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W3F1-2008-0039

May 20, 2008

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

SUBJECT: Steam Generator Conditions Observed at Waterford 3
During Refueling Outage 15
Waterford Steam Electric Station, Unit 3
Docket No. 50-382

REFERENCES:
1. Entergy letter dated December 20, 2006, *Entergy Actions to Address RF14 Batwing Failures,* (W3F1-2006-0070)
2. Entergy letter dated December 19, 2006, *Summary of Cycle 15 Operational Assessment for Steam Generator Batwing Concerns,* (W3F1-2006-0072)

Dear Sir or Madam:

This letter communicates the technical evaluations for the inspection, evaluation, and mitigation actions taken during Refueling Outage 15 (RF 15) for Steam Generators 31 and 32. The technical evaluations address: (1) visual characterization of the Steam Generator (SG) batwing related tube wear at tubes immediately adjacent to the stay cavity, a mechanism originally identified at San Onofre Nuclear Generating Station (SONGS) in 1985 and (2) the Waterford 3 (W3) displaced batwing condition initially observed in May 2005 during Refuel Outage 13. This letter also provides the commitments that will continue to be applied for W3 during Operating Cycle 16. These commitments were continued from the commitments of record discussed in Reference 1. This information is provided in three Enclosures; Enclosure 1, which is the SG 31 technical evaluation; Enclosure 2, which is the SG 32 technical evaluation; and Enclosure 3, which is the list of regulatory commitments of record that will continue to be applied for Operating Cycle 16.

In summary, the augmented SG secondary side inspections have been completed in both SGs for RF15. Acceptance criteria were met, and there were no changes identified to the critical variables or extent of condition used to establish acceptability of the previously approved mitigation actions. The SG conditions observed in RF15 are understood and bounded by the analyzed conditions delineated in Reference 2. The SG tube eddy current data, primary to secondary leak rate trending, and steam generator loose parts monitoring information continue

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to demonstrate the effectiveness of the mitigation actions taken. External peers and experts reviewed and concurred with the rigor of the evaluations, mitigation actions, and operational monitoring measures. In conclusion, we have employed conservative and defense in depth approaches we believe will ensure the safe operation of W3.

We will arrange for a meeting with the NRC after RF15 to facilitate further dialogue and discussion on this matter.

The regulatory commitments in this correspondence are specified in the Enclosure 3. Please contact me or Robert Murillo at 504-739-6715 if there are any questions.

Sincerely,

KTW/RJM/RLW/ssf

Enclosures:

1. SG 31 Secondary Side Inspection Results Summary and Conclusions Spring 2008 Refuel Outage 15
2. SG 32 Secondary Side Inspection Results Summary and Conclusions Spring 2008 Refuel Outage 15
3. Licensee-Identified Commitments

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Enclosure 1

W3F1-2008-0039

SG 31 Secondary Side Inspection
Results Summary and Conclusions
Spring 2008 Refuel Outage 15

SG31 Secondary Side
Inspection Results Summary and Conclusions
Spring 2008 Refuel 15 Outage

Work Order 130169

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(Electronically Approved in PCRS as CR-WF3-2008-1987 CA 10)

Executive Summary

An inspection of Steam Generator #1 (SG 31) was performed during the Spring 2008 Refuel 15 outage to determine if there were any changes in extent of condition or the critical variables that were the basis for the Refuel-14 and Cycle 15 operational assessment. The visual inspections performed consisted of an upper batwing weld and wrap around bar inspection, diagonal 45° through-tube bundle inspection, a bottom-up inspection of the batwings in the stay cylinder region and a Foreign Object Search and Retrieval (FOSAR). All inspection results were satisfactory and met the established acceptance criteria. There were no changes to the expected extent of condition or the critical variables that were the basis for the RF14 and Mid-Cycle 15 (PO-07-01) operational assessments. The assessments performed in RF14 and PO-07-01 still remain valid and bounding.

Batwing 85/86 was repaired on the hot leg side during Refuel 15 by adding a weld that had not been installed during original component fabrication. Additionally, tubes along the blowdown lane were plugged to the first tie rod.

1. Upper Weld and Wrapper Bar Inspection

The purpose of this inspection was to look for deformation of the wrap around bar and any obvious damage to the wrap around bar-to-batwing welds. This inspection was also intended to identify any physical changes from the Mid Cycle 15 (PO-07-01) planned outage inspection results (i.e. verify no weld degradation and verify no damage to the wrap around bar). In accordance with Westinghouse letter CWTR3-06-92 dated December 14, 2006, the stay cavity region ranges from column 64 to 111 and the batwing-to-wrapper bar welds of concern are those within this range of SG tube column lines. This inspection included observation of the batwing-to-wrap around bar connections between columns 50 and 120 on the hot and cold legs which conservatively bounds the stay cavity region.

Upon initial entry into SG31 a visual inspection of the wrap around bar and the accessible wrap around bar-to-batwing welds was made. Instructions for this inspection are provided in Work Order 130169 as Inspection 1. This inspection was conducted by observing the desired areas using a high power spotlight. No damage was noted and the inspection is documented as complete in Work Order 130169.

A more detailed video examination was also performed of the wrap around bar and the stay cavity region batwing supports at the periphery of the hot and cold legs to examine the wrap around bar and confirm the integrity of the welds at the connection point. Instructions for this inspection are provided in Work Order 130169 as Inspection 3. A fiber optic camera was used for this examination and the results were recorded on digital media. Seventy-one (71) batwing weld locations were inspected on both the hot leg (HL) and cold leg (CL) side. Four additional welds located well outside of the stay cylinder cavity region (tube columns 32 and 139 on both the hot leg and cold leg sides) were also inspected. No damage or degradation was noted and the inspection is documented as complete in Work Order 130169.

The batwing between columns 85 and 86 on the hot leg side was previously observed (in RF14 and PO-07-01) to be attached to the wrap around bar by a weld on only one side of the batwing. During RF15, this connection was enhanced by adding the missing weld per WO 130172 and EC-4681.

Upper weld and wrapper bar inspection results met acceptance criteria and were acceptable.

2. 45° Through Upper Tube Bundle Inspection

A diagonal 45° Through Upper Tube Bundle Inspection of the upper stay cavity region of SG31 was performed to assess the physical integrity of the tubes at the batwing to tube interface at the inner most row adjacent to the stay cavity. This inspection was not performed on SG31(but was performed on SG32) during the PO-07-01 planned outage. Instructions for this inspection are provided in Work Order 130169 as Inspection 2. Detailed evaluations of the video inspection data were conducted by an engineering team comprised of Entergy and Westinghouse personnel. The results of the evaluations are reported in Section 6 and pictures of indications observed and other points of interest are provided in Attachment I. The following summarizes the results of the 45° inspection.

There are 72 wear indications observed during the review of the 45° Through-Tube Bundle Inspection video. The observed wear indications are comprised of 67 as "old wear", 1 as "new wear", and 4 as "second row wear". It is possible that the total wear indications noted include duplicates since it is difficult to track tube bundle locations during video inspection. Therefore this inspection is considered a best effort to inspect the condition of the SG31 upper stay cavity.

Batwing to Tube Interaction

The review of the video identified 72 wear indications at the "Batwing to Tube Interface" the majority of which is due to "old wear". Through wall wear was observed.

This wear was predicted in the mid 1980's based on operating experience at the SONGS plant. The SONGS batwing wear mechanism consisted of upward flow forces in the tube bundle central cavity causing batwing twisting and applying high contact force against the tubes at the periphery and adjacent to the stay cavity. Analysis and testing determined that the wear rate at each successive tube progressing from the stay cavity into the tube bundle would be expected to decrease, that the wear rate would be expected to decrease as more tubes wore, and that the number of tubes affected would be expected to be smaller than the excess heat transfer area built into each steam generator. The analysis determined that 1) tube integrity is maintained, 2) batwing integrity at the weld is maintained, and 3) batwing integrity at the worn section is maintained. Testing performed in the mid 1980's included eddy current testing, ultrasonic testing, radiography, visual inspection, and mock-up testing. Steam Generator performance and plant impacts at steady state and transient conditions were evaluated to establish the potential consequences including LOCA. The wear progression analysis was performed by CE using empirical wear parameters and the validity of the wear progression analysis predictions was verified at St. Lucie 2 by tracking ECT data over approximately 6 consecutive cycles. Plant specific evaluations were prepared, including Waterford 3, and documented by Westinghouse Report CEN-328, Remedy for Steam Generator Tube and Diagonal Strip Wear, dated March 1986 for Palisades (Replacement Generators); Palo Verde Units 1, 2, and 3; St. Lucie Unit 2; SONGS Units 2 and 3; Washington Nuclear Project 3; and Waterford Unit 3. Applicability was confirmed by LTR –NCE-08-93 "Assessment of CEN-328 for Waterford 3 RF15 Steam generator Batwing-Tube Wear Evaluation.

To evaluate dropped batwing wear a conservative criterion for comparison of the as-found condition of the tube is the criteria for "gross tube damage" provided in Westinghouse Letter LTR-SGDA-07-217. This letter provides criteria for acceptable and unacceptable tube damage/wear and tube prying action. For tube wear at first row of tubes immediately adjacent to the stay cavity, a criterion of wear no more than 1/3 of the way through the stabilized tube was acceptable.

Although through wall wear scars were observed none exceeds the 1/3 depth criterion. This criterion is considered the SONGS related "original wear issue". All of the inner most tubes of the stay cavity have been plugged and stabilized. In some cases the through wall wear is such that the stabilizer is visible. In no instances has stabilizer damaged been observed. In four observed instances, wear has been observed on second row of tubes immediately adjacent to the stay cavity. These tubes were plugged in the mid 1980's but not stabilized. The observed wear is consistent with the predictions of Westinghouse Report CEN-328. These observed tube wear scars met the acceptance criteria defined in Westinghouse Letter LTR-SGDA-07-217. The structural integrity

of the second row wear was evaluated and found acceptable in Westinghouse Letter LTR-SGDA-08-130.

The 45° Through-Tube Bundle Inspection summary and selected still pictures is included as Attachment 1.

Broken Batwings

During the 45° Through-Tube Bundle Inspection the condition of the batwings were also observed. The points of interest that identify broken batwings at the intersection at the notch at the perforated center support plate are listed in Attachment I as int-01, int-02, int-03, int-04, int-06, int-08, and int-10. The RF15 inspection video shows an estimated 6 to 8 batwings are broken at this location. During the PO-07-01 bottom-up inspection, 4 batwings were identified as being broken at the notch.

Loose Parts

Though an estimated 6 to 8 batwings are broken at the center support plate, there are no detached segments.

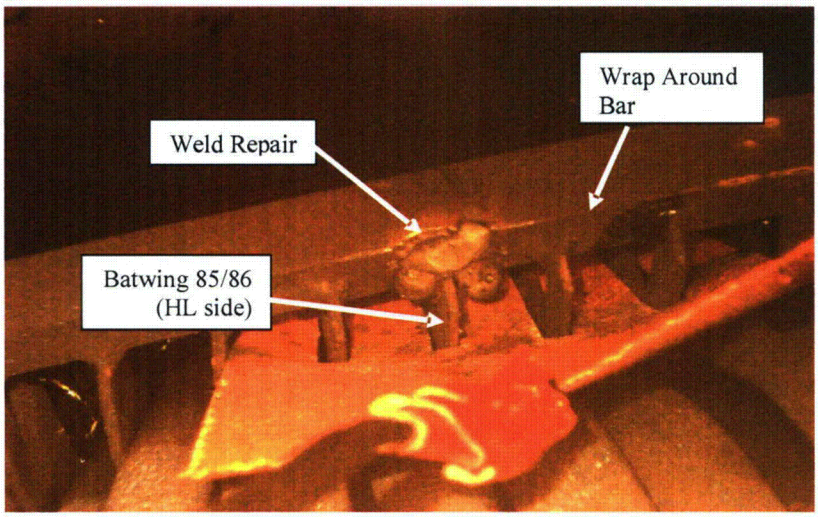
Intrados Tube Wear

No cases of intrados tube wear have been observed in SG 31. This is reasonable since there are no loose curved batwings.

The 45° Through Upper Tube Bundle Inspection met the acceptance criteria and was acceptable.

