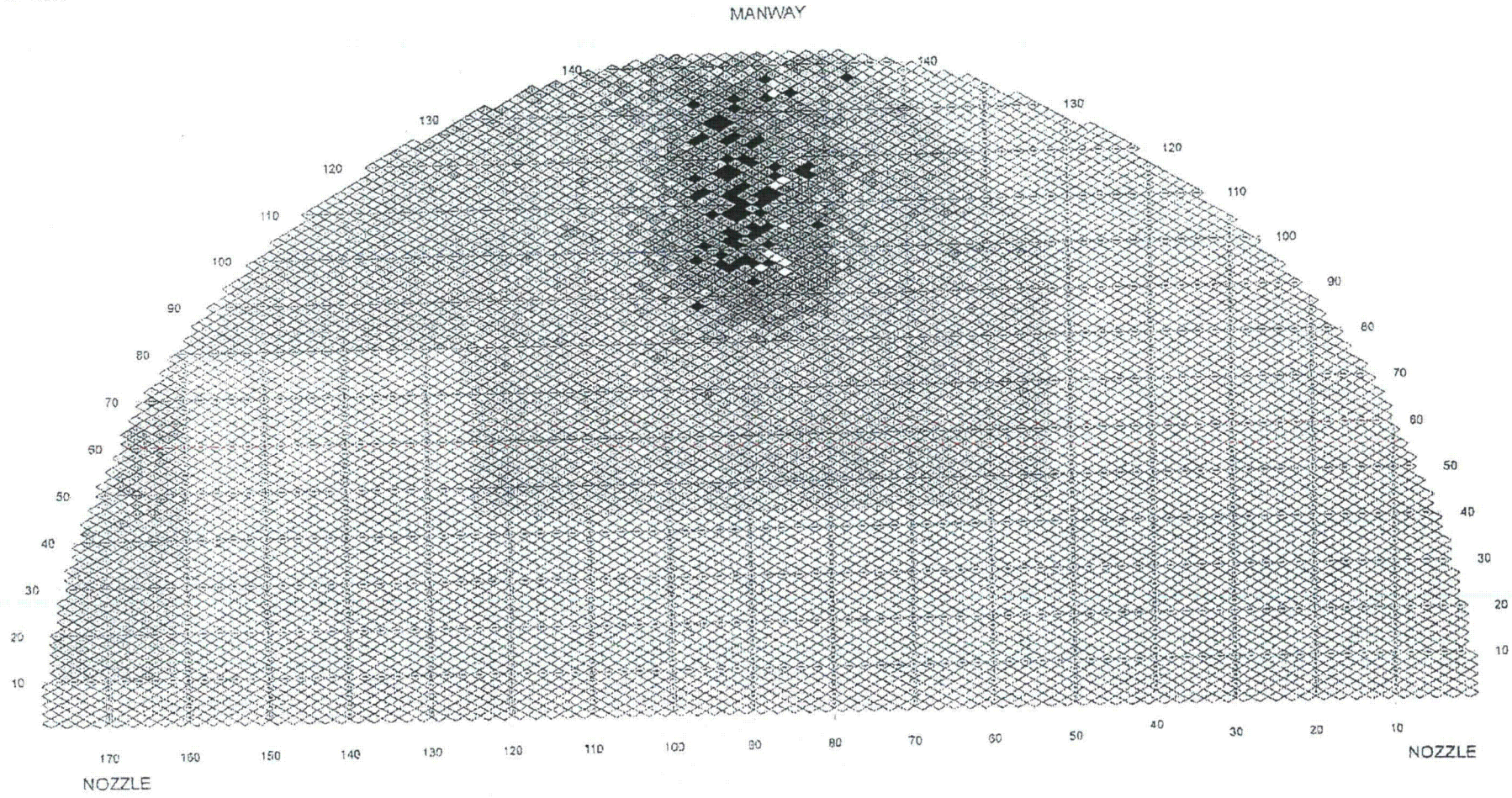
GROUP	TUBES
>=20%	69

AREVA - EDMS (map module) (version 11.0)

SCALE: 0.066571 X
Wed Feb 01 07:27:40 2012

TOTAL TUBES: 9727
SELECTED TUBES: 4124
OUT OF SERVICE (#): NA

S/G 88 Repl
COLD
PRIMARY FACE



02/09/12

SONGS Unit 2
Steam Generator Eddy Current Testing
February 9, 2012

Status

Bobbin ECT

- Steam Generator 2E088: Complete on 9727/9727 tubes (100%)
- Steam Generator 2E089: Complete on 9727/9727 tubes (100%)
- Totals: 19454/19454 tubes (100%)

Rotating Probe (special interest)

- Steam Generator 2E088: Complete on 203/203 tubes (100%)
- Steam Generator 2E089: Complete on 162/162 tubes (100%)
- Totals: 365/365 tubes (100%)

Rotating Probe (top of tubesheet expanded scope)

- Steam Generator 2E088: Complete on 2060/2060 tubes (100%)
- Steam Generator 2E089: Complete on 2060/2060 tubes (100%)
- Totals: 4120/4120 tubes (100%)

Rotating Probe (tube/retainer bar intersections expanded scope)

- Steam Generator 2E088: Complete on 81/192 tubes (42%)
- Steam Generator 2E089: Complete on 61/192 tubes (32%)
- Totals: 142/384 tubes (37%)

Findings to Date

Bobbin ECT

	Through Wall Thickness Percentage, Number of Tubes				
	>35%	20-34%	10-19%	<10%	None
- Steam Generator 2E088:	2	74	406	600	8645
- Steam Generator 2E089:	-	65	496	768	8396
- Totals:	2	139	902	1368	17043

Rotating Probe (special interest)

- Steam Generator 2E088: Refer to later page for retainer bar indications.
  Potential Loose Part (PLP) at adjacent tubes, middle tube support plate.
- Steam Generator 2E089: Refer to later page for retainer bar indications.
  No other indications to report.

Rotating Probe (top of tubesheet expanded scope)

- Steam Generator 2E088: No wear or potential loose part indications.
- Steam Generator 2E089: No wear or potential loose part indications.

Rotating Probe (tube/retainer bar intersections)

- Steam Generator 2E088: No other indications to report.
- Steam Generator 2E089: No other indications to report.

Significance of Findings

Wear indications at retainer bars

The top of the tube bundle has two sets of retainer bars, each set spanning between 23 tube columns at the periphery. The total number of tubes that are adjacent to retainer bars is approximately 100 per steam generator. The location and depth of these wear indications found in both Unit 2 steam generators indicate that retainer bar wear should now be considered the most likely cause of the tube leak in Unit 3 steam generator 3E088.

Potential loose part at tube support plate

4th support plate
- tomorrow
- Most likely saturday

The straight leg portion of the tube bundle has seven tube support plates approximately equally spaced between the tubesheet and the U-bend portion. Steam generator 2E088 has a foreign object at the middle support plate between adjacent tubes. This finding will require opening the available inspection port above the middle tube support for FOSAR. In addition, the ECT preplan included a provision for expanding the scope of rotating probe exams to include the top of tubesheet area, outer three tubes, in case of a confirmed loose part. This examination is complete with no wear or potential loose part indications.

Condition monitoring will require in-situ pressure testing.

Condition monitoring is a formal evaluation process that reviews the ECT results against performance criteria from the plant technical specifications. According to EPRI guidelines, the depth of the retainer bar wear indications will require in-situ testing to be completed as part of the condition monitoring process. In this test, the individual tube is pressurized to design conditions. Testing procedures are complete.

Operational assessment will require examinations in the next outage.

Operational assessment is a forward-looking process of predicting the expected wear during the interval to the next examination. This process determines when the next examination will be required. The evaluation is expected to show that all structural and leakage criteria will continue to be met during the next operating cycle. Examinations will be required at the next refueling outage.

Tube plugging and stabillization criteria are being developed.

Further analytical work is needed to understand the mechanism producing retaining bar wear indications. The supplier, MHI, has mobilized home-office resources in Japan to support these analyses. MHI's on-site team arrived at SONGS 2/7.

Current Actions

- Eddy Current Testing	
	Steam Generator E088 - Completion Forecast 2/9
	Steam Generator E089 - Completion Forecast 2/9
- In-situ testing	Completion Forecast 2/10
- Plugging	Holding for in-situ test and criteria development
- Tube stabilization analyses	Completion Forecast 2/10
- Secondary Side Inspection	Steam Generator E089 retainer bars planning 2/9 → Today or Weekend
- NRC NRR Conference Call	Following In-situ Pressure Test 2/10
- MHI Report	Completion Forecast 2/10

Planned Actions

- Examination in 2C18
- Discussions with manufacturer and NRC
- Industry communications per S/G Program

Retainer Bar Investigation

Rotating Probe (special interest)

- Steam Generator 2E088: Two wear indications at retainer bars, on separate tubes, 54% and 47% through wall depth.
- Steam Generator 2E089: Five wear indications at retainer bars, on four tubes. Indications characterized at 90%, 38%, 30% 29% and 28% through wall depth

MHI Input

- Retainer Bar Dimensions: Two diameters of retainer bar are in use in our steam generators, twelve of each diameter are present in each steam generator. To date, the indications are only occurring at the smaller diameter bars. MHI is working on the theory that the tube wear is caused by vibration of the smaller diameter bars.

Secondary Side Inspection

A secondary side remote visual inspection is being planned to examine the retainer bars associated with the wear indications.

In-Situ Pressure Testing

NIP - 2250 psi

Testing Program

- Main Steam Line Break: 3200 psi with leak rate < 0.5 gpm. Hold time for the test is 2 minutes. Note that the testing equipment is capable of a maximum of ~4.5 gpm at 7000 psi.

- Structural Integrity: 5300 psi without tube rupture; i.e., which would be indicated by depressurization. There is no leakage acceptance limit for this test pressure. Hold time for the test is 2 minutes.

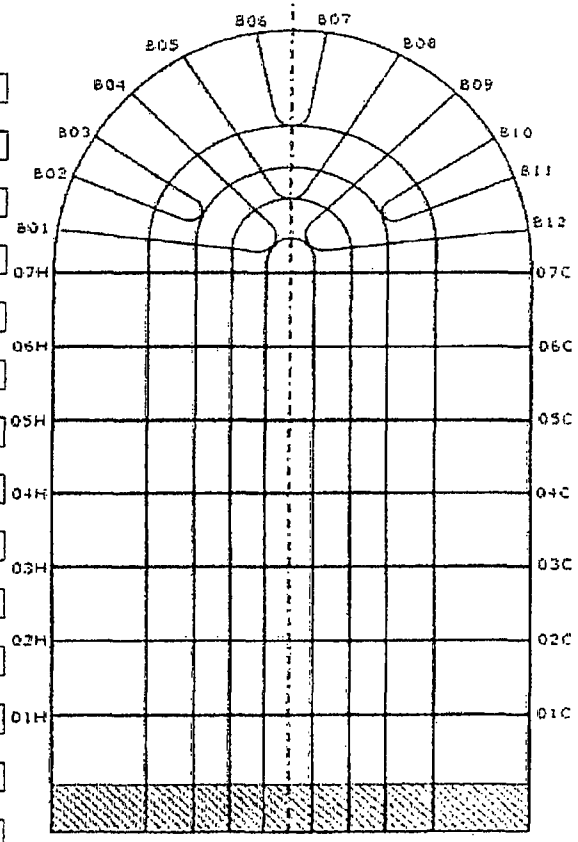
SONGS-2

Jan-2012 Refueling

TSP & AVB Wear Indications

SG88 Bobbin Data

	<10	10-19	20-29	>=30
B06	154	158	20	1
B05	139	110	18	
B04	93	31	1	
B03	33	7		
B02	2	1		
B01	1			
07H	8	13		
06H	11	20		
05H	24	20		
04H	31	19		
03H	11	9		
02H	4			
01H				
TSH				



	>=30	20-29	10-19	<10
B07	1	21	145	194
B08	1	15	132	176
B09	1	8	88	94
B10		1	32	69
B11			1	7
B12				2
07C			7	6
06C			7	6
05C			1	5
04C			6	8
03C			5	1
02C			1	1
01C				1
TSC				

>=30	20-29	10-19	<10	
4	84	813	1081	TOTAL INDICATIONS
9727				TOTAL INSPECTED

Status as of 2/9/2012 2:34 AM

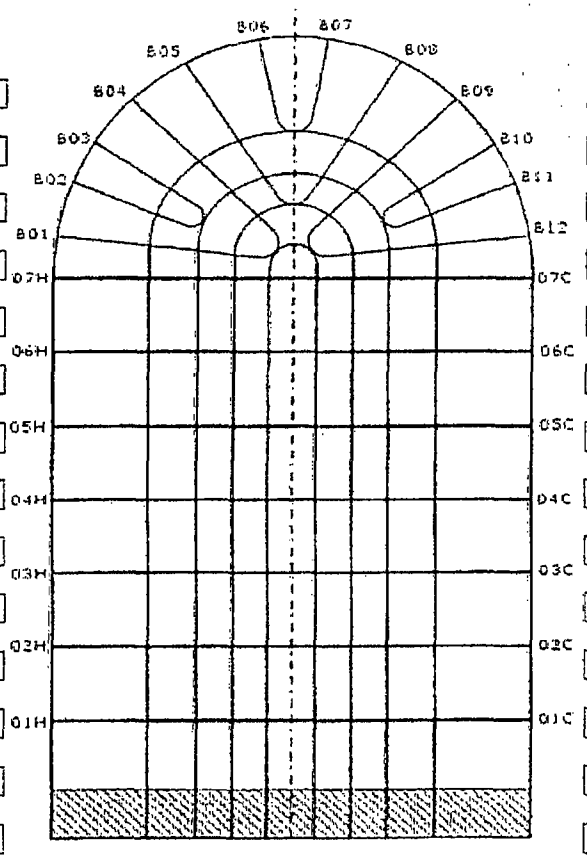
SONGS-2

Jan-2012 Refueling

TSP & AVB Wear Indications

SG89 Bobbin Data

	<10	10-19	20-29	>=30
B08	274	228	20	
B05	221	134	9	
B04	131	54		
B03	76	10		
B02	11			
B01	5			
07H	16	19		
06H	11	15		
05H	10	10		
04H	8	6		
03H	2	2		
02H				
01H				
TSH				