3. Batwing Weld Repair

In RF 14, it was noted that the batwing between tube columns 85 and 86 on the hot leg side of SG31 was attached to the wrap around bar with a weld on one side. Since this batwing is in the central cavity region and is required to have a double-sided weld, plans were made to perform a weld repair during RF 15. This work was performed as planned and is documented in Work Order 130172. The batwing weld repair was acceptable.



SG31 – Weld repair on batwing-to-wrapper bar connection for the batwing between tube columns 85 and 86 on the hot leg side

4. Bottom Up Video Inspection

A bottom up video inspection of SG 31 was performed using a camera system installed through the lower hand hole and along the Blowdown Lane to the bottom of the Stay Cavity column. A composite photo was prepared and was compared to the composite photos taken during the PO-07-01. Detailed evaluations of the results were made by the combined Entergy and Westinghouse engineering review team. The results are documented in WO 130169 Task 01, Inspection 4.

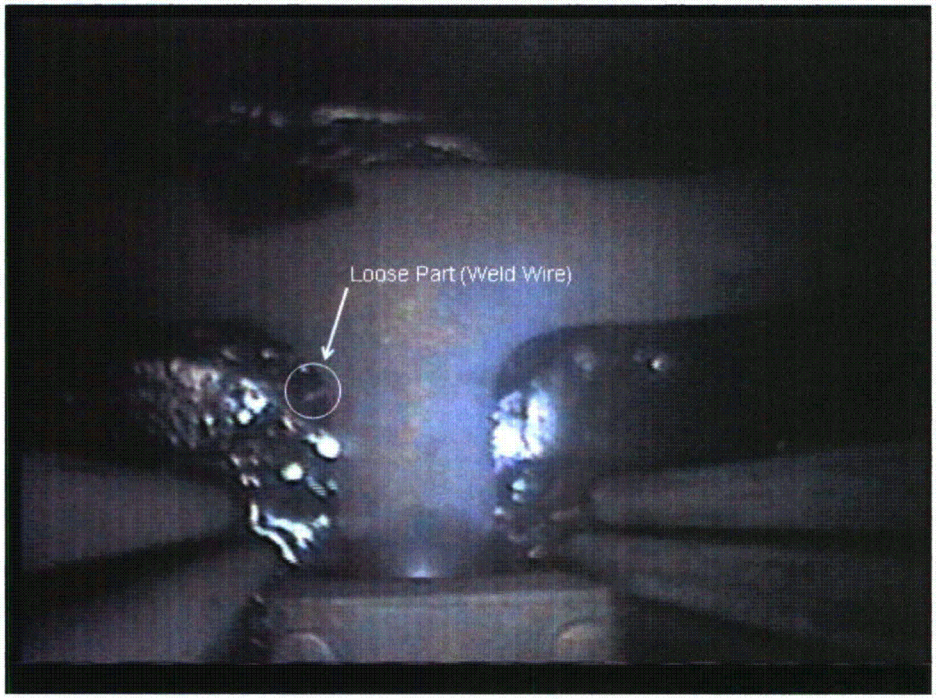
Portions of the inner rims of "eggcrate" grids 4 through 7, which encircle the central cavity, could be viewed. No damage was detected at the "eggcrate" grids, nor were any loose batwing segments found.

The lower portions of batwings crossing the central cavity, which are located in the upper stay cavity could be observed and a composite photo was assembled by stitching together frames from the video footage. All batwing segments were identified. It appears that 4 batwings located between tube columns 86 and 90 were found to have broken on the hot leg side of the center notch. However the bottom up inspection is not as precise or revealing as the 45° Through-Tube Bundle Inspection, which showed 6 to 8 batwings broken at the perforated top plate. There were also wear marks found on the underside of the perforated top plate due to the broken batwings rubbing. The batwings themselves were still present but offset from their original position. These batwings did not appear to be broken when inspected during RF 14. The RF 14 and PO-07-01 composite photos (Figures 1 and 2, respectively) are presented for comparison with RF15 composite photo (Figure 3).

The bottom-up video inspection met acceptance criteria and was acceptable.

5. Foreign Object Search and Retrieval (FOSAR)

A Foreign Object Search and Retrieval inspection was performed following all secondary side work. The FOSAR inspection followed sludge lancing and included all accessible regions of the tube sheet secondary surface including the central cavity, tube lane and annulus regions. One piece of what appears to be weld wire was seen trapped under the blow down pipe. This piece was observed in the same location during RF13. Many attempts to remove it at that time were unsuccessful because it was lodged under the blowdown pipe. Retrieval during RF15 was not successful, and the part was evaluated and determined to be acceptable.



6. Conclusion:

All inspection results were satisfactory and met the established acceptance criteria. No changes in the extent of condition or critical variables that were used as the basis for mitigating actions taken for the RF14 and PO-07-01 operational assessments were found. The assessments performed in RF14 and PO-07-01 remains valid and bounding.

Indication No	Disc	Disc Time	Leg	Entry Pt	Thru Wall	> 1/3TD	New Wear	Stabilizer Visible	2 Sided Wear	2nd Row Wear	Comments **(See NOTE at end of table)**	Old Wear	New Wear	Intrados Wear	2nd Row Wear
int-01	SG31 #8	0:24:26	HL	Zone A							BW spacing appears normal except for a couple closer together. Also shown at 0:25:08.				
int-02	SG31 #8	0:35:08	HL	Zone B							BW spacing appears normal except for a couple closer together.				
int-03	SG31 #8	0:35:45	HL	Zone B							Three open center support slots.				
int-04	SG31 #8	0:37:22	HL	Zone B							Broken BW ends observed remaining in center slot.				
int-05	SG31 #8	0:39:34	HL	Zone B							Broken BW ends observed remaining in center slot.				
int-06	SG31 #8	0:40:06	HL	Zone B							Broken BW ends observed at top plate remaining in center slot, two adjacent slots empty.				
int-07	SG31 #8	1:29:07	HL	Zone B							Shiny spots on top of BW, material missing from BW, potential active wear.				
int-08	SG31 #8	1:45:57	HL	Zone B							Severed BWs at center notch support.				
int-09	SG31 #9	0:17:25	CL	Zone A							BW diagonal to horizontal strip, Nickel weld appears thicker than BW sections.				
int-10	SG31 #7	1:25:10	CL	Zone C							BWs broken at center notch between perforated support plate. Also at 1:27:27.				
31-01	SG31 #8	0:00:24	HL	Zone A	Yes	No	No	Yes	Unknown	Unknown	Through-wall wear with BW in original position, BW wear appears to be active.	1			

Indication No	Disc	Disc Time	Leg	Entry Pt	Thru Wall	> 1/3TD	New Wear	Stabilizer Visible	2 Sided Wear	2nd Row Wear	Comments **(See NOTE at end of table)**	Old Wear	New Wear	Intrados Wear	2nd Row Wear
31-02	SG31 #8	0:04:42	HL	Zone A	Yes	No	No	No	No	No	Tube visible with single through-wall wear indication.	1			
31-03	SG31 #8	0:04:57	HL	Zone A	Yes	No	No	No	Unknown	Unknown	Tube visible with single through-wall wear indication. BW observed in original position.	1			
31-04	SG31 #8	0:05:11	HL	Zone A	No	No	No	No	No	Yes	Second row tube wear visible with BW in original position.	1			1
31-05	SG31 #8	0:05:59	HL	Zone A	Yes	No	No	No	Yes	No	Tube visible with single through-wall wear indication.	1			
31-06	SG31 #8	0:06:49	HL	Zone A	No	No	No	No	No	No	Flat spot noted on tubing below BW.	1			
31-07	SG31 #8	0:07:05	HL	Zone A	Yes	No	No	No	No	No	Oxidized wear location observed near BW to tube interface.	1			
31-08	SG31 #8	0:14:20	HL	Zone A	Yes	No	No	No	Yes	No	Tube visible with double sided through-wall wear indication. BWs observed in original position.	1			
31-09	SG31 #8	0:15:06	HL	Zone A	Yes	No	No	No	No	No	Through-wall wear noted on *one side of tube, potentially* duplicate.	1			
31-10	SG31 #8	0:16:06	HL	Zone A	Yes	No	No	No	Yes	No	Single tube with visible double sided wear indications.	1			
31-11	SG31 #8	0:16:41	HL	Zone A	Yes	No	No	No	No	No	Visible wear indication aligned with BW in original location.	1			
31-12	SG31 #8	0:16:54	HL	Zone A	No	No	No	No	No	No	Wear indication aligned with BW elevation.	1			
31-13	SG31 #8	0:45:29	HL	Zone B	Yes	No	No	No	No	No	Through-wall wear indication on tube.	1			
31-14	SG31 #8	0:45:40	HL	Zone B	No	No	No	No	No	No	Wear indication aligned with BW elevation.	1			

Indication No	Disc	Disc Time	Leg	Entry Pt	Thru Wall	> 1/3TD	New Wear	Stabilizer Visible	2 Sided Wear	2nd Row Wear	Comments **(See NOTE at end of table)**	Old Wear	New Wear	Intrados Wear	2nd Row Wear
31-15	SG31 #8	0:45:50	HL	Zone B	Yes	No	No	No	Yes	No	Single tube with visible double sided through-wall wear indications.	1			
31-16	SG31 #8	0:46:41	HL	Zone B	Yes	No	No	No	No	No	Wear indication extending above BW elevation.	1			
31-17	SG31 #8	0:47:10	HL	Zone B	Yes	No	No	Yes	Yes	No	Single tube with two sided through-wall wear indications, stabilizer slightly visible in frame.	1			
31-18	SG31 #8	0:47:50	HL	Zone B	Yes	No	No	No	No	Yes	Second row tube wear visible with BW in original position, oxidized wear location. Also seen at 0:48:11.	1			1
31-19	SG31 #8	0:48:03	HL	Zone B	Yes	No	No	No	No	No	Single tube with through-wall wear indication aligned with BW at original location.	1			
31-20	SG31 #8	0:48:29	HL	Zone B	No	No	No	No	No	No	Flat wear location aligned with BW.	1			
31-21	SG31 #8	0:48:48	HL	Zone B	Yes	No	No	No	No	No	Through-wall wear indication on adjacent tube, wear location is oxidized.	1			
31-22	SG31 #8	1:02:30	HL	Zone C	Yes	No	No	No	Yes	No	Single tube with double sided wear indications.	1			
31-23	SG31 #8	1:02:43	HL	Zone C	Yes	No	No	No	No	No	Through-wall wear indication with rough edges.	1			
31-24	SG31 #8	1:03:44	HL	Zone C	Yes	No	No	No	Yes	No	Through-wall wear indication on single side of tube.	1			
31-25	SG31 #8	1:04:55	HL	Zone C	Yes	No	No	No	Yes	No	Single tube with two sided through-wall wear indications.	1			
31-26	SG31 #8	1:05:39	HL	Zone C	No	No	No	No	No	No	Flat wear location aligned with BW.	1			

Indication No	Disc	Disc Time	Leg	Entry Pt	Thru Wall	> 1/3TD	New Wear	Stabilizer Visible	2 Sided Wear	2nd Row Wear	Comments **(See NOTE at end of table)**	Old Wear	New Wear	Intrados Wear	2nd Row Wear
31-27	SG31 #8	1:06:18	HL	Zone C	Yes	No	No	No	No	No	Flat wear through-wall indications.	1			
31-28	SG31 #8	1:06:32	HL	Zone C	Yes	No	No	No	No	No	Through-wall wear indication on single side of tube.	1			
31-29	SG31 #8	1:08:48	HL	Zone A	Yes	No	No	No	No	No	Active wear near indication, BW has shiny surface.	1			
31-30	SG31 #8	1:09:43	HL	Zone A	No	No	No	No	No	No	Wear indication visible just above BW elevations.	1			
31-31	SG31 #8	1:10:51	HL	Zone A	Yes	No	No	Yes	No	No	Through-wall wear indication with clearly visible stabilizer. No wear observed on cable.	1			
31-32	SG31 #8	1:14:08	HL	Zone A	Yes	No	No	No	No	No	Through-wall wear indication with oxidized wear location.	1			
31-33	SG31 #8	1:14:38	HL	Zone A	Yes	No	No	No	No	No	Single sided through-wall wear indication.	1			
31-34	SG31 #8	1:16:38	HL	Zone A	Yes	No	No	No	No	No	Flat wear indication, most of wear scar is not through-wall.	1			
31-35	SG31 #8	1:17:34	HL	Zone A	Yes	No	No	No	No	No	Single through-wall wear scar observed on tube.	1			
31-36	SG31 #8	1:22:16	HL	Zone B	Yes	No	No	No	No	No	Through-wall indication aligned with BW elevation.	1			
31-37	SG31 #8	1:24:45	HL	Zone B	Yes	No	No	No	No	No	Through-wall tube wear indication.	1			
31-38	SG31 #8	1:28:12	HL	Zone B	Yes	No	No	No	No	No	Single through-wall wear scar observed on tube.	1			
31-39	SG31 #8	1:28:41	HL	Zone B	No	No	No	No	No	No	Wear indication at BW intersection with tube.	1			
31-40	SG31 #8	1:29:32	HL	Zone B	No	No	No	No	No	No	Flat wear indication at BW intersection.	1			
31-41	SG31 #8	1:30:41	HL	Zone B	Yes	No	No	No	No	No	Single through-wall wear scar observed on tube.	1			

Indication No	Disc	Disc Time	Leg	Entry Pt	Thru Wall	> 1/3TD	New Wear	Stabilizer Visible	2 Sided Wear	2nd Row Wear	Comments **(See NOTE at end of table)**	Old Wear	New Wear	Intrados Wear	2nd Row Wear
31-42	SG31 #8	1:36:38	HL	Zone B	Yes	No	No	Yes	Yes	No	Through-wall wear indication with oxidized wear location. Stabilizer visible.	1			
31-43	SG31 #8	1:38:00	HL	Zone B	Yes	No	No	No	No	No	Single through-wall wear scar observed on tube. Oxidized wear location.	1			
31-44	SG31 #8	1:39:04	HL	Zone B	Yes	No	No	Yes	No	No	Stabilizer visible through wear location.	1			
31-45	SG31 #8	1:51:08	HL	Zone C	Yes	No	No	No	Yes	No	Single tube with double sided through-wall indications.	1			
31-46	SG31 #8	1:55:01	HL	Zone C	Yes	No	No	No	No	No	Single through-wall wear indication, oxidized wear scar.	1			
31-47	SG31 #8	1:55:24	HL	Zone C	Yes	No	No	No	No	No	Single through-wall wear indication.	1			
31-48	SG31 #8	1:56:37	HL	Zone C	Yes	No	No	Yes	Yes	No	Stabilizer visible through wear location. Two sided wear location	1			
31-49	SG31 #9	0:12:12	CL	Zone A	Yes	No	No	No	No	Yes	Second row tube wear indication.	1			1
31-50	SG31 #9	0:25:00	CL	Zone B	Yes	No	No	No	Yes	No	Single tube with double sided through-wall wear indications.	1			
31-51	SG31 #9	0:40:30	CL	Zone C	Yes	NO	No	No	Yes	No	Single tube with double sided through-wall wear indication adjacent to BWs.	1			
31-52	SG31 #9	0:42:33	CL	Zone C	Yes	No	No	Yes	No	No	Single tube with through-wall indication.	1			
31-53	SG31 #7	0:29:43	CL	Zone A	Yes	No	No	No	Yes	No	Single tube with double sided through-wall wear indications.	1			
31-54	SG31 #7	0:32:55	CL	Zone A	Yes	No	No	No	Yes	No	Single tube with double sided through-wall wear indications.	1			

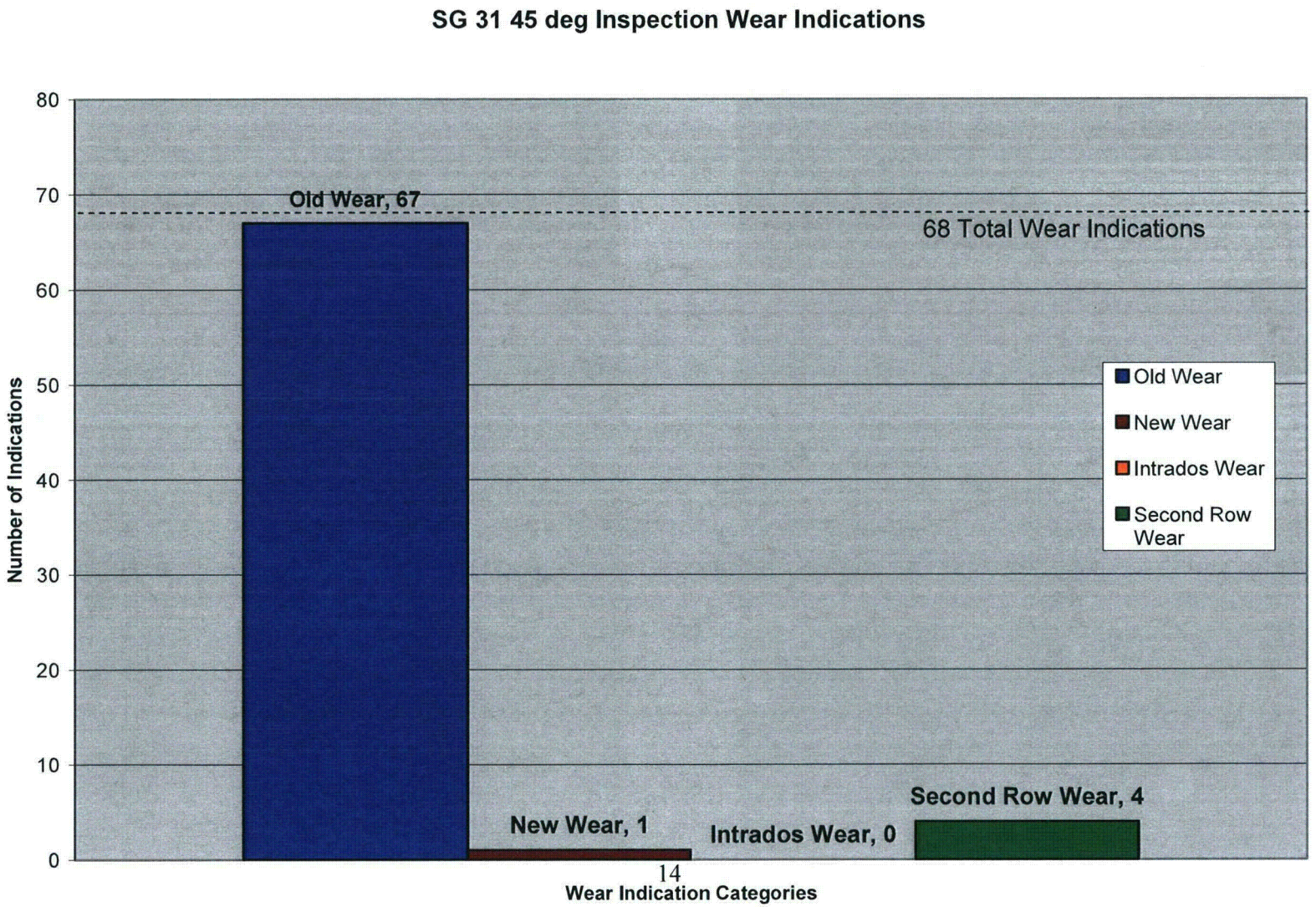
Indication No	Disc	Disc Time	Leg	Entry Pt	Thru Wall	> 1/3TD	New Wear	Stabilizer Visible	2 Sided Wear	2nd Row Wear	Comments **(See NOTE at end of table)**	Old Wear	New Wear	Intrados Wear	2nd Row Wear
31-55	SG31 #7	0:35:10	CL	Zone A	Yes	No	No	No	Yes	No	Two tubes visible in frame both with wear indications from BW.	1			
31-56	SG31 #7	0:35:46	CL	Zone A	Yes	No	No	No	No	No	Two tubes visible in fame both with wear indications from BW.	1			
31-57	SG31 #7	0:43:13	CL	Zone A	No	No	No	No	No	No	Flat wear indication aligned with BW.	1			
31-58	SG31 #7	0:43:36	CL	Zone A	Yes	No	No	No	No	No	Two tubes visible with through wall indication visible. Potential active wear.	1			
31-59	SG31 #7	0:45:38	CL	Zone A	No	No	No	No	No	Yes	Flat wear indication aligned with BW, second row wear visible behind. Also visible in 0:45:42.	1			1
31-60	SG31 #7	0:47:10	CL	Zone A	Yes	No	No	No	No	No	Through wall wear indication, potentially active BW wear.	1			
31-61	SG31 #7	0:48:11	CL	Zone B	No	No	Yes	No	No	No	Lengthy flat BW wear scar, appears to be location of a dropped BW. New wear just above new BW location		1		
31-62	SG31 #7	0:50:15	CL	Zone B	Yes	No	No	No	Yes	No	Single through-wall wear indication, oxidized wear scar.	1			
31-63	SG31 #7	0:51:47	CL	Zone B	Yes	No	No	No	No	No	Single tube with through-wall wear indication, adjacent BW appears to have dropped from original position.	1			
31-64	SG31 #7	1:10:25	CL	Zone C	Yes	No	No	Yes	No	No	Through-wall wear indication with visible stabilizer cable.	1			
31-65	SG31 #7	1:12:05	CL	Zone C	Yes	No	No	No	Yes	No	Single tube with double sided through-wall wear indications.	1			
31-66	SG31 #7	1:13:46	CL	Zone C	Yes	No	No	No	No	No	Single tube with through-wall indication aligned with adjacent BW.	1			

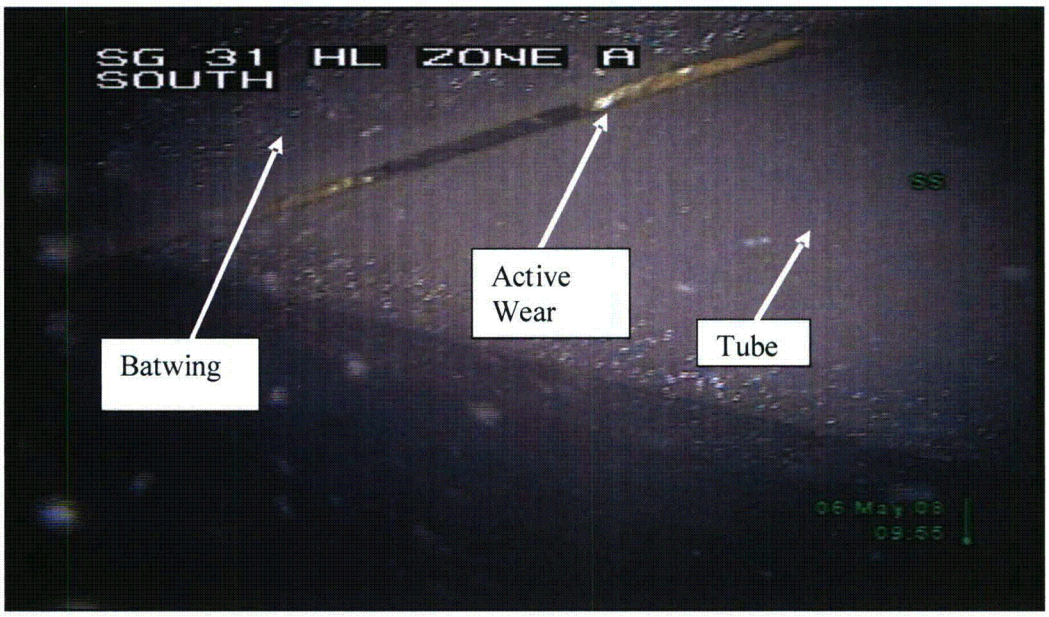
SG31 Secondary Side Inspection Results Summary and Conclusions – Spring 2008 RF15 Outage
Attachment I 45° Through-Tube Bundle Inspection Summary and Selected Still Pictures