	>=30	20-29	10-19	<10
B07		23	252	271
B08		17	213	268
B09		8	96	169
B10		1	25	60
B11			2	12
B12				2
07C		1	3	1
06C			5	
05C			8	2
04C			12	3
03C			5	
02C				
01C				
TSC				

>=30	20-29	10-19	<10	
0	79	1099	1552	TOTAL INDICATIONS
9727				TOTAL INSPECTED

Status as of 2/9/2012 2:32 AM

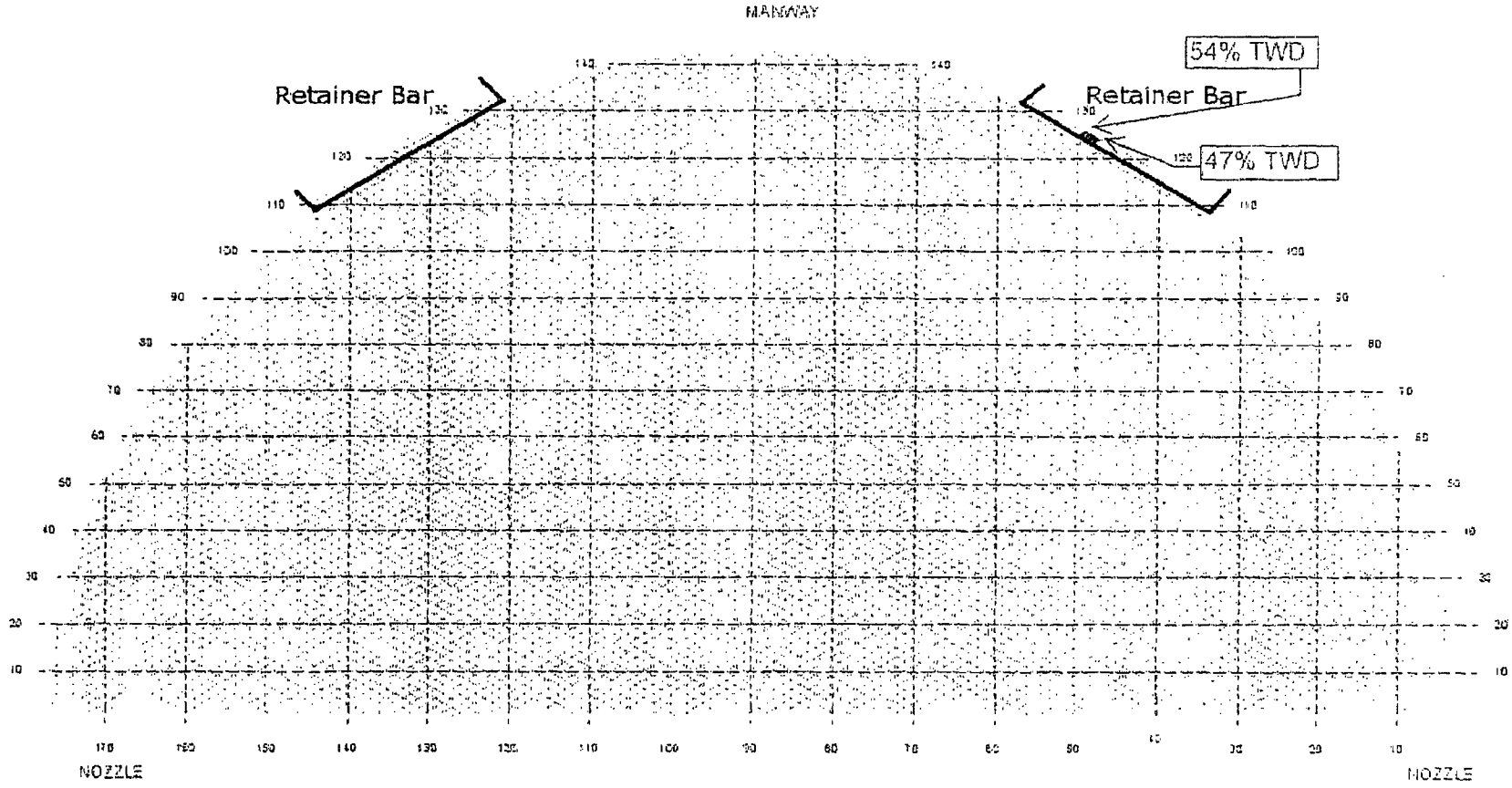
SONGS Unit 2
SG88 Retainer Bar Wear Indications

GROUP	TUBES
Retainer Bar Indications	2

SCALE 0.066571 X
Tue Feb 07 13:51:08 2012

S/G 88 Repl
COLD
PRIMARY FACE

TOTAL TUBES 9727
SELECTED TUBES 2
OUT OF SERVICE (#) NA



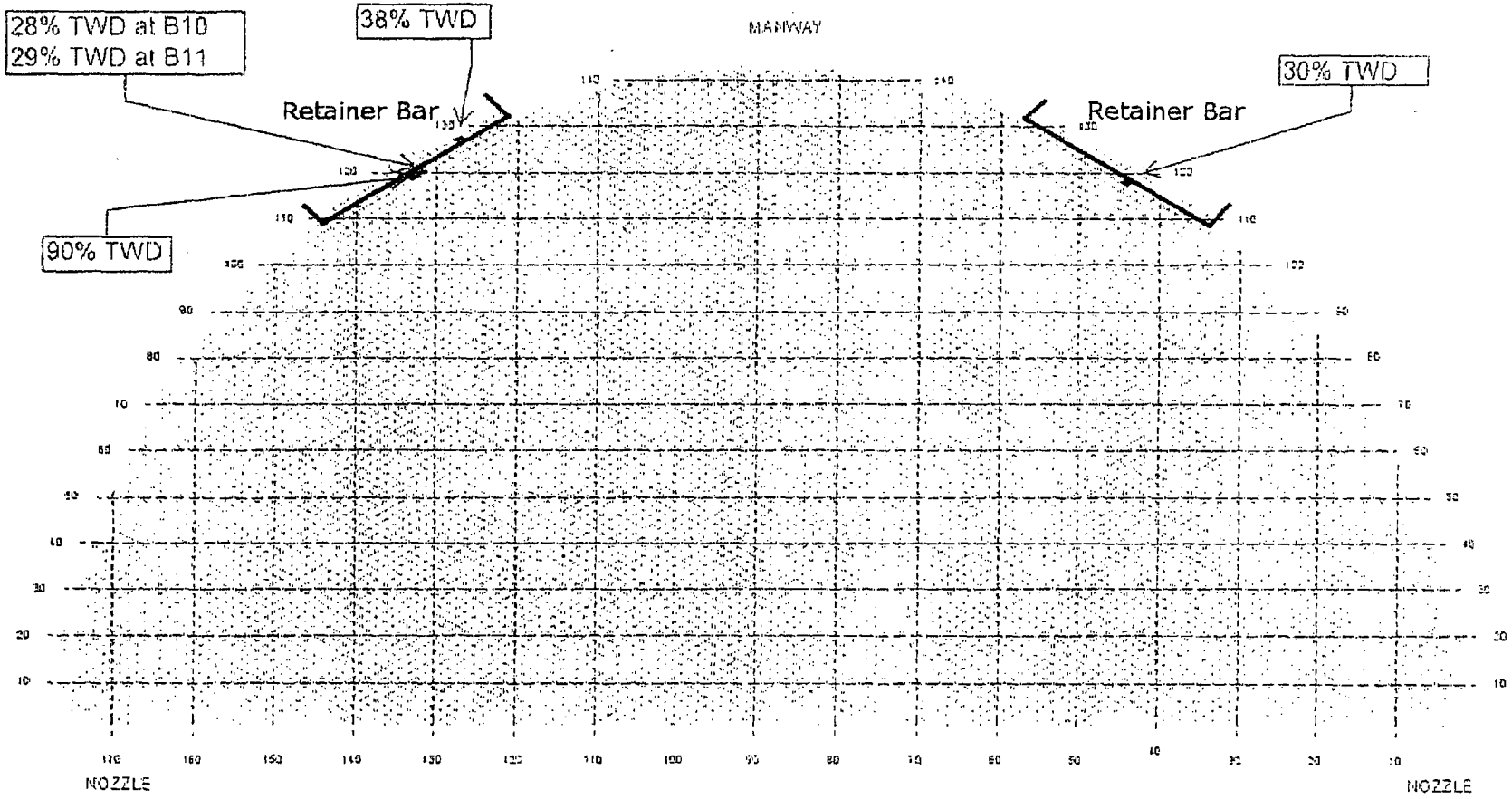
SONGS Unit 2
SG89 Retainer Bar Wear Indications

GROUP	TUBES
Retainer Bar Indications	4

SCALE 0.068571 X
Tue Feb 07 13 58 52 2012

S/G 89 Repl
COLD
PRIMARY FACE

TOTAL TUBES 9727
SELECTED TUBES 4
OUT OF SERVICE (#) NA



SONGS Unit 3
Steam Generator Inspection and Eddy Current Testing
February 10, 2012

- All tubes @ retainer bars
- All AVB locations inspected in U2

Status

Steam Generator 3E088 Secondary Side Leakage Test:
- Completed 2/10/12
- One leaking tube at approximately R106 C78
- Exact tube location and height will be confirmed today using ECT
- Leakage rate approximately 0.001 gpm at 80 psi

Bobbin ECT
- Steam Generator 3E088: Setup in progress
- Steam Generator 3E089: Setup will begin 2/10
- Scope is under development, an initial scope to inspect the leaking tube and adjacent tubes, all tube locations at retainer bars with bobbin probes and the Unit 2 AVB wear region has been issued.

Rotating Probe (special interest)
- Steam Generator 3E088: Pending bobbin results
- Steam Generator 3E089: Pending bobbin results

Findings to Date

Bobbin ECT

	Through Wall Thickness Percentage, Number of Tubes				
	>35%	20-34%	10-19%	<10%	None
- Steam Generator 3E088:	-	-	-	-	-
- Steam Generator 3E089:	-	-	-	-	-
- Totals:	-	-	-	-	-

Rotating Probe (special interest)
- Steam Generator 3E088: Pending bobbin ECT
- Steam Generator 3E089: Pending bobbin ECT

Significance of Findings

Leakage Test

The leak location is near the center of the tube bundle in the region with tube to AVB wear in Unit 2's steam generators. This location is not associated with the retainer bars. The ECT program will be used to identify whether the cause of the leak is support wear or another cause such as a foreign object/loose part.

2/10

Condition monitoring will require in-situ pressure testing.

Condition monitoring is a formal evaluation process that reviews the ECT results against performance criteria from the plant technical specifications. According to EPRI guidelines, the leaking tube requires in-situ testing to be completed as part of the condition monitoring process. In this test, the individual tube is pressurized to design conditions. Testing procedures are complete.

Refueling Outage Inspection

The industry steam generator inspection guidelines require a complete inspection during the upcoming Unit 3 refueling outage. Inspections performed during the forced outage do not offset this requirement.

Current Actions

- Eddy Current Testing	Steam Generator E088 – Begin Inspection Forecast 2/10
	Steam Generator E089 – Begin Inspection Forecast 2/11
- In-situ testing	Completion Forecast – pending completion of ECT
- Plugging	Holding for in-situ test and criteria development

Planned Actions

- Examination in 3C17
- Discussions with manufacturer and NRC
- Industry communications per S/G Program

SONGS Unit 2
Steam Generator Eddy Current Testing
February 10, 2012

Status

Bobbin ECT

- Steam Generator 2E088: Complete on 9727/9727 tubes (100%)
- Steam Generator 2E089: Complete on 9727/9727 tubes (100%)
- Totals: 19454/19454 tubes (100%)

Rotating Probe (special interest)

- Steam Generator 2E088: Complete on 203/203 tubes (100%)
- Steam Generator 2E089: Complete on 162/162 tubes (100%)
- Totals: 365/365 tubes (100%)

Rotating Probe (top of tubesheet expanded scope)

- Steam Generator 2E088: Complete on 2060/2060 tubes (100%)
- Steam Generator 2E089: Complete on 2060/2060 tubes (100%)
- Totals: 4120/4120 tubes (100%)

Rotating Probe (tube/retainer bar intersections expanded scope)

- Steam Generator 2E088: Complete on 192/192 tubes (100%)
- Steam Generator 2E089: Complete on 192/192 tubes (100%)
- Totals: 384/384 tubes (100%)

Findings to Date

Bobbin ECT

	Through Wall Thickness Percentage, Number of Tubes (Only Bobbin)				
	>35%	20-34%	10-19%	<10%	None
- Steam Generator 2E088:	2	74	406	600	8645
- Steam Generator 2E089:	-	65	496	768	8396
- Totals:	2	139	902	1368	17043

Rotating Probe (special interest)

- Steam Generator 2E088: Refer to later page for retainer bar indications.
  Potential Loose Part (PLP) at adjacent tubes, middle tube support plate.
- Steam Generator 2E089: Refer to later page for retainer bar indications.
  No other indications to report.

Rotating Probe (top of tubesheet expanded scope)

- Steam Generator 2E088: No wear or potential loose part indications.
- Steam Generator 2E089: No wear or potential loose part indications.

Rotating Probe (tube/retainer bar intersections)

- Steam Generator 2E088: No other indications.
- Steam Generator 2E089: No other indications.

Significance of Findings

Wear indications at retainer bars

The top of the tube bundle has two sets of retainer bars, each set spanning between 23 tube columns at the periphery. The total number of tubes that are adjacent to retainer bars is 94 per steam generator.

Potential loose part at tube support plate

Tonight or Tomorrow

The straight leg portion of the tube bundle has seven tube support plates approximately equally spaced between the tubesheet and the U-bend portion. Steam generator 2E088 has a foreign object at the middle support plate, determined from wear indications of of 10% and 17% through wall thickness on adjacent tubes. This finding will require opening the available inspection port above the middle tube support for FOSAR. In addition, the ECT preplan included a provision for expanding the scope of rotating probe exams to include the top of tubesheet area, outer three tubes, in case of a confirmed loose part. This examination is complete with no wear or potential loose part indications.