Indication No	Disc	Disc Time	Leg	Entry Pt	Thru Wall	> 1/3TD	New Wear	Stabilizer Visible	2 Sided Wear	2nd Row Wear	Comments **(See NOTE at end of table)**	Old Wear	New Wear	Intrados Wear	2nd Row Wear
31-67	SG31 #7	1:15:40	CL	Zone C	Yes	No	No	No	No	No	Single tube with through-wall indication.	1			
31-68	SG31 #7	1:16:44	CL	Zone C	Yes	No	No	No	Yes	No	Single tube with double through-wall indication.	1			
											Totals	67	1	0	4

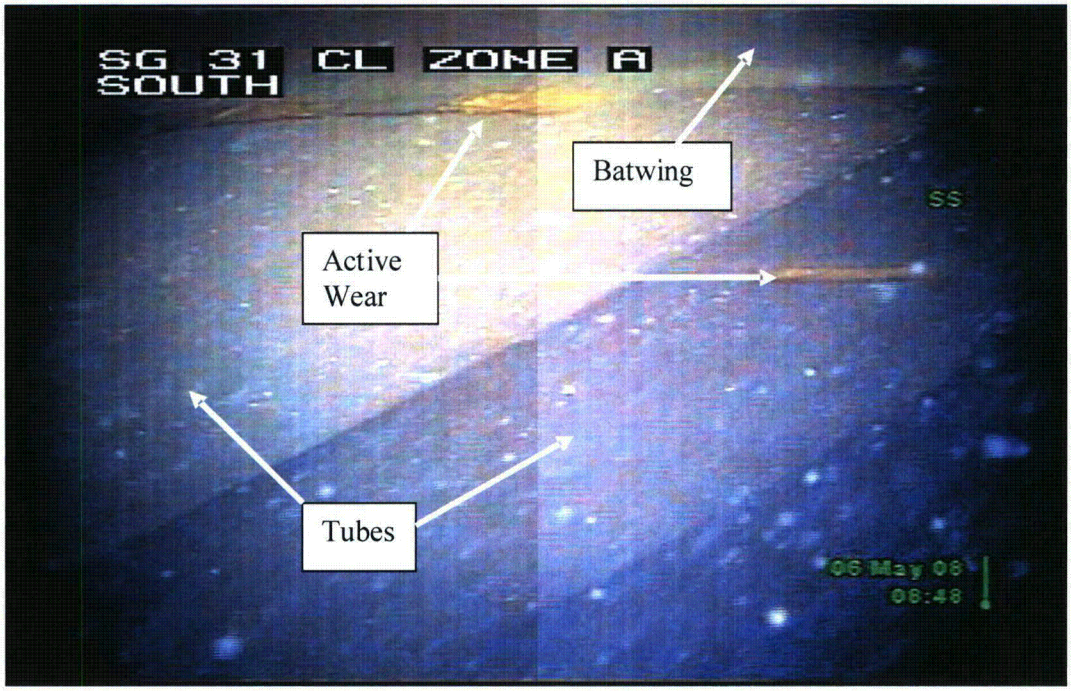
Some indications may be duplicates due to inspection video ambiguities

NOTE: All indications meet established acceptance criteria

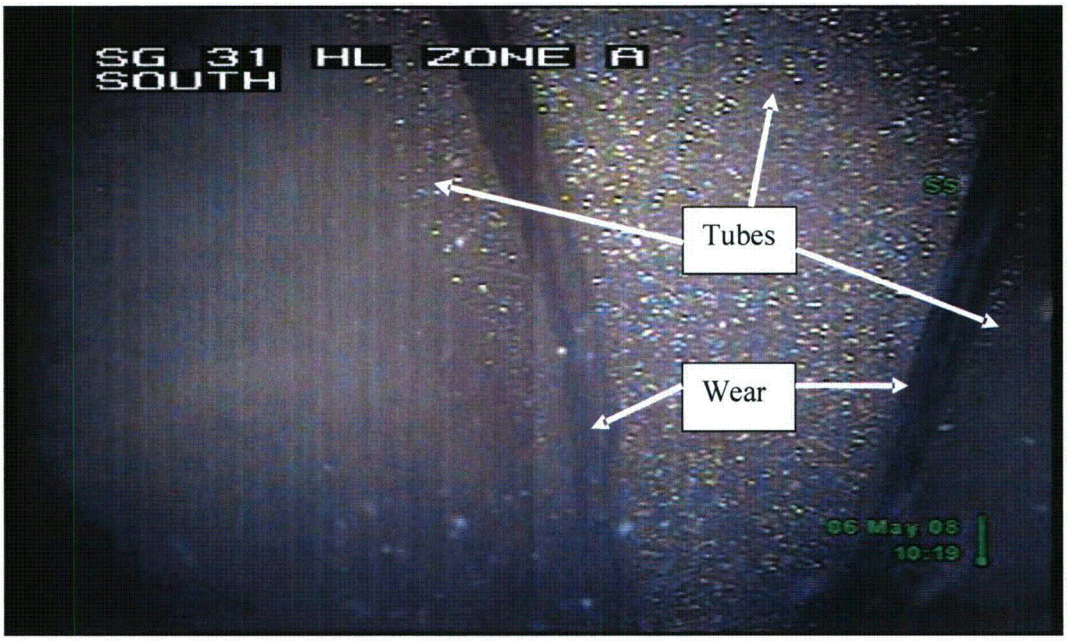

SG 31 45 deg Inspection Wear Indications
80
70
60
50
40
30
20
10
0
Number of Indications
Old Wear, 67
68 Total Wear Indications
New Wear, 1
Intrados Wear, 0
Second Row Wear, 4
Old Wear
New Wear
Intrados Wear
Second Row Wear
Wear Indication Categories



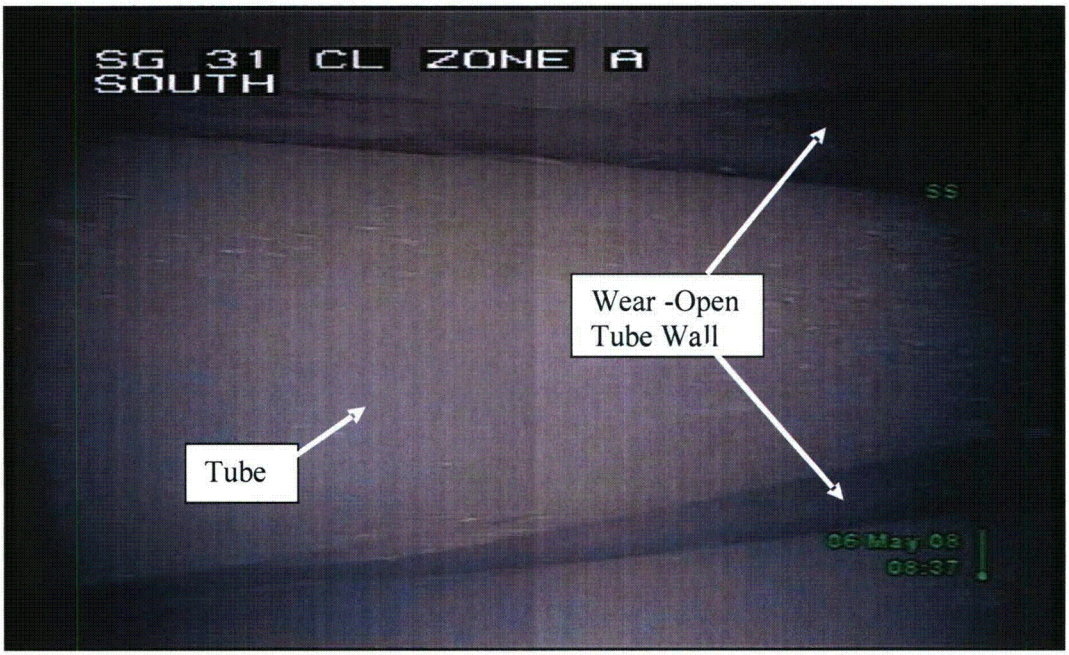
Indication No. 31-01
Active through-wall wear with the batwing shown in original position



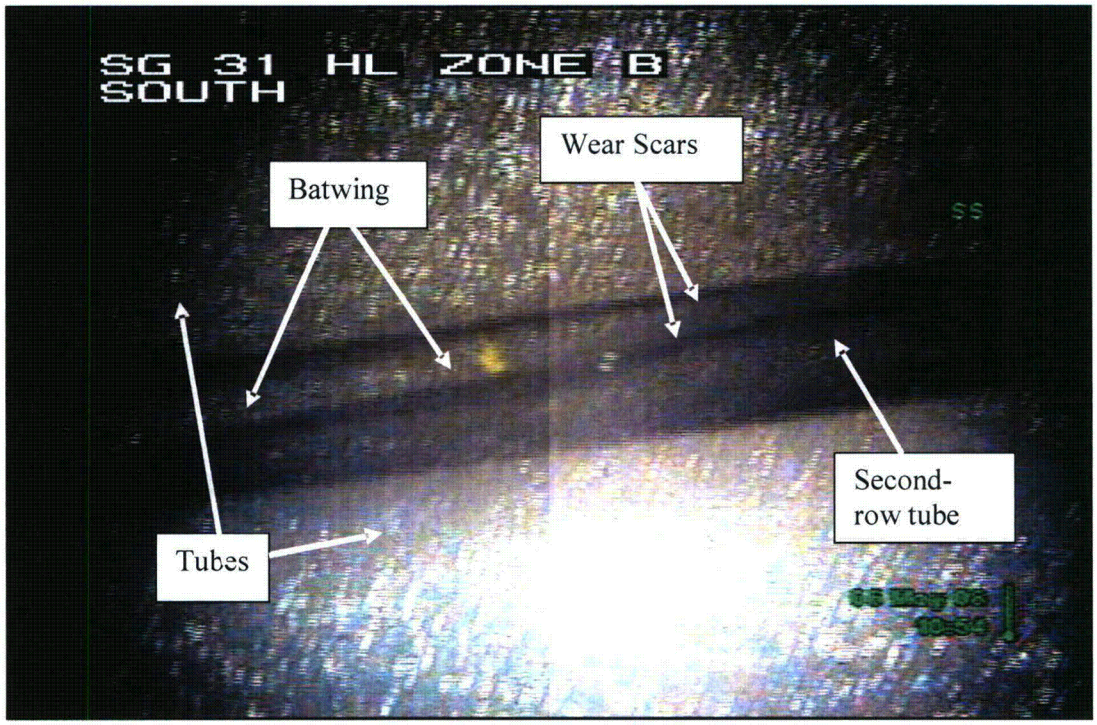
Indication No. 31-58
Two tubes with through-wall indication visible; potential active wear



Indication No. 31-10
Two Sided Wear: Single tube with double-sided wear indication

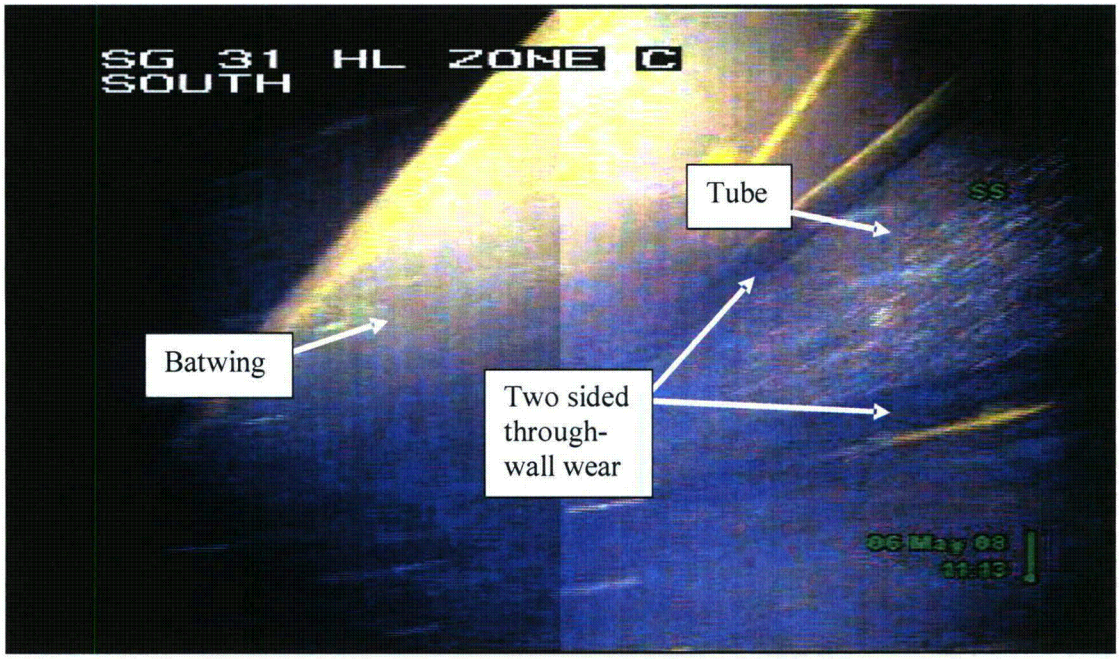


Indication No. 31-54
Two Sided Wear: Single tube with two sided through wall wear indication.