Condition monitoring will require in-situ pressure testing.

Condition monitoring is a formal evaluation process that reviews the ECT results against performance criteria from the plant technical specifications. According to EPRI guidelines, the tube with wear indication of 90% through wall thickness in steam generator 2E089 will require in-situ testing to be completed as part of the condition monitoring process. In this test, the individual tube is pressurized to design conditions.

Operational assessment will require examinations in the next outage.

Operational assessment is a forward-looking process of predicting the expected wear during the interval to the next examination. This process determines when the next examination will be required. The evaluation is expected to show that all structural and leakage criteria will continue to be met during the next operating cycle. Examinations will be required at the next refueling outage.

Tube plugging and stabilization criteria are being developed.

Repair plans under consideration for the tubes adjacent to retainer bars involve plugging all of these tubes and potentially stabilizing a number of them. Further analytical work is needed to understand the mechanism producing retaining bar wear indications. The supplier, MHI, has mobilized home-office resources in Japan to support these analyses. MHI's on-site team arrived at SONGS 2/7.

Current Actions

- Eddy Current Testing — Steam Generator E088 - Completed 2/10; Steam Generator E089 - Completed 2/10
- In-situ testing (7:00 am - 7:00pm) — Completion Forecast 2/10
- Plugging — Holding for in-situ test and criteria development
- Tube stabilization analyses — Completion Forecast 2/10
- Secondary Side Inspection — Steam Generator 2E089 retainer bars planning
- NRC NRR Conference Call — Following In-situ Pressure Test 2/10
- MHI Report — Completion Forecast 2/10 – MHI briefing management

If they don't start @ 12-1 will be until tomorrow

Planned Actions

- Examination in 2C18
- Discussions with manufacturer and NRC
- Industry communications per S/G Program

Retainer Bar Investigation

Rotating Probe (special interest)

- Steam Generator 2E088: Two wear indications at retainer bars, on separate tubes, 54% and 47% through wall depth.
- Steam Generator 2E089: Five wear indications at retainer bars, on four tubes. Indications characterized at 90%, 38%, 30% 29% and 28% through wall depth

Examinations completed 2/10 with no additional indications on either 2E088 and 2E089.

MHI Input

- Retainer Bar Dimensions: Two diameters of retainer bar are in use in our steam generators, twelve of each diameter are present in each steam generator. To date, the indications are only occurring at the smaller diameter bars. MHI is working on the theory that the tube wear is caused by vibration of the smaller diameter bars.

Secondary Side Inspection

A secondary side remote visual inspection is being planned to examine the retainer bars associated with the wear indications.

In-Situ Pressure Testing

Testing Program

- Main Steam Line Break: 3200 psi with leak rate < 0.5 gpm. Hold time for the test is 2 minutes. Note that the testing equipment is capable of a maximum of ~4.5 gpm at 7000 psi.
- Structural Integrity: 5300 psi without tube rupture; i.e., which would be indicated by depressurization. There is no leakage acceptance limit for this test pressure. Hold time for the test is 2 minutes.

↓ C-Scan of retainer bar wear

↓ line to line depth profile

Condition Monitoring

- Full Probabilistic Analysis
- 30% plugging criteria
- Call of record — Bobbin Data

SONGS Unit 3
Steam Generator Inspection and Eddy Current Testing
February 14, 2012

Status

Steam Generator 3E088 Secondary Side Leakage Test:
- Completed 2/10/12
- One leaking tube at approximately R106 C78, confirmation by eddy current in progress
- Probable leak location in U-bend and is located 2" above 4th AVB on hot leg side
- Leakage rate approximately 0.001 gpm at 80 psi

Bobbin ECT
- Steam Generator 3E088: Complete on 6201/9727 tubes (64%)
- Steam Generator 3E089: Complete on 4654/9727 tubes (48%)
- Overall: Complete on 10855/19454 tubes (56%)
- Scope – 100% full-length bobbin followed by rotating probe as determined by bobbin results

Rotating Probe (special interest)
- Steam Generator 3E088: Pending bobbin results
- Steam Generator 3E089: Pending bobbin results

Findings to Date

Bobbin ECT

	>= 50%	35-49%	20-34%	<20%	None
- Steam Generator 3E088:	66	108	237	1022	4768
- Steam Generator 3E089:	0	114	187	900	3453
Totals	66	222	424	1922	8221

Rotating Probe (special interest)
- Steam Generator 3E088: Pending bobbin ECT
- Steam Generator 3E089: Pending bobbin ECT

Significance of Findings

Leakage Test

The leak location is near the center of the tube bundle in the region with tube to AVB wear in Unit 2's steam generators. This location is not associated with the retainer bars.

Freespan Indications

Bobbin ECT results indicate the leak location is in the ubend of the tube; ~2" above the 4th AVB intersection with the tube. The leak location is near the middle of a 20" long axial freespan

C/12

indication. Similar indications have been found in adjacent tubes. Additionally, wear has been found in nearly all of the tube to support structures for this tube. Similar support structure wear has been identified in adjacent tubes. The freespan indications are oriented at the top or bottom of the tube.

The bobbin probe examination is being used to bound the region with these indications. One region of approximately 200 tubes has been identified in steam generator E088. A similar region is present in E089, although the indications are generally smaller.

ECT Techniques for Freespan Indications

The ECT consultant from Palo Verde has completed his review. He concurs with the use of the bobbin probe for detection of the freespan indications and the rotating probe for depth sizing. AREVA has initiated a site-specific validation of the sizing technique as recommended by the consultant. The schedule to complete this validation effort will be provided today.

Condition monitoring will require in-situ pressure testing.

Condition monitoring is a formal evaluation process that reviews the ECT results against performance criteria from the plant technical specifications. According to EPRI guidelines, the leaking tube requires in-situ testing to be completed as part of the condition monitoring process. In this test, the individual tube is pressurized to design conditions. Testing procedures are complete; testing acceptance criteria requires ECT to finalize.

Refueling Outage Inspection

The industry steam generator inspection guidelines require a complete inspection during the upcoming Unit 3 refueling outage. Inspections performed during the forced outage do not offset this requirement.

Retainer Bar Inspections

75% of the bobbin data has been evaluated, 1 tube has a small indication and 4 are under review. Special interest examinations are required to determine depth of the indications.

Current Actions

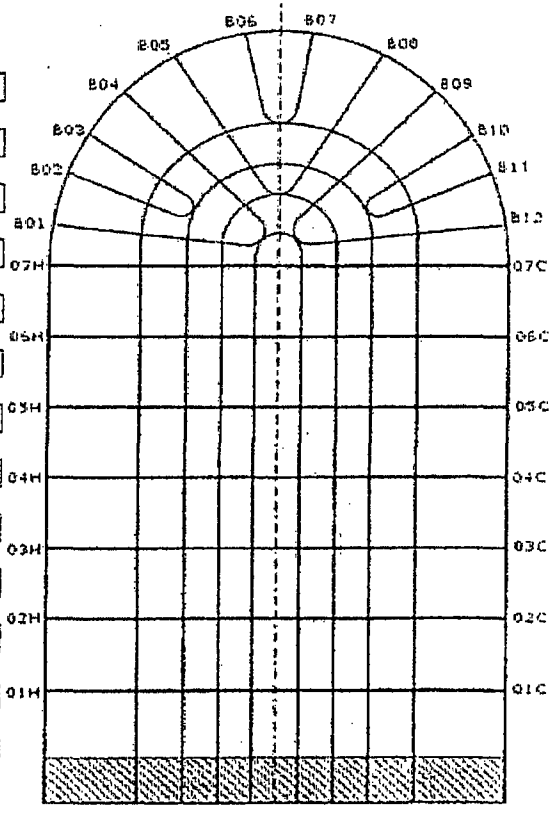
- Eddy Current Testing	Steam Generator E088 – Began 2/11
	Steam Generator E089 – Began 2/11
- In-situ testing	Completion Forecast – pending completion of ECT
- Plugging/Stabilizing	Holding for in-situ test and criteria development

Planned Action

- Examination in 3C17
- Discussions with manufacturer and NRC
- Industry communications per S/G Program

SONGS-3
Feb-2012 Leaker Outage

TSP & AVB Wear Indications
SG88 Bobbin Data



	<20%	20-34%	35-48%	>=50%	
B06	473	20	1		
B05	416	18	1		
B04	303	25	1		
B03	220	24			
B02	125	16			
B01	98	11			
07H	63	28	49	58	
06H	39	45	66	8	
05H	50	79	2		
04H	56	64	3		
03H	57	32			
02H	47	3			
01H	24	25			
TSH					

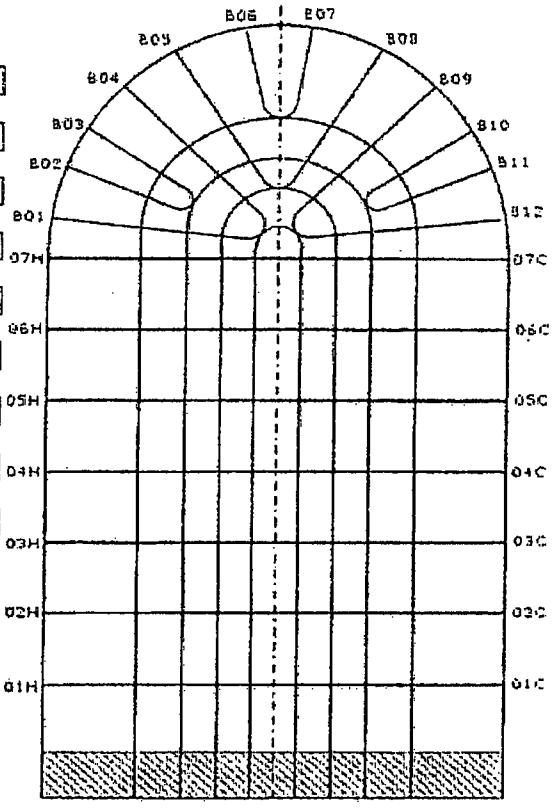
	>=50%	35-49%	20-34%	<20%	
B07			5	436	
B08			1	361	
B09			6	270	
B10			3	239	
B11			7	121	
B12			20	97	
07C	51	48	17	38	
06C		46	61	35	
05C		3	79	50	
04C			47	68	
03C			26	53	
02C				11	
01C					
TSC					

>=60%	40-59%	20-39%	<20%	
117	220	662	3726	FOTAL INDICATIONS
6892				TOTAL INSPECTED

SONGS-3
Feb-2012 Leaker Outage

TSP & AVB Wear Indications
SG89 Bobbin Data

	<20	20-34	35-49	>=50
B06	428	5		
B05	373	10		
B04	324	21		
B03	195	2		
B02	131	3		
B01	116	1		
07H	29	33	39	
06H	32	74	46	
05H	63	87	7	
04H	67	27	1	
03H	63	19		
02H	71	8	1	
01H	42	22		
TSH				



	>=50	35-49	20-34	<20
B07			2	384
B08				340
B09				263
B10				134
B11			1	77
B12				86
07C		44	38	10
06C		48	65	32
05C		2	40	76
04C		1	55	70
03C			11	64
02C			6	30
01C			1	32
TSC				

>=50	35-49	20-34	<20	
0	189	530	3480	TOTAL INDICATIONS
4654				TOTAL INSPECTED

02/14/2012

Status as of 2/14/2012 4:00 AM

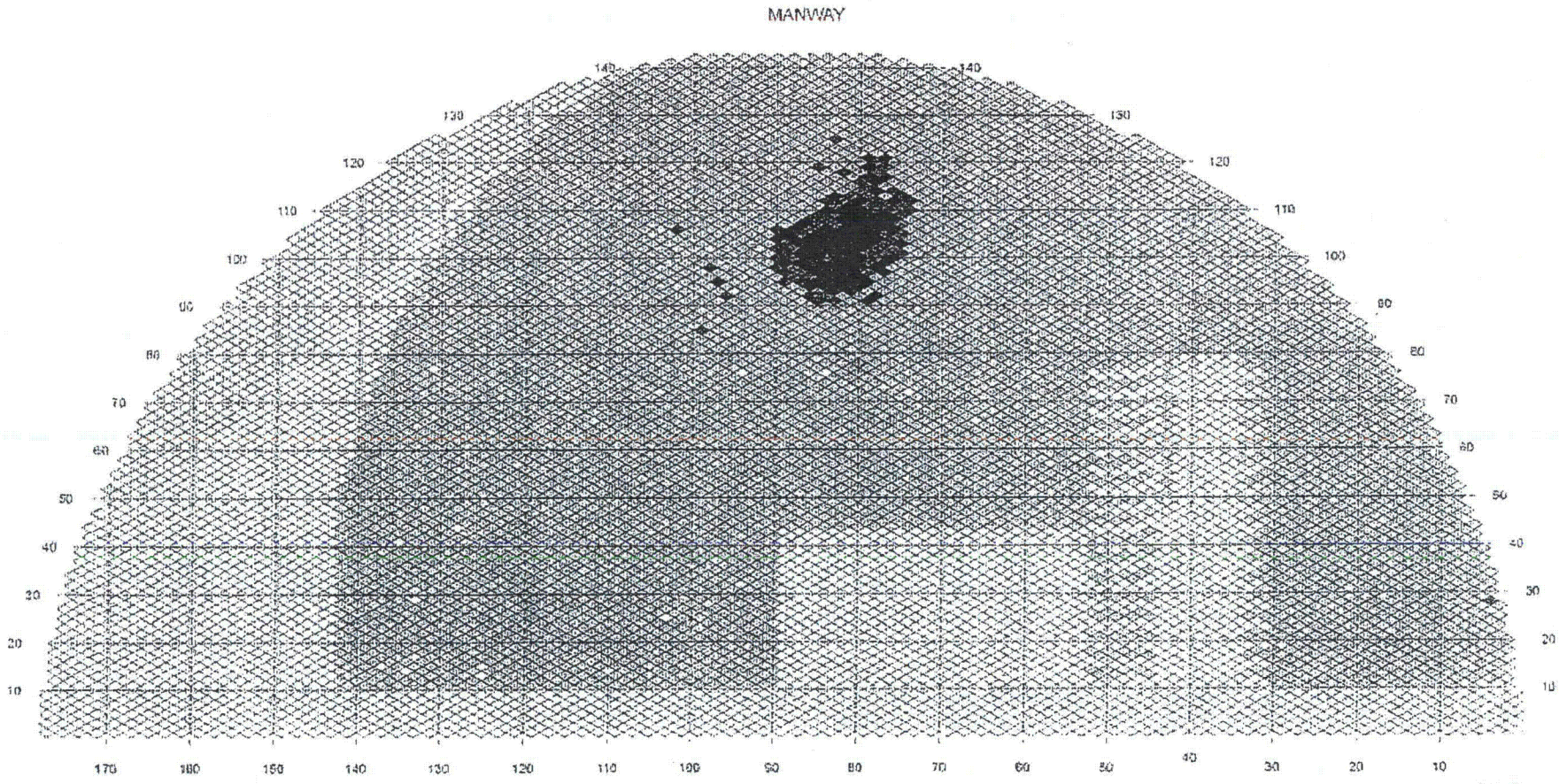
SCE-SONGS Unit 3 - R_PL
TSP Wear by Depth Bin

GROUP	TUBES
>50% TWD	66
35-49% TWD	174
20-34% TWD	131
<20% TWD	1[illegible]5

S/G 88 Repl
COLD
PRIMARY FACE

TOTAL TUBES: 9727
SELECTED TUBES: 6201
OUT OF SERVICE (#): NA

SCALE: 0.066571 X
Tue Feb 14 03:44:50 2012



SCE-SONGS Unit 3 - R_PL
TSP Wear by Depth Bin

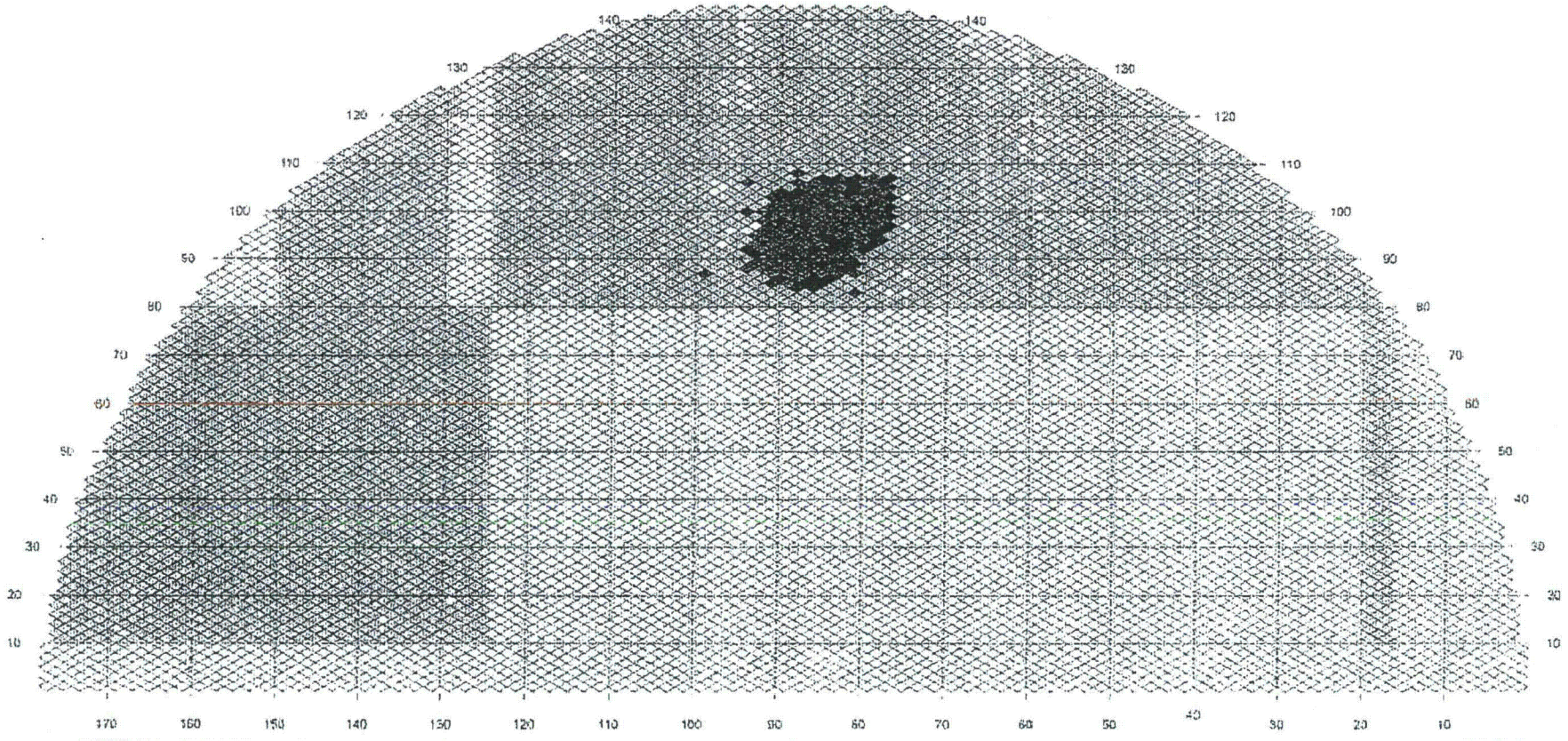
GROUP	TUBES
A 89TSP_GE50	[illegible]
[illegible]	[illegible]
A 89TSP_20-34	148
A 89TSP_LT20	[illegible]

S/G 89 Repl
COLD
PRIMARY FACE

TOTAL TUBES: 9727
SELECTED TUBES: 4654
OUT OF SERVICE (#): NA

SCALE 0.066571 X
Tue Feb 14 03:54:10 2012

MANWAY



SCE-SONGS Unit 3 - R_PL

~~Outage~~

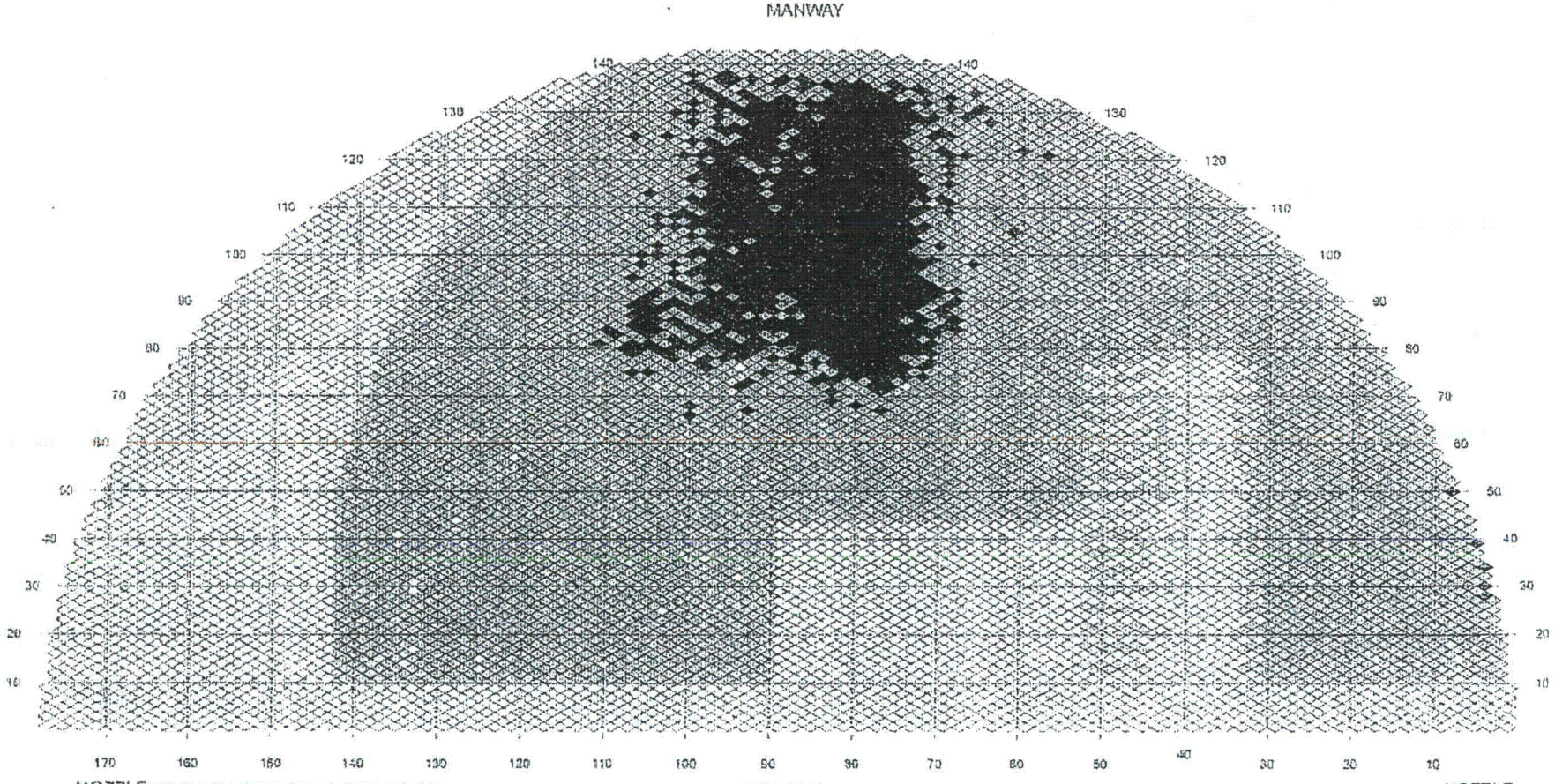
AVB Wear

GROUP	TUBES
>50% TWD	17
[illegible] TWD	[illegible]
20-34% TWD	106
<20% TWD	[illegible]

S/G 88 Repl
COLD
PRIMARY FACE

TOTAL TUBES: 9727
SELECTED TUBES: 6201
OUT OF SERVICE (#): NA

SCALE: 0.066571 X
Tue Feb 14 03:38:22 2012



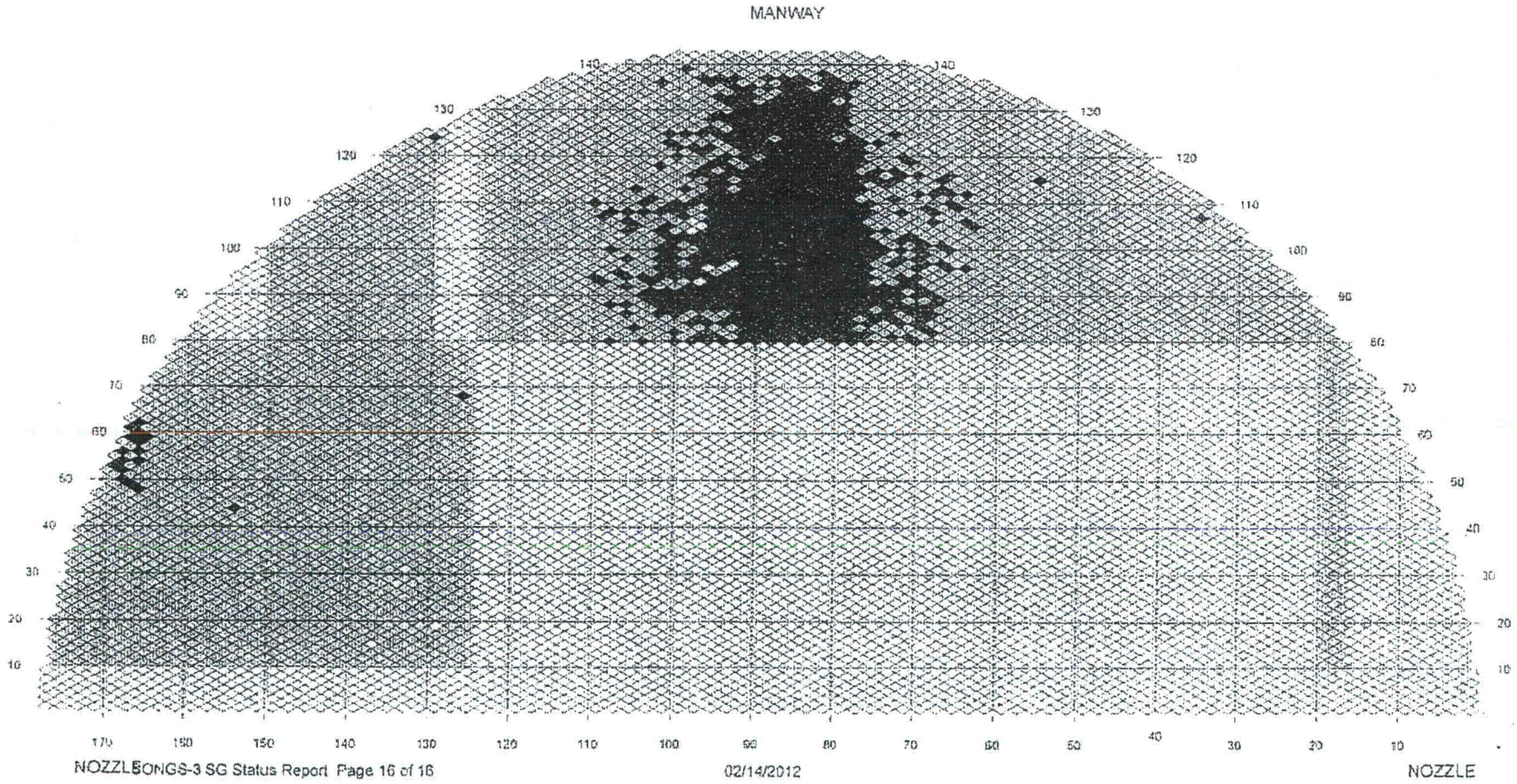
SCE-SONGS Unit 3 - R_PL
AVB Wear by Depth Bin

GROUP	TUBES
>50% TWD	0
35-49% TWD	[illegible]
20-34% TWD	39
<20% TWD	[illegible]

S/G 89 Repl
COLD
PRIMARY FACE

TOTAL TUBES: 9727
SELECTED TUBES: 4717
OUT OF SERVICE (#): NA

SCALE: 0.066571 X
Tue Feb 14 03:50:07 2012



SONGS Unit 2
Steam Generator Eddy Current Testing
February 14, 2012

Status

Bobbin ECT
- Steam Generator 2E088: Complete on 9727/9727 tubes (100%)
- Steam Generator 2E089: Complete on 9727/9727 tubes (100%)
- Totals: 19454/19454 tubes (100%)

Rotating Probe (special interest)
- Steam Generator 2E088: Complete on 203/203 tubes (100%)
- Steam Generator 2E089: Complete on 162/162 tubes (100%)
- Totals: 365/365 tubes (100%)

Rotating Probe (top of tubesheet expanded scope)
- Steam Generator 2E088: Complete on 2060/2060 tubes (100%)
- Steam Generator 2E089: Complete on 2060/2060 tubes (100%)
- Totals: 4120/4120 tubes (100%)

Rotating Probe (tube/retainer bar intersections expanded scope)
- Steam Generator 2E088: Complete on 192/192 tubes (100%)
- Steam Generator 2E089: Complete on 192/192 tubes (100%)
- Totals: 384/384 tubes (100%)

Findings to Date

Bobbin ECT

	Through Wall Thickness Percentage, Number of Tubes				
	>35%	20-34%	10-19%	<10%	None
- Steam Generator 2E088:	2	74	406	600	8645
- Steam Generator 2E089:	-	65	496	768	8398
- Totals:	2	139	902	1368	17043

Rotating Probe (special interest)
- Steam Generator 2E088: Refer to later page for retainer bar indications.
- Steam Generator 2E089: Refer to later page for retainer bar indications.