Indication No. 31-18

Second Row Wear: Tube through-wall wear with second row tube wear visible. Batwing is observed in original position.

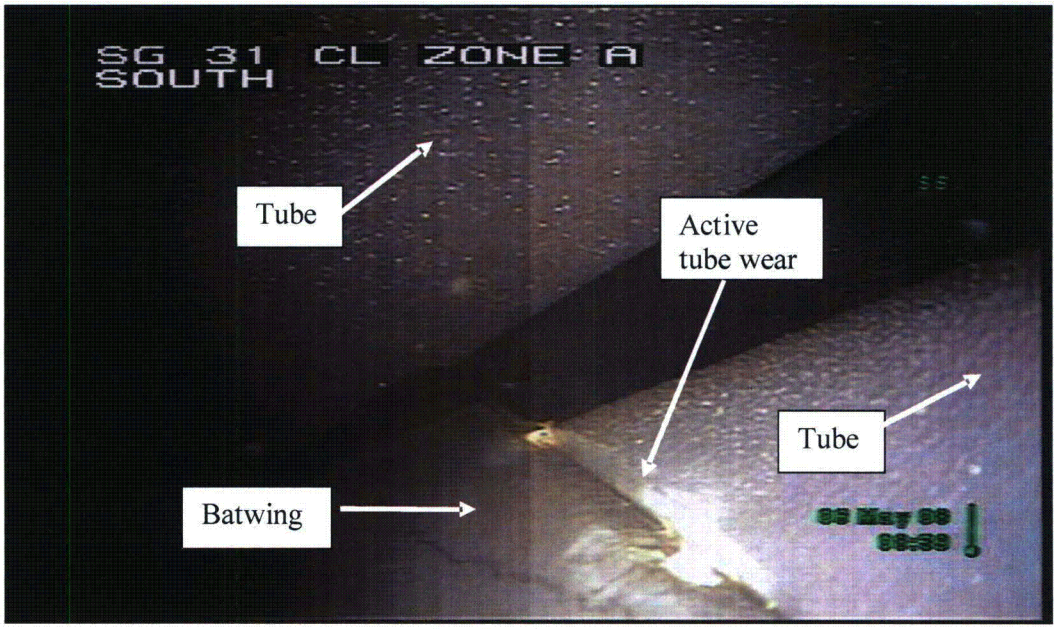


Indication No. 31-25

Second Row Wear: Single tube with two sided through-wall wear indications.

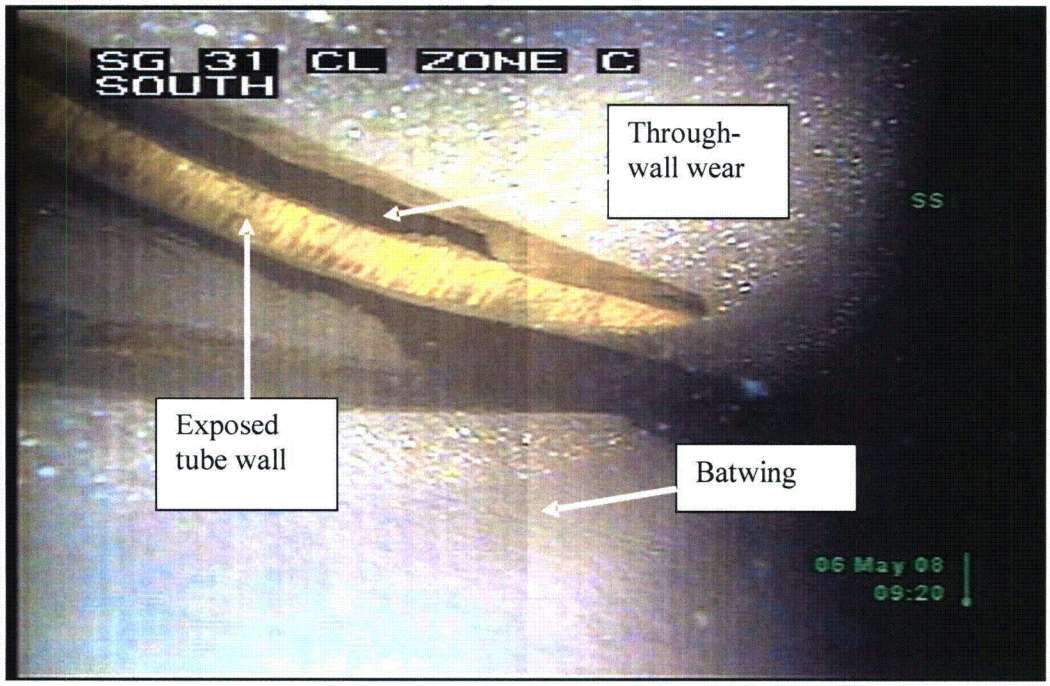
Indication No. 31-31

Through Wall Wear: Tube through-wall wear with clearly visible stabilizer. The stabilizer cable shows no indication of wear. The worn section does not exceed 1/3 tube diameter. Exceeding 1/3 tube diameter would require wear of the stabilizer cable. Since the stabilizer cable is not worn then wear does not exceed 1/3 tube diameter.



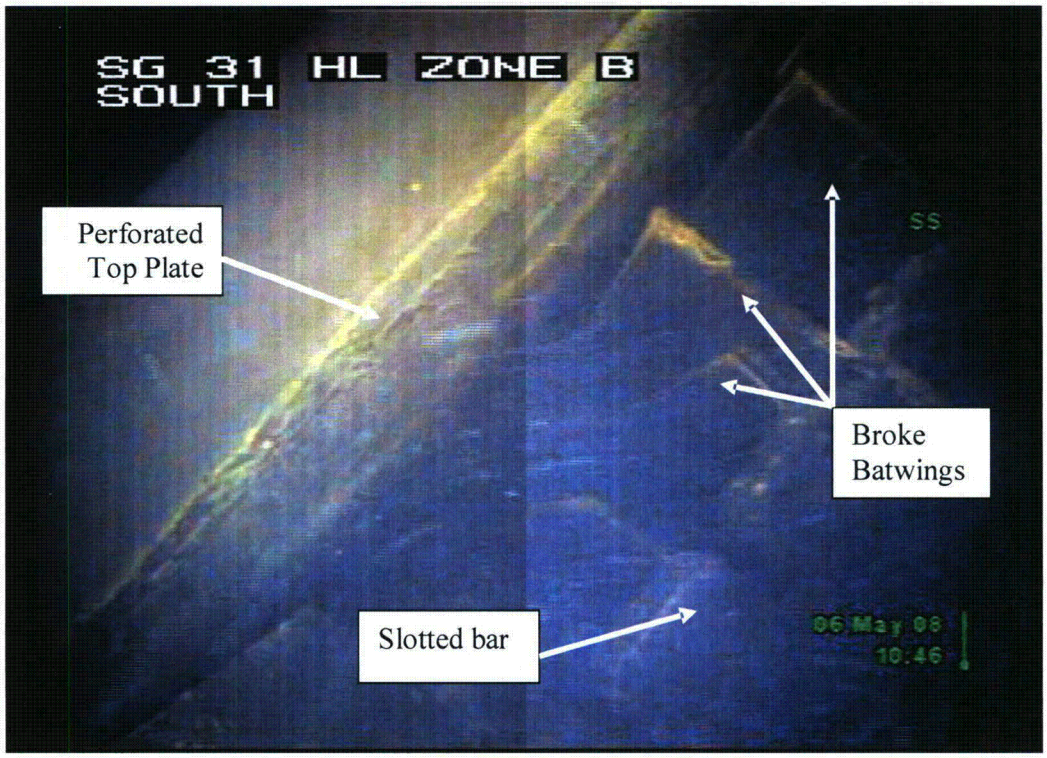
Indication No. 31-55

Two Sided Wear: Two tubes with wear indication from batwing.



Indication No. 31-65

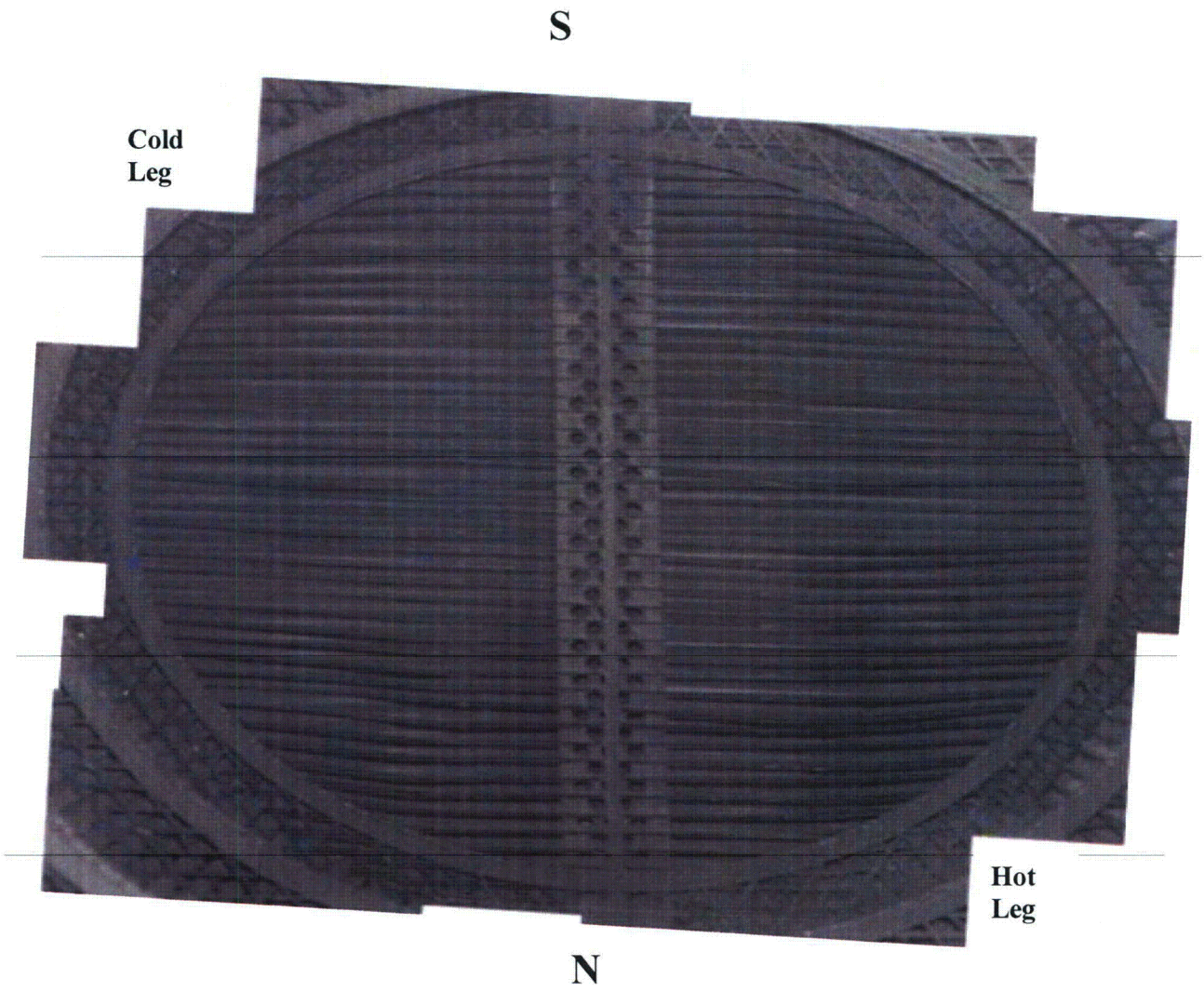
Tube Through-Wall: Single tube with double sided through-wall wear indication