Rotating Probe (top of tubesheet expanded scope)
- Steam Generator 2E088: No wear or potential loose part indications.
- Steam Generator 2E089: No wear or potential loose part indications.

Rotating Probe (tube/retainer bar intersections)
- Steam Generator 2E088: No other indications to report.
- Steam Generator 2E089: No other indications to report.

C/1

Significance of Findings

Wear indications at retainer bars

The top of the tube bundle has two sets of retainer bars, each set spanning between 23 tube columns at the periphery. The total number of tubes that are adjacent to retainer bars is 94 per steam generator.

Potential loose part at tube support plate

The straight leg portion of the tube bundle has seven tube support plates approximately equally spaced between the tubesheet and the U-bend portion. Steam generator 2E088 has a foreign object at the middle support plate between adjacent tubes. The foreign object has been removed. From the size (~7/8" long by ½" wide) and configuration of the object, we can eliminate the steam generator internals and the plant feedwater system as the source of the object. In addition, the ECT preplan included a provision for expanding the scope of rotating probe exams to include the top of tubesheet area, outer three tubes, in case of a confirmed loose part. This examination is complete with no wear or potential loose part indications.

Condition monitoring will require in-situ pressure testing.

Condition monitoring is a formal evaluation process that reviews the ECT results against performance criteria from the plant technical specifications. According to EPRI guidelines, the depth of the retainer bar wear indications will require in-situ testing to be completed as part of the condition monitoring process. In this test, the individual tube is pressurized to design conditions. Test complete and satisfactory; no leakage occurred.

Operational assessment will require examinations in the next outage.

Operational assessment is a forward-looking process of predicting the expected wear during the interval to the next examination. This process determines when the next examination will be required. The evaluation is expected to show that all structural and leakage criteria will continue to be met during the next operating cycle. Examinations will be required at the next refueling outage.

Tube plugging and stabilization criteria are being developed.

MHI issued their analysis and a repair scope has been developed for the retainer bar indications. All tubes adjacent (94) to the retainer bars will be removed from service by the installation of tube plugs. Twelve of these tubes and the tubes with the wear at retainer bar locations will be internally stabilized.

Current Actions

- Eddy Current Testing	Review for Unit 3 type freespan indications – 2/15 forecast Steam Generator E089 - Complete
- In-situ testing	Complete
- Plug List Development	Steam Generator E088 – Complete for Retainer Bar Final list 2/15 forecast Steam Generator E089 – Complete (Note these lists do not include results of the Unit 3 forced outage inspection)
- Plugging	In-progress
- Tube stabilization analyses	Complete
- Secondary Side Inspection	Steam Generator E089 retainer bars planning 2/15 forecast
- NRC NRR Conference Call	Pending
- MHI Report	Complete

Planned Actions

- Examination in 2C18
- Discussions with manufacturer and NRC
- Industry communications per S/G Program

Retainer Bar Investigation

Rotating Probe (special interest)

- Steam Generator 2E088: Two wear indications at retainer bars, on separate tubes, 54% and 47% through wall depth.
- Steam Generator 2E089: Five wear indications at retainer bars, on four tubes. Indications characterized at 90%, 38%, 30% 29% and 28% through wall depth.

MHI Input

- Retainer Bar Dimensions: Two diameters of retainer bar are in use in our steam generators, twelve of each diameter are present in each steam generator. The indications are only occurring at the smaller diameter bars.

Secondary Side Inspection

A secondary side remote visual inspection is planned to examine the retainer bars associated with the wear indications.

In-Situ Pressure Testing

Testing Program – Test complete no leakage observed

- Main Steam Line Break: 3200 psi with leak rate < 0.5 gpm. Hold time for the test is 2 minutes. Note that the testing equipment is capable of a maximum of ~4.5 gpm at 7000 psi.

- Structural Integrity: 5300 psi without tube rupture; i.e., which would be indicated by depressurization. There is no leakage acceptance limit for this test pressure. Hold time for the test is 2 minutes.

Tube Plugging and Stabilization Plan:

Reason	SG 2E088	SG 2E089	Total
Retainer Bars	94	94	188
Retainer Bar Stabilizers	14	15	29
Wear at AVB's	4 (not issued to field)	0	4
AVB Stabilizers	Under Review (up to 4)	0	Under Review

Final repair list for E088 is FC 2/15

Tube Plugging and Stabilization Installation Status:

Type	SG 2E088		SG 2E089	
	Hot Leg	Cold Leg	Hot Leg	Cold Leg
Tube Plugs	80/80	16/80	0/79	0/79
Tube Plugs and Stabilizers	0/14 WIP		0/15	

Remaining ECT Testing

Since we currently do not have a clear understanding of the Unit 3 freespan indication mechanism and thus cannot develop a basis for the mechanism being limited to only Unit 3's steam generators, we have developed a plan to review the ECT data from the just completed inspection of Unit 2.

The plan will sample existing bobbin data from approximately 1000 tubes in each steam generator for similar indications in U2 locations that mirror the locations where freespan indications are being found in Unit 3.

The sample plan will require update if the Unit 3 results identify additional areas to examine in Unit 2. As the review progresses, additional ECT data from the Unit 2 steam generators made be needed.

~~Prior to the new area of interest the forecast to complete was 2/15.~~

sentinel plugs ?!?

Secondary Side Inspection of Steam Generator E089

- Secondary visual inspection of retainer bars – FC 2/15.

Condition Monitoring Report

- Draft for review by SCE and Industry Peer – FC 2/22
- Complete and issue report – FC 2/27

Operational Assessment Report

- Preliminary report complete – FC 2/27
- Final report is due 90 days after the unit returns to service.
- Draft for SCE and Industry Peer Review – 30 days following return to service

Steam Generator Activities which constrain Modes 1, 2, 3 or 4

- Preliminary Operation Assessment Report
- Final Condition Monitoring Report
- Steam Generator secondary side remote visual inspection of retainer bars – FC 2/15
- Unit 2 ECT review for Unit 3 freespan indications – FC 2/15
- Final Tube Plug and Stabilizer List SG E088 – FC 2/15
- Tube plug and stabilizer installation
- Condition Monitoring Report
- Review repair program with NRC NRR

NRC Concerns

- Visual inspections will not be routine.
- Not stabilizing all tubes in contact with retainer bars.

SONGS Unit 3
Steam Generator Inspection and Eddy Current Testing
0500 February 27, 2012

Examination Scope

Steam Generator 3E088 Secondary Side Leakage Test:
- Completed 2/10/12
- One leaking tube at approximately R106 C78, confirmed by eddy current
- Probable leak location in U-bend and is located 2" above 4th AVB on hot leg side
- Leakage rate approximately 0.001 gpm at 80 psi

Bobbin ECT
- Completed
- Refer to attached AREVA "Big Picture" report for status.

Rotating Probe (special interest)
- Base Scope:
- AVB bobbin indications => 20%
- TSP bobbin indications => 20%
- Freespan indications – all bobbin indications
- Bobbin indications as requested by ECT Level III

Rotating Probe Expansions:
- Expansion 1: Rotating probe inspection of all tube interface locations with retainer bars, issued to AREVA 2/19. Scope – U-bend region from TSP's 07H to 07C (94 tubes per steam generator)
- Expansion 2: Rotating probe inspection of tubes bounding the bobbin freespan indications by one tube, issued to AREVA 2/20. Scope consists of the U-bend region from TSP's 07H to 07C (72 tubes in 3E088 and 61 tubes in 3E089).
- Expansion 3: Rotating probe inspection of tubes with bobbin wear indications >= 20%. Scope is (23 tubes in 3E088 and 14 tubes in 3E089).
- Expansion 4: Rotating probe inspection of tubes bounding the bobbin freespan indications by three tube pitches, issued to AREVA 2/23. Scope consists of the U-bend region from TSP's 07H to 07C (146 tubes in 3E088 and 183 tubes in 3E089). Acquisition and resolution of the data from this expansion is complete, no new indications were found. No further bounding of the freespan indications is planned.
- Expansion 5 (not yet issued): Rotating probe (pancake coil) inspection of tubes with freespan indications is under consideration by the root cause team for gap size estimation. Scope consists of the U-bend region from TSP's 07H to 07C (~200 tubes per steam generator).

- Refer to attached AREVA "Big Picture" report for status.

C/14

Findings to Date

Bobbin and Rotating Probe ECT

- Steam Generator 3E088

Through Wall Thickness Percentage, Number of Tubes

	>= 50%	35-49%	20-34%	10-19%	<10%	Total
U-Bend Freespan Wear	26	18	18	7	0	69
TSP Wear	48	25	14	55	11	153
AVB Wear	0	2	48	298	346	694
Totals	**74**	**45**	**80**	**360**	**357**	**916**

(The totals above reflect only the largest indication in each tube. Since a tube may have multiple indications, the above totals will not match the attached charts)

8811 tubes do not have indications

- Steam Generator 3E089

Through Wall Thickness Percentage, Number of Tubes

	>= 50%	35-49%	20-34%	10-19%	<10%	Total
U-Bend Freespan Wear	16	29	13	9	0	67
TSP Wear	44	39	20	27	9	139
AVB Wear	0	0	14	243	423	680
Totals	**60**	**68**	**47**	**279**	**432**	**886**

(The totals above reflect only the largest indication in each tube. Since a tube may have multiple indications, the above totals will not match the attached charts)

8841 tubes do not have indications

Retainer Bar Indications Characterized by Rotating Probe ECT

- Steam Generator 3E088: Three tubes with wear indications at retainer bars B10 and B11, 44%, 28%, and 41% through wall depth.
- Steam Generator 3E089: One tube with wear indication at retainer bar B11, 46% through wall depth.

Repair Scope

- Depth sizing of the rotating probe examinations is complete.
- The repair scope will be determined once the cause of the freespan indications is determined. A preliminary estimate of the repair scope can be estimated by including all tubes with TSP and AVB wear >= 35% as well as all tubes with freespan indications and tubes that interface with Retainer Bars.
- From the above tables, the repair scope estimate is provided in the following table:

	3E088	3E089
U-Bend Freespan Wear (All)	69	67
TSP Wear (>=35% TWD)	73	83
AVB Wear (>=35% TWD)	2	0
Retainer Bar (All)	94	94
Totals	238	244

Significance of Findings

Leakage Test

The leak location is near the center of the tube bundle in the region with tube to AVB wear in Unit 2's steam generators. This location is not associated with the retainer bars.

Freespan Indications

Bobbin ECT results indicate the leak location is in the U-bend of the tube; ~2" above the 4th AVB intersection with the tube. The leak location is near the middle of a 20" long axial freespan indication. Similar indications have been found in adjacent tubes. Additionally, wear has been found in nearly all of the tube to support structures for this tube. Similar support structure wear has been identified in adjacent tubes. The freespan indications are oriented at the top or bottom of the tube.

The bobbin probe examination has been used to bound the region with these indications. One region of approximately 200 tubes has been identified in steam generator 3E088. A similar region is present in 3E089. These bobbin indications are being characterized by rotating probe. Rotating probe results are consistent with the bobbin findings.

Data review of wear profile above and below AVB is underway.

ECT Techniques for Freespan Indications

The ECT consultant from Palo Verde has completed his review. He concurs with the use of the bobbin probe for detection of the freespan indications and the rotating probe for depth sizing. AREVA has initiated a site-specific validation of the sizing technique as recommended by the consultant. Validation was completed 2/17.

Condition monitoring will require in-situ pressure testing.

Condition monitoring is a formal evaluation process that reviews the ECT results against performance criteria from the plant technical specifications. According to EPRI guidelines, the leaking tube requires in-situ testing to be completed as part of the condition monitoring process. In this test, the individual tube is pressurized to design conditions. Testing procedures are complete; testing acceptance criteria requires rotating probe examinations to finalize.

Refueling Outage Inspection

The industry steam generator inspection guidelines require a complete inspection during the upcoming Unit 3 refueling outage. Inspections performed during the forced outage do not offset this requirement.

Retainer Bar Inspections

100% of the bobbin data has been evaluated, 4 tubes have indications. Wear locations are consistent with those found in Unit 2 steam generators. A visual examination performed 2/19 found no unexpected or unusual conditions in 3E088. A similar inspection is being planned for 3E089. Refer to the Secondary Side Inspection Summary in the Unit 2 Status report for additional information.

Industry Experts

In parallel with the efforts of MHI's technical team, we have put together a team of other industry experts in thermal-hydraulics and flow-induced vibration analysis. Team members are also experienced in previous industry events involving unusual steam generator tube wear.

Secondary Side Inspection

An inner tube bundle remote visual inspection of the region experiencing freespan indications could not be completed from the secondary manway. The inspection was re-planned using the transition cone handhole and started on 2/20. The inspection was suspended due to equipment malfunction on 2/21 and resumed following completion of Unit 2 inspections.

Divider Plate Weld Separation

During fabrication of the Unit 3 steam generators in Japan, the primary channel head divider plate weld separated from the channel head in both steam generators. Repairs were completed by MHI prior to shipping the steam generators to the SONGS. Visual and Ultrasonic (UT) examinations of the divider to bowl region are planned during this outage. The UT examination was completed 2/20 with satisfactory results. The visual examination will start following completion of eddy current testing (FC2/26).

Current Actions

- Eddy Current Testing	Steam Generator E088 – Special interest began 2/17 Steam Generator E089 – Special interest began 2/18
- In-situ testing	Completion Forecast – pending completion of ECT
- Plugging/Stabilizing	Holding for in-situ test and criteria development
- Secondary Side Inspections	Refer to table
- Industry Experts	Daily meetings
- Visual of Bowl to Divider Weld	Following eddy current testing

Planned Actions

- Examination in 3C17
- Discussions with manufacturer and NRC
- Industry communications per S/G Program
- Condition Monitoring and Operational Assessment – TBD
- First In Situ Test – TBD

Unit 3 Secondary Side Inspection

Unit 3 SG E088	Status	Unit 3 SG E089	Status
Revision 0: Secondary Manway - Condition of Upper Bundle - Condition of Retainer Bars	Additional Inspections Required FC 2/28	Revision 0: Secondary Manway - Condition of Upper Bundle - Condition of Retainer Bars	FC 2/29 "" ""
Revision 1: Transition Cone Handhole - Condition of 7th TSP in region of U3 Wear - Condition of AVB and tube to AVB gaps in region of U3 Wear - Condition of areas of no wear	Data Obtained, Engineering Review In Progress	Revision 1: Transition Cone Handhole - Condition of 7th TSP in region of U3 Wear - Condition of AVB and tube to AVB gaps in region of U3 Wear - Condition of areas of no wear	Start 2/28 "" "" ""

Steam Generator 3E088 Additional Detail:

The revision 0 inspection found retainer bars and AVB's intact with no anomalous indications. Additional inspection scope was added to align the content of both Unit 2 and Unit 3 inspections. The revision 1 visual examination has found tube to tube wear and tube to AVB wear consistent the ECT results. Engineering review of the examination and a tube by tube comparison with the ECT results is resuming following completion of the Unit 2 secondary side inspections.

The Big Picture

SONGS Steam Generators

2/26/2012 @ 15:00 and 2/27/2012 @ 0500
All crews are off returning to work at 0700 2/27/2012 Engineering Projects will continue throughout the Night shift

Unit 3

3EO88 Hot Leg	Scope	Complete	3EO89 Hot Leg	Scope	Complete
ECT Bobbin Exam	100%	100%	ECT Bobbin Exam	100%	100%
SI Straight Section	283	100%	SI Straight Section	309	100%
SI U-Bend Region	150	100%	SI U-Bend Region	168	100%
SI F/L U-Bend	19	100%	SI F/L U-Bend	1	100%
Exp 1 (Retainer Bar F/L U-bend)	94	100%	Exp 1 (Retainer Bar F/LU-bend)	94	100%
Exp 2 (RPC SI free span)	72	100%	Exp 2 (RPC SI free span)	62	100%
Exp 3 (>20% TWD)	23	100%	Exp 3 (>20% TWD)	14	100%
Exp 4 (Freespan wear zone bounding #1)	146	100%	Exp 4 (Freespan wear zone bounding #1)	183	100%
3EO88 Cold Leg			**3EO89 Cold Leg**		
ECT Bobbin Exam	100%	100%	ECT Bobbin Exam	100%	100%
SI Straight Section	218	100%	SI Straight Section	242	100%
SI U-Bend Region	150	100%	SI U-Bend Region	168	100%
SI F/L U-Bend	19	100%	SI F/L U-Bend	1	100%
Exp 1 (Retainer Bar F/L U-bend)	94	100%	Exp 1 (Retainer Bar F/L U-bend)	94	100%
Exp 2 (RPC SI free span)	72	100%	Exp 2 (RPC SI free span)	62	100%
Exp 3 (>20% TWD)	2	100%	Exp 3 (>20% TWD)	N/A	N/A
Exp 4 (Freespan wear zone bounding #1)	146	100%	Exp 4 (Freespan wear zone bounding #1)	183	100%

Summary:

Plugs 435 on site 226- arrive 2/27
Stabilizers (668 inch) 161 on site- 100 arrive 2/27
Stabilizers (750 inch) 7 on site

Plan of the Day:

- Data Analysis – Special Projects
- 3EO88 H/L – Engineering hold point
- 3EO88 C/L – Engineering hold point
- 3EO89 H/L – Engineering hold point
- 3EO89 C/L – Engineering hold point

SONGS Unit 2
Steam Generator Inspection and Eddy Current Testing
0500 February 27, 2012

Scope and Status

Bobbin ECT

- Steam Generator 2E088: Complete on 9727/9727 tubes (100%)
- Steam Generator 2E089: Complete on 9727/9727 tubes (100%)
- Totals: 19454/19454 tubes (100%)

Rotating Probe (special interest)

- Steam Generator 2E088: Complete on 203/203 tubes (100%)
- Steam Generator 2E089: Complete on 162/162 tubes (100%)
- Totals: 365/365 tubes (100%)

Rotating Probe (top of tubesheet expanded scope)

- Steam Generator 2E088: Complete on 2060/2060 tubes (100%)
- Steam Generator 2E089: Complete on 2060/2060 tubes (100%)
- Totals: 4120/4120 tubes (100%)

Rotating Probe (tube/retainer bar intersections expanded scope)

- Steam Generator 2E088: Complete on 192/192 tubes (100%)
- Steam Generator 2E089: Complete on 192/192 tubes (100%)
- Totals: 384/384 tubes (100%)

Findings to Date

Bobbin ECT

	Through Wall Thickness Percentage, Number of Tubes				
	>35%	20-34%	10-19%	<10%	None
- Steam Generator 2E088:	2	74	406	600	8645
- Steam Generator 2E089:	-	65	496	768	8398
- Totals:	2	139	902	1368	17043

Rotating Probe (special interest)

- Steam Generator 2E088: Two wear indications at retainer bars, on separate tubes, 54% and 47% through wall depth.
- Steam Generator 2E089: Five wear indications at retainer bars, on four tubes. Indications characterized at 90%, 38%, 30%, 29% and 28% through wall depth.

Rotating Probe (top of tubesheet expanded scope)

- Steam Generator 2E088: No wear or potential loose part indications.
- Steam Generator 2E089: No wear or potential loose part indications.

Rotating Probe (tube/retainer bar intersections)

- Steam Generator 2E088: No other indications.
- Steam Generator 2E089: No other indications.

Significance of Findings

Wear indications at retainer bars

The top of the tube bundle has two sets of retainer bars, each set spanning between 23 tube columns at the periphery. The total number of tubes that are adjacent to retainer bars is 94 per steam generator.

Potential loose part at tube support plate

The straight leg portion of the tube bundle has seven tube support plates approximately equally spaced between the tubesheet and the U-bend portion. Steam generator 2E088 had a foreign object at the middle support plate between adjacent tubes. The foreign object (~7/8" long by ½" wide) has been removed. Metallurgical analysis of the object indicates it is weld metal from a nickel to carbon steel weld. This means the object was most likely introduced during fabrication by MHI. MHI has been asked to attempt to identify the likely source of the weld metal. This is a longer term action. In addition, the ECT preplan included a provision for expanding the scope of rotating probe exams to include the top of tubesheet area, outer three tubes, in case of a confirmed loose part. This examination is complete with no wear or potential loose part indications.

Condition monitoring required in-situ pressure testing.

Condition monitoring is a formal evaluation process that reviews the ECT results against performance criteria from the plant technical specifications. According to EPRI guidelines, the depth of the retainer bar wear indications required in-situ testing to be completed as part of the condition monitoring process. In this test, the individual tube is pressurized to design conditions. Test complete and satisfactory; no leakage occurred.

Operational assessment will require examinations in the next outage.

Operational assessment is a forward-looking process of predicting the expected wear during the interval to the next examination. This process determines when the next examination will be required. The evaluation is expected to show that all structural and leakage criteria will continue to be met during the next operating cycle. Examinations will be required at the next refueling outage.

Tube plugging and stabilization criteria are being developed.

The four tubes with wear indications at AVB supports have been plugged and stabilized.

Retainer Bar and Unit 3 Wear Secondary Side Inspections.

An additional secondary side inspection of the upper bundle U-bend region in both Unit 2 steam generators has been completed. The purpose of the inspection was to visually examine the AVB's and AVB retaining structures (including the Retainer Bars) as well as tubes and supports in the region experiencing wear in Unit 3's steam generators.

Current Actions

- Condition Monitoring Report – Final draft provided
- Preliminary Operational Assessment Report – Final draft provided
- Steam Generator Secondary Side Inspections – Complete

Planned Actions

- Examination in 2C18
- Discussions with manufacturer and NRC
- Industry communications per S/G Program

Retainer Bar Investigation

Rotating Probe (special interest)

- Steam Generator 2E088: Two wear indications at retainer bars, on separate tubes, 54% and 47% through wall depth.
- Steam Generator 2E089: Five wear indications at retainer bars, on four tubes. Indications characterized at 90%, 38%, 30%, 29% and 28% through wall depth.

MHI Input

- Retainer Bar Dimensions: Two diameters of retainer bar are in use in our steam generators, twelve of each diameter are present in each steam generator. The indications only occurred at the smaller diameter bars.
- Repair Plan: MHI issued their analysis and a repair scope was developed for the retainer bar indications. All tubes adjacent (94) to the retainer bars have been removed from service by the installation of tube plugs. Twelve of these tubes and the tubes with the wear at retainer bar locations have been internally stabilized.

In-Situ Pressure Testing

Testing Program – Test complete no leakage observed

- Main Steam Line Break: 3200 psi with leak rate < 0.5 gpm. Hold time for the test is 2 minutes. Note that the testing equipment is capable of a maximum of ~4.5 gpm at 7000 psi.
- Structural Integrity: 5300 psi without tube burst; i.e., which would be indicated by depressurization. There is no leakage acceptance limit for this test pressure. Hold time for the test is 2 minutes.

Remaining Eddy Current Testing

All ECT is complete in Unit 2.

Since we currently do not have a clear understanding of the Unit 3 freespan indication mechanism and thus cannot develop a basis for the mechanism being limited to only Unit 3's steam generators, we developed a plan to review the ECT data from the completed inspection of Unit 2.

The plan sampled existing bobbin data from approximately 1000 tubes in each steam generator for similar indications in Unit 2 locations that mirror the locations where freespan indications are being found in Unit 3. The review has been completed; no freespan indications were found in either Unit 2 steam generator.

Condition Monitoring Report

- Draft for review by SCE and Industry Peers – Comments incorporated into Final Draft
- Complete and issue report – FC 2/27

Operational Assessment Report

- Draft preliminary report for review by SCE and Industry Peers – Comments incorporated Into Final Draft
- Preliminary report complete – FC 2/27
- Final report is due 90 days after the unit returns to service.
- Final report draft for SCE and Industry Peer Review – 30 days following return to service

Steam Generator Activities which Constrain Modes 1, 2, 3 or 4

- Preliminary Operation Assessment Report – FC 2/27
- Condition Monitoring Report – FC 2/27
- Complete E088/9 Secondary Side Inspections – Refer to attached table

Unit 2 Secondary Side Inspection

Unit 2 SG E088	Status	Unit 2 SG E089	Status
Revision 0: Secondary Manway - Condition of Upper Bundle - Condition of Retainer Bars	 Complete ""	Revision 0 Secondary Manway - Condition of Upper Bundle - Condition of Retainer Bars	 Complete ""
Revision 1: Transition Cone Handhole - Condition of 7th TSP in region of U3 Wear - Condition of AVB and tube to AVB gaps in region of U3 Wear	Complete	Revision 1: Transition Cone Handhole - Condition of 7th TSP in region of U3 Wear - Condition of AVB and tube to AVB gaps in region of U3 Wear	Complete

Results from Unit 2 Secondary Side Inspection

The inspection from the transition cone handhole in steam generator 2E088 was completed on 2/22/12. No indications of tube to tube or tube to AVB wear have been identified. No abnormal conditions have been detected at the top of the 7th TSB or at AVBs. A second review of the recordings has been completed with no additional findings.

The inspection from the secondary manway of steam generator 2E089 was completed on 2/24/12. No abnormal conditions were found with the condition of the upper bundle or the retainer bars. Inspection from the transition cone handhole completed on 2/26. Visual tube wear at AVB locations has been correlated with ECT data.