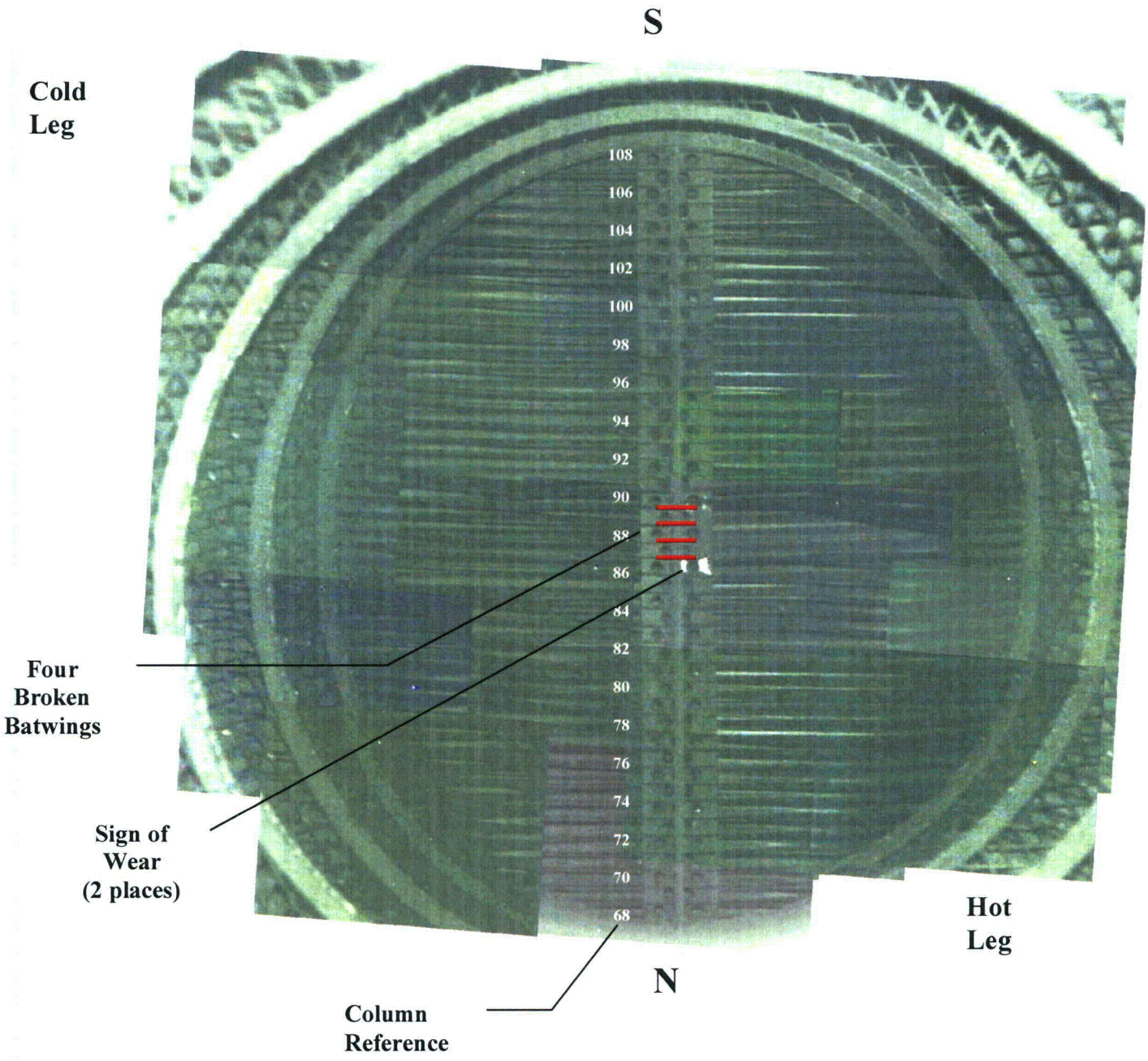
Indication No. INT-05

Broken batwing ends observed remaining in center slot of perforated top plate.

RF14 Bottom-up Composite Photo of SG31

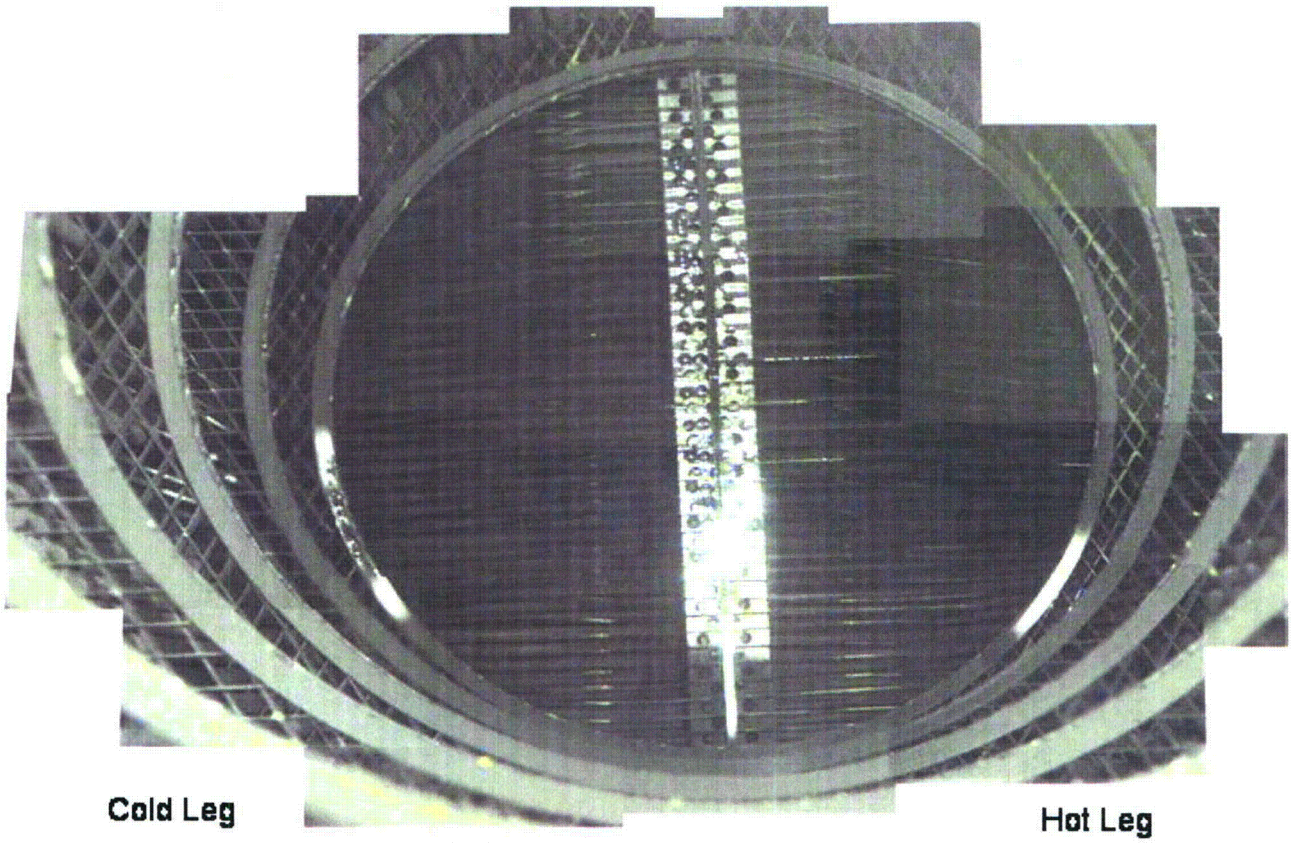


Mid Cycle 15 Bottom-up Composite Photo of SG31



RF 15 Bottom-up Composite Photo of SG31

S



RF15 – SG31 Bottom-Up Inspection Composite View

N

Summary of Batwing Condition Found in SG 31

Batwing Location (tube columns on each side of BW)	As-Found Condition in RF15 1 = intact 2 = dangling 3 = broken 4 = bowed 5 = shifted, 6 = horizontal segment broken off	Identified as broken during PO-07-01 (NOTE 1)	Identified as broken during RF15 (NOTE 2)	Detailed Observation during RF15
68 thru 84	1			Batwing intact. No change since RF14
84/85	3		X	Broken at notch
85/86	3	X	X	Broken at notch
86/87	3	X	X	Broken at notch
87/88	3	X	X	Broken at notch
88/89	3	X	X	Broken at notch
89/90	3		X	Broken at notch
90/91	3		X	Broken at notch
91/92	3		X	Broken at notch
92 thru 108	1			Batwing intact. No change since RF14

NOTE 1: No broken batwings were found during the RF14 bottom up inspection.

NOTE 2: The 45° Through-Tube Bundle Inspection video clearly shows 6 to 8 batwings broke at the center perforated support plate; however the inspection video does not provide any location information. The bottom-up inspection video and composite drawing lacks the clarity and quality to distinguish which batwings are actually broken. Therefore the above table is a best effort to identify which batwings are broken.

Enclosure 2

W3F1-2008-0039

SG 32 Secondary Side Inspection
Results Summary and Conclusions
Spring 2008 Refuel Outage 15

SG32 Secondary Side
Inspection Results Summary and Conclusions
Spring 2008 Refuel 15 Outage

Work Order 130171

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(Electronically Approved in PCRS as CR-WF3-2008-01987 CA 10)

Executive Summary

An inspection of Steam Generator #2 (SG32) was performed during the Spring 2008 Refuel 15 (RF15) outage to determine if there were any changes in extent of condition or the critical variables that were the basis for the mitigating actions taken in Refuel-14 and the Cycle 15 Operational Assessment. The visual inspections performed consisted of an upper batwing weld and wrap around bar inspection, diagonal 45° Through-Tube Bundle Inspection, a Bottom-Up Inspection of the batwings in the central stay cavity region, and a Foreign Object Search and Retrieval (FOSAR). All inspection results met the established acceptance criteria. There were no changes to the extent of condition or the critical variables that were the basis for the mitigating actions taken in Refuel-14 and the Cycle 15 Operational Assessment. Additionally, the assessments performed in RF14 and the October 2007 Mid-Cycle 15 outage (PO-07-01) remain valid and bounding.

Batwing 84/85 was repaired during Refuel 15 by hydraulically expanding five (5) adjacent tubes. Expanding the adjacent tubes will apply additional restraining force on the detached batwing which will secure it in its current position. Additionally, the tubes along the blowdown lane were stabilized and plugged to the first tie rod.

1. Upper Weld and Wrap Around Bar Inspection

The purpose of this inspection was to look for deformation of the wrap around bar and any obvious damage to the wrap around bar-to-batwing welds and weld clips installed during Refuel 14 (RF14). This inspection was also intended to identify any physical changes compared to the Mid-Cycle 15 planned outage (PO-07-01) inspection results (i.e. verify weld clips are intact, verify no weld degradation and verify no damage to the wrap around bar). The batwing weld repairs performed during RF14 are located within the stay cavity region at the wrap around bar. In accordance with Westinghouse letter CWTR3-06-92 dated December 14, 2006, the batwing-to-wrap around bar welds of concern are those within the stay cavity region which includes batwings between tube column numbers 64 and 111. This inspection included observation of the batwing-to-wrap around bar connections between tube column numbers 50 and 120 on the hot and cold leg sides of the steam generator which conservatively bounds the central stay cylinder cavity region.

Upon initial entry into SG32 a visual inspection of the wrap around bar and the accessible wrap around bar-to-batwing welds was conducted. Instructions for this inspection are provided in Work Order 130171 as Inspection 1. Areas to be inspected were observed using a high power light. No damage was noted and the inspection was documented as complete in Work Order 130171.