The Big Picture

SONGS Steam Generators

2/26/2012 @ 15:00 and 2/27/2012 @ 0500
All crews are off returning to work at 0700 2/27/2012 Engineering Projects will continue throughout the Night shift

Unit 2

Summary:
All Work Complete

C/15

San Onofre Unit 3

Insitu Status Report

As of 1825 3/19/12

Shift Status for SG 88													
Date	Shift	Row	Col	Leak Rate @ NODP (gpm)	Leak Rate @ MSLB (gpm)	Leak Rate @ Max Press (gpm)	Max Press Reached	3xNODP Reached?	Additional Testing Req'd?	Status (Pass, Fail, Incomplete, Indeterminent) and Time	Nuclear Notification Number	Percent Wear (%)	Length of Wear (in)
3/13/12	Days	96	84	0	0	0	>5250	Yes	No	Pass -09:31	N/A		
3/13/12	Days	106	86	0	0	0	>5250	Yes	No	Pass -12:27	N/A		
3/13/12	Days	99	87	0	0	0	>5250	Yes	No	Pass -13:02	N/A		
3/13/12	Days	103	87	0	0	0	>5250	Yes	No	Pass -13:43	N/A		
3/13/12	Days	108	82	0	0	0	>5250	Yes	No	Pass -14:30	N/A		
3/13/12	Days	103	83	0	0	0	>5250	Yes	No	Pass -15:15	N/A		
3/13/12	Days	104	86	0	0	0	>5250	Yes	No	Pass -15:54	N/A		
3/13/12	Days	109	77	0	0	0	>5250	Yes	No	Pass -16:52	N/A		
3/14/12	Days	103	77	0	0	0	>5250	Yes	No	Pass -09:24	N/A	34	14
3/14/12	Days	110	78	0	0	0	>5250	Yes	No	Pass -10:11	N/A	63	21
3/14/12	Days	106	78	0.072	N/A	> 0.5	2884	No	Yes -ECT	Fail -11:20	201897717	Leaker	28
3/14/12	Days	109	79	0	0	0	>5250	Yes	No	Pass -12:08	N/A	39	36
3/14/12	Days	102	78	0	> 0.5	> 0.5	3268	No	Yes -ECT	Fail -12:49	201897883	99	23
3/14/12	Days	98	84	0	0	0	>5250	Yes	No	Pass -13:55	N/A	39	14
3/14/12	Days	104	78	0	> 0.5	> 0.5	3180	No	Yes -ECT	Fail -14:25	201898071	99	27
3/15/12	Days	100	80	0	0	N/A	4732	No	Yes -ECT	Fail -11:09	201899579	81	28
3/15/12	Days	100	86	0	0	0	>5250	Yes	No	Pass -12:22	N/A	42	22
3/15/12	Days	107	77	0	0	N/A	5160	No	Yes -ECT	Fail -14:37	201899965	80	34
3/15/12	Days	107	85	0	0	0	>5250	Yes	No	Pass -15:32	N/A	48	24
3/15/12	Days	101	81	0	0	N/A	4889	No	Yes -ECT	Fail -16:04	201900019	78	26
3/15/12	Days	120	78	0	0	0	>5250	Yes	No	Pass -16:58	N/A	44	28
3/15/12	Days	98	80	0	0	N/A	4886	No	Yes -ECT	Fail -17:34	201900244	72	28
3/15/12	Days	97	87	0	0	0	>5250	Yes	No	Pass -18:28	N/A	44	16
3/16/12	Days	105	77	0	0	0	>5250	Yes	No	Pass -10:05	N/A	72	33

Shift Status for SG 88													
Date	Shift	Row	Col	Leak Rate @ NODP (gpm)	Leak Rate @ MSLB (gpm)	Leak Rate @ Max Press (gpm)	Max Press Reached	3xNODP Reached?	Additional Testing Req'd?	Status (Pass, Fail, Incomplete, Indeterminent) and Time	Nuclear Notification Number	Percent Wear (%)	Length of Wear (in)
3/16/12	Days	108	80	0	0	0	>5250	Yes	No	Pass -11:28	N/A	72	27
3/16/12	Days	99	81	0	0	N/A	5026	No	Yes -ECT	Fail -12:16	201901456	72	27
3/16/12	Days	97	85	0	0	0	>5250	Yes	No	Pass -13:13	N/A	47	22
3/16/12	Days	95	81	0	0	0	>5250	Yes	No	Pass -13:57	N/A	68	20
3/16/12	Days	110	80	0	0	0	>5250	Yes	No	Pass -14:35	N/A	70	25
3/16/12	Days	108	78	0	0	0	>5250	Yes	No	Pass -15:23	N/A	66	20
3/16/12	Days	104	84	0	0	0	>5250	Yes	No	Pass -16:17	N/A	66	23
3/16/12	Days	106	84	0	0	0	>5250	Yes	No	Pass -16:59	N/A	64	22
3/16/12	Days	97	81	0	0	0	>5250	Yes	No	Pass -17:39	N/A	67	19
3/16/12	Days	107	81	0	0	0	>5250	Yes	No	Pass -18:23	N/A		
3/17/12	Days	104	80	0	0	0	>5250	Yes	No	Pass -11:32	N/A		
3/17/12	Days	104	82	0	0	0	>5250	Yes	No	Pass -12:07	N/A		
3/17/12	Days	95	83	0	0	0	>5250	Yes	No	Pass -12:46	N/A		
3/17/12	Days	102	80	0	0	0	>5250	Yes	No	Pass -13:18	N/A		
3/17/12	Days	105	81	0	0	0	>5250	Yes	No	Pass -13:46	N/A		
3/17/12	Days	102	82	0	0	0	>5250	Yes	No	Pass -14:32	N/A		
3/17/12	Days	97	83	0	0	0	>5250	Yes	No	Pass -15:02	N/A		
3/17/12	Days	117	77	0	0	0	>5250	Yes	No	Pass -15:35	N/A		
3/17/12	Days	113	81	0	0	0	>5250	Yes	No	Pass -16:13	N/A		
3/17/12	Days	107	79	0	0	0	>5250	Yes	No	Pass -16:55	N/A		
3/17/12	Days	111	81	0	0	0	>5250	Yes	No	Pass -17:25	N/A		
3/17/12	Days	103	79	0	0	0	>5250	Yes	No	Pass -18:01	N/A		
3/19/12	Days	105	87	0	0	0	>5250	Yes	No	Pass -09:18	N/A		
3/19/12	Days	119	77	0	0	0	>5250	Yes	No	Pass -09:53	N/A		

Shift Status for SG 88											
Date	Shift	Row	Col	Leak Rate @ NODP (gpm)	Leak Rate @ MSLB (gpm)	Leak Rate @ Max Press (gpm)	Max Press Reached	3xNODP Reached?	Additional Testing Req'd?	Status (Pass, Fail, Incomplete, Indeterminent) and Time	Nuclear Notification Number
3/19/12	Days	100	82	0	0	0	>5250	Yes	No	Pass - 10:59	N/A
3/19/12	Days	107	87	0	0	0	>5250	Yes	No	Pass - 11:35	N/A
3/19/12	Days	105	83	0	0	0	>5250	Yes	No	Pass - 12:08	N/A
3/19/12	Days	106	80	0	0	0	>5250	Yes	No	Pass - 12:41	N/A
3/19/12	Days	108	76	0	0	0	>5250	Yes	No	Pass - 13:19	N/A
3/19/12	Days	99	83	0	0	0	>5250	Yes	No	Pass - 13:56	N/A
3/19/12	Days	101	83	0	0	0	>5250	Yes	No	Pass - 14:51	N/A
3/19/12	Days	112	80	0	0	0	>5250	Yes	No	Pass - 15:32	N/A
3/19/12	Days	103	81	0	0	0	>5250	Yes	No	Pass - 16:02	N/A
3/19/12	Days	105	79	0	0	0	>5250	Yes	No	Pass - 16:38	N/A
3/19/12	Days	109	81	0	0	0	>5250	Yes	No	Pass - 17:17	N/A
3/19/12	Days	119	79	0	0	0	>5250	Yes	No	Pass - 17:49	N/A
3/19/12	Days	98	82	0	0	0	>5250	Yes	No	Pass - 18:20	N/A

Shift Status for SG 89											
Date	Shift	Row	Col	Leak Rate @ NODP (gpm)	Leak Rate @ MSLB (gpm)	Leak Rate @ Max Press (gpm)	Max Press Reached	3xNODP Reached?	Additional Testing Req'd?	Status (Pass, Fail, Incomplete, Indeterminent) and Time	Nuclear Notification Number
3/15/12	Days	92	86	0	0	0	>5250	Yes	No	Pass - 10:13	N/A
3/15/12	Days	94	90	0	0	0	>5250	Yes	No	Pass - 10:50	N/A
3/15/12	Days	96	90	0	0	0	>5250	Yes	No	Pass - 11:33	N/A
3/15/12	Days	94	88	0	0	0	>5250	Yes	No	Pass - 12:03	N/A
3/15/12	Days	92	88	0	0	0	>5250	Yes	No	Pass - 12:52	N/A
3/15/12	Days	105	87	0	0	0	>5250	Yes	No	Pass - 13:28	N/A
3/15/12	Days	99	85	0	0	0	>5250	Yes	No	Pass - 14:08	N/A
3/15/12	Days	97	85	0	0	0	>5250	Yes	No	Pass - 14:39	N/A
3/15/12	Days	103	87	0	0	0	>5250	Yes	No	Pass - 15:18	N/A
3/16/12	Days	97	89	0	0	0	>5250	Yes	No	Pass - 09:24	N/A
3/16/12	Days	99	89	0	0	0	>5250	Yes	No	Pass - 10:00	N/A
3/16/12	Days	90	90	0	0	0	>5250	Yes	No	Pass - 10:31	N/A
3/16/12	Days	88	90	0	0	0	>5250	Yes	No	Pass - 11:04	N/A
3/16/12	Days	95	89	0	0	0	>5250	Yes	No	Pass - 12:21	N/A
3/16/12	Days	100	80	0	0	0	>5250	Yes	No	Pass - 12:51	N/A
3/16/12	Days	93	89	0	0	0	>5250	Yes	No	Pass - 13:25	N/A
3/16/12	Days	98	80	0	0	0	>5250	Yes	No	Pass - 13:59	N/A
3/16/12	Days	96	86	0	0	0	>5250	Yes	No	Pass - 14:31	N/A
3/16/12	Days	99	91	0	0	0	>5250	Yes	No	Pass - 15:05	N/A
3/16/12	Days	101	89	0	0	0	>5250	Yes	No	Pass - 15:42	N/A
3/16/12	Days	94	86	0	0	0	>5250	Yes	No	Pass - 16:13	N/A
3/16/12	Days	100	88	0	0	0	>5250	Yes	No	Pass - 16:49	N/A
3/16/12	Days	89	89	0	0	0	>5250	Yes	No	Pass - 15:39	N/A
3/17/12	Days	98	88	0	0	0	>5250	Yes	No	Pass - 11:11	N/A

Shift Status for SG 89											
Date	Shift	Row	Col	Leak Rate @ NODP (gpm)	Leak Rate @ MSLB (gpm)	Leak Rate @ Max Press (gpm)	Max Press Reached	3xNODP Reached?	Additional Testing Req'd?	Status (Pass, Fail, Incomplete, Indeterminent) and Time	Nuclear Notification Number
3/17/12	Days	105	85	0	0	0	>5250	Yes	No	Pass - 11:39	N/A
3/17/12	Days	93	87	0	0	0	>5250	Yes	No	Pass - 12:35	N/A
3/17/12	Days	91	89	0	0	0	>5250	Yes	No	Pass - 13:08	N/A
3/17/12	Days	98	90	0	0	0	>5250	Yes	No	Pass - 13:51	N/A
3/17/12	Days	97	87	0	0	0	>5250	Yes	No	Pass - 14:24	N/A
3/17/12	Days	97	83	0	0	0	>5250	Yes	No	Pass - 15:02	N/A
3/17/12	Days	100	90	0	0	0	>5250	Yes	No	Pass - 15:31	N/A
3/17/12	Days	97	91	0	0	0	>5250	Yes	No	Pass - 16:06	N/A
3/17/12	Days	95	91	0	0	0	>5250	Yes	No	Pass - 16:48	N/A
3/17/12	Days	92	90	0	0	0	>5250	Yes	No	Pass - 17:21	N/A
3/17/12	Days	98	82	0	0	0	>5250	Yes	No	Pass - 17:50	N/A
3/19/12	Days	103	85	0	0	0	>5250	Yes	No	Pass - 09:26	N/A
3/19/12	Days	95	83	0	0	0	>5250	Yes	No	Pass - 09:57	N/A
3/19/12	Days	104	78	0	0	0	>5250	Yes	No	Pass - 10:24	N/A
3/19/12	Days	91	87	0	0	0	>5250	Yes	No	Pass - 10:55	N/A
3/19/12	Days	89	85	0	0	0	>5250	Yes	No	Pass - 11:27	N/A
3/19/12	Days	98	86	0	0	0	>5250	Yes	No	Pass - 11:56	N/A
3/19/12	Days	99	87	0	0	0	>5250	Yes	No	Pass - 12:34	N/A
3/19/12	Days	96	88	0	0	0	>5250	Yes	No	Pass - 13:05	N/A
3/19/12	Days	100	82	0	0	0	>5250	Yes	No	Pass - 13:37	N/A
3/19/12	Days	91	85	0	0	0	>5250	Yes	No	Pass - 14:26	N/A
3/19/12	Days	93	91	0	0	0	>5250	Yes	No	Pass - 15:03	N/A
3/19/12	Days	92	92	0	0	0	>5250	Yes	No	Pass - 15:34	N/A
3/19/12	Days	98	84	0	0	0	>5250	Yes	No	Pass - 16:08	N/A

Shift Status for SG 89											
Date	Shift	Row	Col	Leak Rate @ NODP (gpm)	Leak Rate @ MSLB (gpm)	Leak Rate @ Max Press (gpm)	Max Press Reached	3xNODP Reached?	Additional Testing Req'd?	Status (Pass, Fail, Incomplete, Indeterminent) and Time	Nuclear Notification Number
3/19/12	Days	102	80	0	0	0	>5250	Yes	No	Pass - 16:42	N/A
3/19/12	Days	88	88	0	0	0	>5250	Yes	No	Pass - 17:29	N/A
3/19/12	Days	102	78	0	0	0	>5250	Yes	No	Pass - 18:00	N/A