A more detailed video examination was also performed of the wrap around bar and stay cavity region batwing supports at the periphery of the hot and cold legs to examine the wrap around bar and confirm the integrity of the welds at the connection point. Instructions for this inspection are provided in Work Order 130171 as Inspection 3. A fiber optic camera was used for this examination and the results were recorded on digital media. Seventy-one (71) batwing weld locations were inspected on the hot leg (HL) side, seventy (70) were inspected on the cold leg (CL) side. The difference in the number of inspected welds (HL vs. CL) is due to batwing 84/85 cold leg having slipped into the tube bundle as observed during RF14. Four additional welds located well outside of the stay cylinder cavity region (tube columns 37 and 144 on both the hot leg and cold leg sides) were also inspected. No damage was noted and the inspection is documented as complete in Work Order 130171.

No significant changes or degradation was observed during the inspections discussed above. Some single-sided welds were observed outside of the central stay cavity region; however per ER-W3-2006-0362-000, single-sided welds outside of the stay cavity region are acceptable. All upper weld and wrap around bar inspection results met established acceptance criteria and were acceptable.

2. 45° Through-Tube Bundle Inspection

A diagonal 45° Through-Tube Bundle Inspection of the upper stay cavity region of SG32 was performed to assess the physical integrity of the tubes and the batwing-to-tube interface at the inner most row adjacent to the stay cavity. Instructions for this inspection are provided in

Work Order 130171 as Inspection 2. Detailed evaluations of the video inspection data were conducted by an engineering team comprised of Entergy and Westinghouse personnel. In general the results of the PO-07-01 inspection remain valid and the observations are not repeated herein. Fifty-nine (59) total wear indications as shown in Attachment 1 were noted during the performance of the 45° Through-Tube Bundle Inspection of which forty-nine (49) are classified as "old wear", five (5) as "new wear", three (3) as "intrados wear" and two (2) as "second row" wear. It is possible that the total wear indications noted include duplicates since it is difficult to track exact tube bundle locations during video inspection. Therefore, this inspection is considered a best effort to inspect the condition of the SG32 upper stay cavity. The following summarizes the results of the 45° inspection.

Batwing to Tube Interaction

The detailed review of the inspection videos identified fifty-nine (59) indications of batwing-to-tube interaction, the majority of which is considered to be "old wear". The wear mechanism is the batwing rubbing against the tube surface characterized as the original "batwing issue" from the mid 1980's as described in Combustion Engineering Report CEN-328, "Remedy for Steam Generator Tube and Diagonal Strip Wear." It is considered to be old wear based on the scale and oxide layer being the same on the stabilizer and surrounding tube surfaces and because the batwing has dropped down and is no longer contacting the original wear area. Thus, no additional wear is occurring at the original batwing position. Most of the observed wear is on the inner most tubes of the stay cavity (first row tubes), all of which are plugged and stabilized. In many cases the through-wall wear is such that the stabilizer is visible. In no instances has wear of the stabilizer been observed. Two indications of wear on second row tubes (tubes one row further out into the tube bundle than the inner most tubes in the central stay cavity) have been observed. These tubes were plugged in the mid 1980's but not stabilized. The observed wear is consistent with the predictions of Combustion Engineering Report CEN-328. These observed tube wear scars met the acceptance criteria as defined in Westinghouse Letter LTR-SGDA-07-217.

The 45° Through-Tube Bundle Inspection summary and selected still pictures are included as Attachment 1.

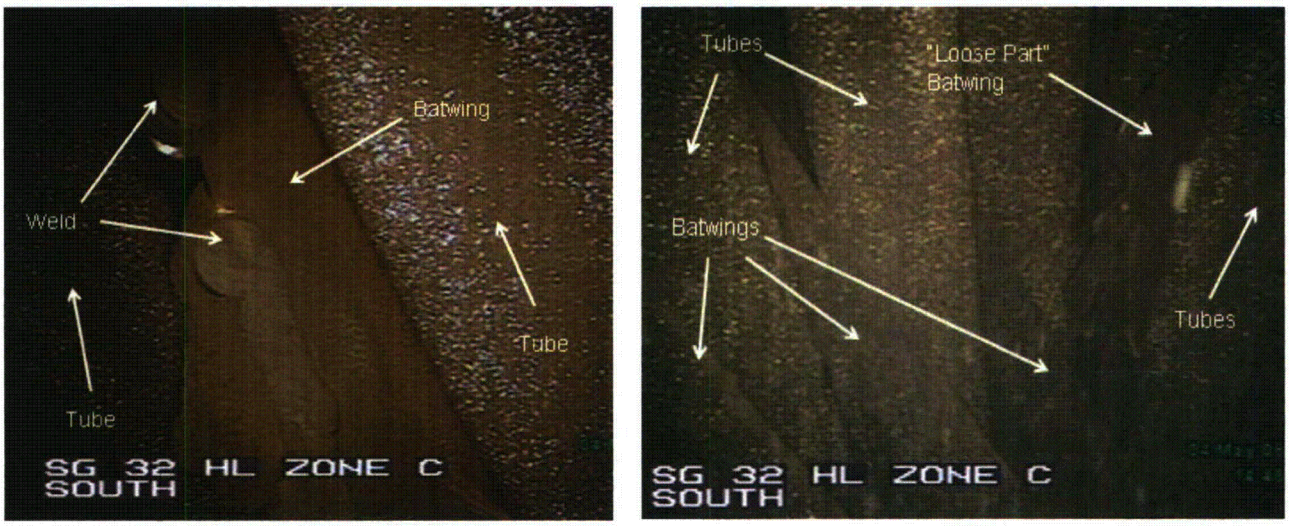
Loose Part

During the 45° Through-Tube Bundle Inspection, a loose batwing section was identified in the upper tube bundle central stay cavity. Based on the inspection video, the loose part is in the vicinity of the tube at Row 35 and Column 95 on the cold leg side. This piece was not observed during inspections conducted in the PO-07-01 outage. During PO-07-01, four (4) loose parts were observed. During RF15, three of the four loose parts remain at the locations where they were observed in PO-07-01. Based upon batwing inventory and part size it is concluded that the loose part that is lodged between the tubes in the upper stay cavity is one of the four loose parts observed during PO-07-01. Refer to figures 3A, 3B and 3C shown in Attachment 4 for comparison of size and location information.

The following observations and conclusions regarding the loose BW section have been made based on engineering review of the inspection video:

- The loose section has a maximum potential length of six inches and is the nominal two-inch BW width.
- The section is oriented such that the 2" face of the loose BW in the tube gap is parallel with the centerline of the contacting tubes creating a potential for flat wear against the tube.
- The loose section is approximately two to three tube rows deep into the tube bundle and enters the bundle at approximately a 30° angle.
- The section spans and contacts a minimum of three tube columns as it enters the inner rows of the SG central cavity. All of the tubes that the loose section could potentially contact in this region of the tube bundle have been removed from service by being either plugged or plugged and stabilized.
- The loose BW section appears fixed in its current position and not expected to migrate further into the bundle or become dislodged from its current location during operation.

Photographs of the loose BW section in the as-found orientation were captured from the 45° Through-Tube Bundle Inspection video. Annotated versions of these inspection photographs are provided in Figure 1. The loose BW section is also identified as "Int-07" in Attachment 1.



1A **1B**

***Figure 1:* Loose Batwing Section**

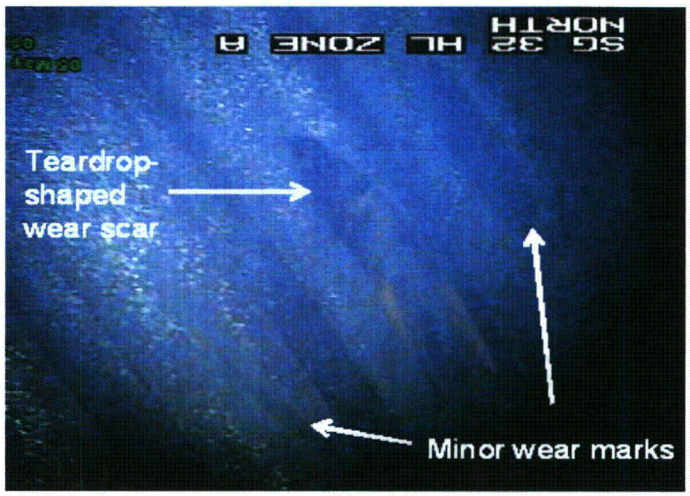
Intrados Tube Wear

Three intrados wear marks were found during the RF 15 inspection. Photo 2A of Figure 2 was taken from video data obtained during the 2007 PO-07-01 outage. Photo 2B of the figure was obtained during the 2008 RF15 outage. There were no batwings, structural members, or material foreign to the steam generator environment observed at the wear scars and no other discernable indications were seen in the general area of these intrados wear scars. It is believed that the two photos in Figure 2 are the same intrados wear mark based on similarities of the wear and the nearby minor wear marks. Although this appeared to be a potential through-wall indication when observed during the PO-07-01 outage, the video evidence in RF15 indicates that it is not through–wall.

Figure 3 is a photograph of intrados tube wear found on the hot leg side during the PO-07-01 outage. No wear scars observed during the RF15 outage appear to match this indication.

Figure 4 and 5 are also photographs of intrados tube wear observed during RF15. Figure 4 clearly shows a very shiny wear mark on the tube, but does not appear to be through–wall wear. Figure 5 also contains indications of abrasion or rubbing of batwings. However, it does not appear to be through-wall tube wear.

2A – Mid Cycle 15 (PO-07-01)
(picture Cap643)



2B – RF15 (rotated for clarity)
(picture 32-40)

Figure 2: ***Intrados Wear Mark***

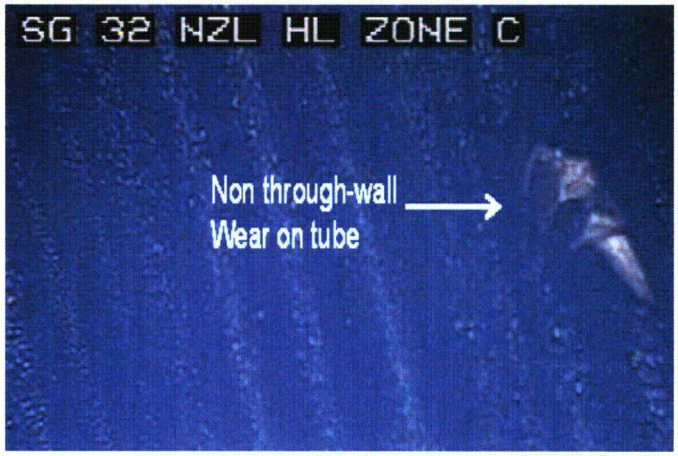


Figure 3: *Mid-Cycle Wear Mark (picture Cap644)*

Figure 4: *RF15 Active Wear Mark (Not Through-Wall, picture 32-41)*

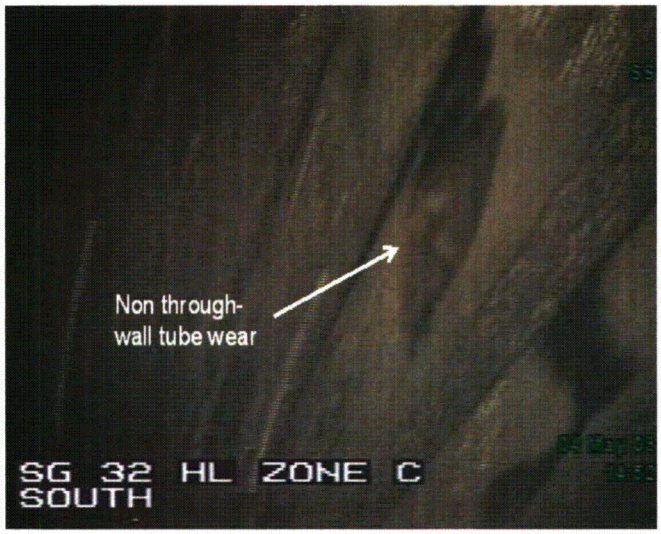


Figure 5: *RF15 Shiny Wear Mark (Not Through-Wall, picture 32-40)*

45° Through-Tube Bundle Inspection Acceptability Determination

Three wear mechanisms have been identified during the 45° Through-Tube Bundle Inspection, namely, original issue batwing wear, dropped batwing wear and intrados wear. Conservative acceptance criteria have been developed for each.