In-Situ Status Report

		SG 88						SG 89					
Day	Shift	Planned	Completed	Pass	Fail	Indeterminate	Additional Testing Needed*	Planned	Completed	Pass	Fail	Indeterminate	Additional Testing Needed*
3/13/2012	D	4	8	8	0	0	0	0	0	0	0	0	0
	N	0	0	0	0	0	0	0	0	0	0	0	0
3/14/2012	D	4	7	4	3	0	3	0	0	0	0	0	0
	N	0	0	0	0	0	0	0	0	0	0	0	0
3/15/2012	D	6	8	4	4	0	4	4	9	9	0	0	0
	N	6	0	0	0	0	0	6	0	0	0	0	0
3/16/2012	D	6	11	10	1	0	1	6	14	14	0	0	0
	N	6	0	0	0	0	0	6	0	0	0	0	0
3/17/2012	D	6	12	12	0	0	0	6	12	12	0	0	0
	N	6	0	0	0	0	0	6	0	0	0	0	0
3/18/2012	D	0	0	0	0	0	0	0	0	0	0	0	0
	N	0	0	0	0	0	0	0	0	0	0	0	0
3/19/2012	D	6	15	15	0	0	0	6	16	16	0	0	0
	N	6	0	0	0	0	0	6	0	0	0	0	0
3/20/2012	D	6						6					
	N	6						4					
3/21/2012	D	5						0					
	N	0						0					
		73	61	53	8	0	8	56	51	51	0	0	0
% Complete			84%						91%				

* - Eddy Current Testing Planned

San Onofre Unit 3 In-Situ Pressure Testing (All Information is Preliminary)

Date	Shift	Row	Col	Leak Rate @ NODP (gpm)	Leak Rate @ MSLB (gpm)	Leak Rate @ Max Press (gpm)	Max Press Reached	Condition Monitoring Probability of Burst	Condition Monitoring Burst Pressure (calculated PSIG)	Best Estimate Burst Pressure (PSIG)	Status (Pass, Fail, Incomplete, Indeterminent)
3/14/12	Days	106	78	0.072	N/A	> 0.5	2884	1.0	375	3006	Fail
3/14/12	Days	102	78	0	> 0.5	> 0.5	3268	1.0	137	2714	Fail
3/14/12	Days	104	78	0	> 0.5	> 0.5	3180	1.0	419	3100	Fail
3/15/12	Days	100	80	0	0	> 0.5	4732	1.0	1426	3767	Fail
3/15/12	Days	107	77	0	0	> 0.5	5160	1.0	1442	3762	Fail
3/15/12	Days	101	81	0	0	> 0.5	4889	1.0	1826	4047	Fail
3/15/12	Days	98	80	0	0	> 0.5	4886	1.0	1853	4087	Fail
3/16/12	Days	99	81	0	0	> 0.5	5026	1.0	2034	4305	Fail

Johnson, Andrew

From: Kaly Kalyanam
Sent: Tuesday, April 21, 2009 11:22 AM
To: Andrew Johnson
Subject: FW: "Indications" on SONGS Unit 3 Replacement Steam Generator
Attachments: NRC Update on RSG Divider Plate Weld.ppt

Hi,

Just to be sure I am forwarding this email to you.

The call with the licensee is today at 2:15 PM at O-8E12.

Thanks

Kaly

From: Kaly Kalyanam
Sent: Monday, April 06, 2009 4:01 PM
To: Allen Hiser; Matthew Mitchell; Terence Chan; John McHale; Michael Markley; Robert Nelson; Michael Hay; Greg Warnick; John Reynoso; Randy Hall
Subject: "Indications" on SONGS Unit 3 Replacement Steam Generator

Late last Friday, I got a call from SONGS 2 and 3 regarding some ""indication" with the one of the two replacement steam generators, slated for Unit 3 (fall 2010). The replacement SGs are fabricated in Japan by Mitsubishi. The Unit 2 SGs are at the site and Unit 3 SGs are at the factory.

This morning, in the call with the region and the resident inspectors, and later with the licensee, I got the details as follows:

Inspection done on one of the Unit 3 SGs, after the hydrostatic test, revealed crack at the clad / butter separation at the bottom of the divider plate between the hot and cold legs. Subsequent exams revealed indications on the other Unit 3 SG.

Inspections done by SCE on both the Unit 2 SGs at the plant site have not identified any separation indications. However, the licensee plans to do more extensive inspections on these SGs the week of April 13. 2008. Also, a team of Southern Cal. Edison engineers are on their way to Japan to get the exact extent of the problem. It appears that a different fabrication process was used on the Unit 3 SGs which might have caused this.

The licensee would like to present the NRC (NRR, Region, and the resident inspectors) with its findings sometime next week (after the return of the SCE engineers from Japan).

I am also attaching the PowerPoint file sent by the licensee.

I will try to get the exact date and time of the call soon. Since I am not sure which Branches in DCI will be involved in this issue, I am sending this email to all four Branch Chiefs. If it needs to go elsewhere, please advise.

C1/16

If you have any preferences, please let me know.

Thanks

Kaly

SONGS
STEAM GENERATOR REPLACEMENT PROJECT

Update on RSG Divider Plate Weld Issue

March 31, 2009

SOUTHERN CALIFORNIA EDISON
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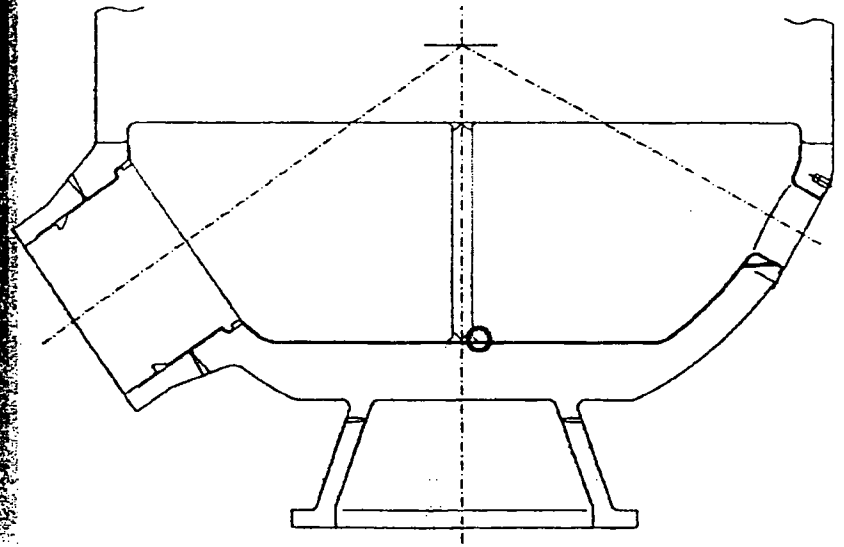
SONGS SGRT TEAM
Steam Generator Replacement Team

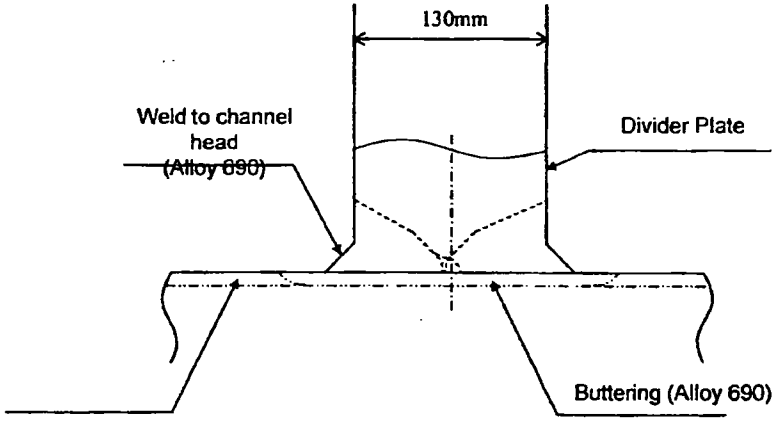
Description

•Crack identified in 3B RSG during secondary side hydrostatic test



Investigation

- Performed NDE (VT, PT &UT) of the divider plate weld from inside and outside the RSG



Findings

- 3A and 3B RSGs
  - Linear PT indications
  - Strain marks
  - Clad/Butter separation
- Findings were mixed between 3A and 3B RSGs and the hot leg and cold leg
- Inspected 2A and 2B RSGs from the outside in the stay cylinder
  - No separation indications

Work Ongoing

- MHI is investigating root cause
  - Additional NDE
  - Boat samples
  - Mock up samples for testing
  - Calculation and design reviews
- MHI is preparing potential repair plans
- SCE is preparing to open 2A and 2B RSGs for additional NDE to ascertain weld condition

c/7

SONGS
STEAM GENERATOR REPLACEMENT PROJECT

U2 Divider Plate Weld NDE Results

April 21, 2009

SOUTHERN CALIFORNIA EDISON
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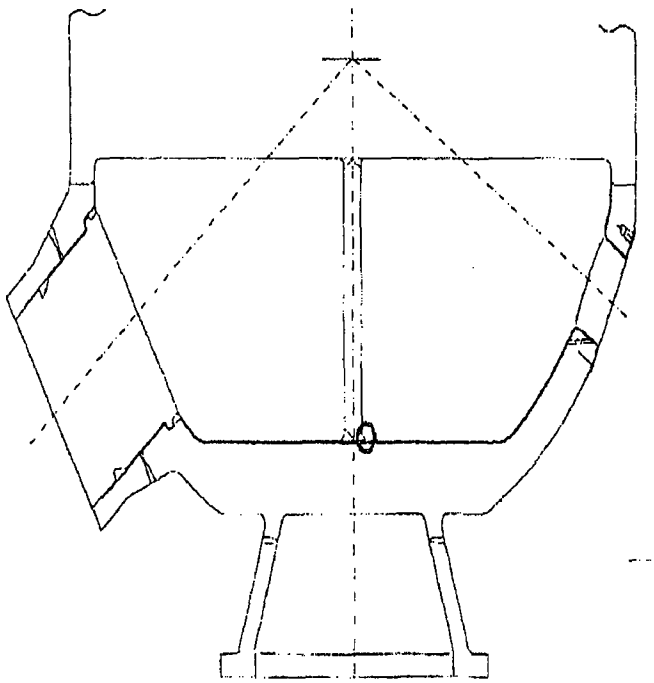
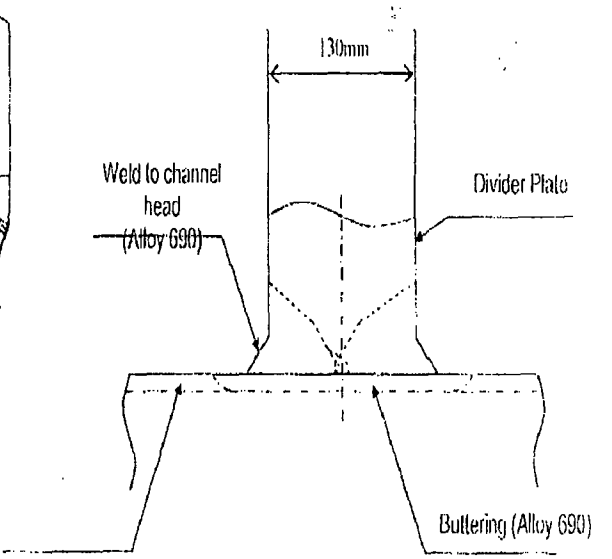
SONGS SGRP TEAM
Steam Generator Replacement Team

Description

- Divider Plate Details





Unit 2 NDE Results

- Conducted the same NDE exams as on U3
- Results
  - No UT evidence of separation along the entire length of the divider plate
  - PT exams identified one small (3/8") linear indication
    - Not indicative of crack or separation based on visual exam
    - Small buffing mark not removed by electro-polishing
  - Weld contours within design

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SONGS

STEAM GENERATOR REPLACEMENT PROJECT

Update on RSG Divider Plate Weld Issue

May 14, 2009

~~Company Confidential~~

Steam Generator Replacement Team

Root Cause Plan

- MHI conducted detailed investigation of design and fabrication
- Design
  - Checked design stress analyses
  - Performed new analysis with model including clad/butter
- Fabrication
  - Differences between U2/U3 were identified and studied
  - Process step documentation was reviewed and compared
  - Mockup samples that represent U2 and U3 fabrication steps were prepared and tested
- Repair Plan
  - MHI developed repair scenarios based on potential root causes
  - MHI developed repair schedules based on above repair scenarios

Root Cause Results/Status

- Draft root cause report was received on April 30
  - Design investigation did not identify any design or stress issues
  - 3A and 3B RSG boat sample results
    - Separation mostly along fusion boundary
    - Hardened layer along fusion boundary (expected result in dissimilar welds)
    - No chemical or other contamination identified
  - Mockup sample results
    - Could not reproduce the failure in the fabrication samples
    - Fusion boundary separation was duplicated only in a special hydrogen embrittlement sample
  - MHI proposed Hydrogen embrittlement was the cause

Root Cause Results/Status

- Root Cause Meeting in Kobe – May 7-9
  - Detailed review of all information to date
  - Narrowed the potential cause list down to two
    - Hydrogen embrittlement
    - Reheat cracking
  - Additional testing and sample removal plan was developed
  - Reviewed proposed repair plan and schedule
    - MHI proposed best option was in channel head repair
    - Schedule
      - Start repair on April 25, 2009
      - RSGs at Long Beach on January 15, 2010
      - Several exceptions to normal shipping process necessary
        - » No N2 on primary side
        - » All PSE done at SONGS
        - » Electropolishing done at SONGS

Root Cause Results/Status

- Provided MHI with a proposal
  - Start removal of damaged material not under the divider plate now while continuing root cause evaluation
  - Continue developing plan to implement in channel head repair
  - Root cause required prior to removal of material under the divider plate
  - If no root cause identified, then MHI must develop channel head removal repair plan
  - Utilize mockups for all repair methods
  - Utilize extensive NDE during repair steps
- Discussed impact on U2 if cause applies
  - Repair window is middle of June to first of August
  - Need additional calculations to show RSG meets design in accident conditions with separated divider plate
  - Rework the 10CFR50.59
  - Provide methodology for present and future NDE exams of area
- Next steps
  - MHI complete additional testing
  - Review data on June 1 prior to next SCE/MHI Executive meeting (June 3)
  - Determine course of action for repair and finalize schedule
  - Finalize root cause report by end of June
  - Implement contingent plans for RSG transportation