Through-wall wear at the batwing-to-tube interface, which was predicted in the mid 1980's based on operating experience at the SONGS plant, has been observed in the Waterford 3 steam generators. The SONGS batwing wear mechanism consisted of upward flow forces in the tube bundle central cavity causing batwing twisting and application of high contact force against the tubes at the periphery and adjacent to the stay cavity. Analysis and testing determined that the wear rate at each successive tube progressing from the stay cavity into the tube bundle would be expected to decrease, that the wear rate would be expected to decrease as more tubes wore, and that the number of tubes affected would be expected to be smaller than the excess heat transfer area built into each steam generator. The analysis determined that 1) tube integrity is maintained, 2) batwing integrity at the weld is maintained, and 3) batwing integrity at the worn section is maintained. Testing performed in the mid 1980s included eddy current testing, ultrasonic testing, radiography, visual inspection, and mock-up testing. Steam Generator performance and plant impacts at steady state and transient conditions were evaluated to establish the potential consequences including LOCA. The wear progression analysis was performed by Combustion Engineering (CE) using empirical wear parameters and the validity of the wear progression analysis predictions was verified at St. Lucie 2 by tracking eddy current testing (ECT) data over approximately six (6) consecutive cycles. Plant specific evaluations were prepared, including one for Waterford 3, and documented by CEN-328, "Remedy for Steam Generator Tube and Diagonal Strip Wear," dated March 1986 for Palisades (Replacement Generators); Palo Verde Units 1, 2, and 3; St. Lucie Unit 2; SONGS Units 2 and 3; Washington Nuclear Project 3; and Waterford Unit 3. Applicability was

confirmed by LTR –NCE-08-93 "Assessment of CEN-328 for Waterford 3 RF15 Steam generator Batwing-tube wear evaluation.

To evaluate dropped batwing wear a conservative criterion for comparison of the as-found condition of the tube is the criteria for "gross tube damage" provided in Westinghouse Letter LTR-SGDA-07-217. This letter provides criteria for acceptable and unacceptable tube damage/wear and tube prying action. For tube wear at the first row of tubes immediately adjacent to the stay cavity, a criterion of wear no more than 1/3 of the way through the stabilized tube was acceptable. Although through-wall wear scars were observed, none exceeds the 1/3 depth criterion. This criteria is considered the SONGS-related "original issue wear".

Three instances of intrados tube wear were observed during the 45° Through-Tube Bundle Inspection. The wear mark found during the PO-07-01 inspection was located and does not show evidence of growth. The other two indications are "shiny" and appear to be new wear however they are not through-wall wear and are on tubes that have been stabilized and plugged. Since the previous observed intrados wear mark has not increased in size and since all observed intrados wear marks are on tubes that have been stabilized and plugged, this condition meets the acceptance criteria provided in Westinghouse letter LTR-SGDA-08-45 "SG 32 Intrados Tube Wear mark Acceptance Criteria and Remediation Recommendations."

During the inspection, visible batwing deformations and tube wear were observed in the upper central cavity region. However, the deformations and tube wear were consistent with expectations and did not exceed acceptance criteria. All evaluations of the acquired video data concluded the as-found condition does not challenge the structural integrity of the stabilized tubes. In conclusion, although there were indications of deformed SG batwings within the stay cavity observed during the RF15 inspections, all acceptance criteria were met and the observed conditions were determined to be acceptable.

3. Bottom-Up Video Inspection

A bottom up video inspection was performed and a composite photo was created. This was then compared to the composite photo prepared during PO-07-01. General conclusions are

- There has not been significant change to the batwing conditions since PO-07-01.
- There has not been a change in the number of broken batwings since PO-07-01.
- The batwing between tube columns 84 and 85 in the cold leg side has not slipped into the central cavity (tubes around this batwing were hydraulically expanded during RF15 to lock this batwing in place).
- No new batwing segments have broken loose since PO-07-01. As shown in Attachment 3, "Summary of SG32 Batwing Condition," segments of the horizontal sections of four (4) batwings are missing. These segments are from Batwing 80/81 Hot Leg, Batwing 80/81 Cold Leg, Batwing 77/78 Cold Leg, and Batwing 79/80 Cold Leg. All four pieces are accounted for as discussed below:

  - A batwing segment of approximately 7 inches is laying flat on egg crate 4 as shown in Attachment 4 Figure 4 and can not be removed at this time using currently available methods. The analysis documented in LTR-SGDA-07-204 Rev. 1 shows this condition is acceptable.
  - A batwing segment of approximately 6 inches long is lodged in the upper tube bundle (see Figure 1 earlier in this report). It is believed that the piece is lodged in the vicinity of Row 35 Column 95 on the cold leg side. This is believed to be the batwing segment that was observed on the top of egg crate 6 during PO-07-01. The analysis documented in LTR-SGDA-08-129 (transmitted by letter CWTR3-08-236) shows that this condition is acceptable.

The As-Found Condition of Waterford-3 SG32 batwings is included as Attachment 2. The Detailed Evaluation of SG32 PO-07-01 outage Bottom-Up Inspection is included as Attachment 3.

In conclusion, there has not been a significant change to the batwing conditions since RF 14. No additional batwings have broken and loose parts have been addressed. The analysis documented in Westinghouse letters LTR-SGDA-07-204 Rev. 1 and LTR-SGDA-08-129 justifies the acceptability of operation in Cycle 16 with these parts remaining in the SG.

4. Post Tube Expansion Bottom-Up Video Inspection

During RF14 it was discovered that the batwing between tube columns 84 and 85 on the cold leg side was disconnected from the wrap around bar and had migrated into the tube bundle. During RF15 a process of hydraulically expanding five (5) tubes adjacent to the loose batwing was performed in accordance with Westinghouse letter LTR-SGDA-08-36. The original plan called for six (6) tube expansions; however the hydraulic expansion tool was unable to reach the targeted area on one (1) of the planned tubes. The configuration of the successfully expanded five (5) tubes in the tube bundle has been simulated and an acceptability evaluation is documented in Westinghouse letter LTR-SGDA-08-139. The purpose of this tube expansion activity was to provide additional restraining forces to the detached batwing in order to secure the batwing in its current position.

Following the expansion process, a Bottom-Up inspection was performed to observe and document the as-left condition of the SG32 central stay cavity region and to validate that no unexpected changes had occurred following tube expansion. This inspection is identified in Work Order 130171 as Inspection 5. Attachment 5 presents the post expansion view of the central stay cavity region and confirms that the expansion process did not alter the configuration of the batwings from the as-found condition before tube expansion.

5. Foreign Object Search and Retrieval (FOSAR)

A Foreign Object Search and Recovery (FOSAR) inspection of the SG secondary side tube bundle on both the hot and cold leg sides was performed for the presence of loose parts. Accessible areas of the top of tube sheet, blowdown lane and annulus were visually examined using a fiber optic camera. There were no loose parts or items identified. All areas appeared clean post sludge lance. The results of this inspection are documented in WO 130171-01 under inspection 6.

6. Conclusions

All inspection results were satisfactory and met the established acceptance criteria. There were no changes in the extent of condition or critical variables that were used as the basis for mitigating actions taken for the RF14 and PO-07-01 (Mid-Cycle 15) operational assessments. The assessments performed in RF14 and PO-07-01 remain valid and bounding.

Attachment 1 - 45° Through-Tube Bundle Inspection Summary and Selected Still Pictures

Indication No	Disc	Disc Time	Leg	Entry Pt	Thru Wall	> 1/3TD	New Wear	Stabilizer Visible	2 Sided Wear	2nd Row Wear	Comments **(See NOTE at end of table)**	Old Wear	New Wear	Intrados Wear	2nd Row Wear
int-01	SG32 #3	0:22:35	CL	Zone C				N/A	N/A	N/A	Three BWs folded together in central cavity CL.				
int-02	SG32 #3	0:46:43	HL	Zone A							Aligned notches and grooves on BWs.				
int-03	SG32 #3	1:08:40	HL	Zone B							Aligned BW notches.				
int-04	SG32 #1	1:19:42	CL	Zone A							BW to BW interaction.				
int-05	SG32 #1	1:35:40	HL	Zone A							Broken BWs collected in single area. Broken BW ends are visible.				
int-06	SG32 #1	1:43:13	HL	Zone A							BWs overlapping and wearing on one another.				
int-07	SG32 #2	0:15:01	HL	Zone B							End of broken BWs appear to be sticking into tube bundle.				
int-08	SG32 #2	0:22:12	HL	Zone B							BW stuck into bundle with shiny spots on adjacent tubes.				
int-09	SG32 #2	0:36:54	HL	Zone C							Lodged piece of broken BW section in tube bundle. Maybe two tube rows deep.				
	SG32 #1	0:20:50	CL	Zone C							Slight wear on BW horizontal section at center support plates				
	SG32 #1	0:27:20	CL	Zone C							Marker flag protruding through bundle.				
	SG32 #1	0:34:20	CL	Zone C							Broken BW oriented horizontally on right.				
	SG32 #1	0:40:49	CL	Zone C							BWs collected together.				
	SG32 #1	0:41:30	CL	Zone C							Pitted BW section close up view.				

Attachment 1 - 45° Through-Tube Bundle Inspection Summary and Selected Still Pictures

Indication No	Disc	Disc Time	Leg	Entry Pt	Thru Wall	> 1/3TD	New Wear	Stabilizer Visible	2 Sided Wear	2nd Row Wear	Comments **(See NOTE at end of table)**	Old Wear	New Wear	Intrados Wear	2nd Row Wear
	SG32 #1	0:41:53	CL	Zone C							BW broken away from slotted bar. Empty slot supports and dropped BWs.				
32-01	SG32 #1	0:49:27	CL	Zone B	Yes	No	No	Yes	Not observed	Not observed	Through-wall wear indication with visible stabilizer, BW dropped below indication.	1			
32-02	SG32 #1	0:50:10	CL	Zone B	Yes	No	No	Not observed	Not observed	Not observed	Through-wall BW wear, flat wear scar.	1			
32-03	SG32 #1	0:50:17	CL	Zone B	Yes	No	No	Yes	Yes	Not observed	Through-wall BW wear, no significant stabilizer wear noted.	1			
32-04	SG32 #1	0:50:36	CL	Zone B	Unknown	Unknown	No	Not observed	Not observed	Not observed	Tube wear is opposite side of 32-03, view is unclear.	1			
32-05	SG32 #1	0:50:43	CL	Zone B	Yes	No	No	Yes	Not observed	Not observed	Clear view of through wall wear with visible stabilizer, no significant wear noted on cable.	1			
32-06	SG32 #1	0:54:38	CL	Zone B	Yes	No	No	Yes	Not observed	Not observed	Through-wall BW wear with visible stabilizer, oxidized wear location.	1			
32-07	SG32 #1	0:55:21	CL	Zone B	Yes	No	No	Yes	Not observed	Not observed	Through-wall BW wear, potential localized new wear near current BW location.	1			
32-08	SG32 #1	0:57:30	CL	Zone B	Yes	No	No	Not observed	Yes	Not observed	Single tube showing potential 2-sided wear.	1			
32-09	SG32 #1	0:57:45	CL	Zone B	Yes	No	No	Not observed	Yes	Not observed	Single tube showing potential 2-sided wear.	1			

Attachment 1 - 45° Through-Tube Bundle Inspection Summary and Selected Still Pictures

Indication No	Disc	Disc Time	Leg	Entry Pt	Thru Wall	> 1/3TD	New Wear	Stabilizer Visible	2 Sided Wear	2nd Row Wear	Comments **(See NOTE at end of table)**	Old Wear	New Wear	Intrados Wear	2nd Row Wear
32-10	SG32 #1	0:59:42	CL	Zone B	Yes	No	No	Yes	Not observed	Not observed	Through-wall BW wear, potential new wear near current BW location.	1			
32-11	SG32 #1	1:00:31	CL	Zone B	Yes	No	No	Yes	Yes	Not observed	Single tube showing potential 2-sided wear, possible repeat indication.	1			
32-12	SG32 #1	1:00:50	CL	Zone B	Yes	No	No	Not observed	Yes	Not observed	Single tube showing 2-sided wear indications.	1			
32-13	SG32 #1	1:08:05	CL	Zone A	Yes	No	No	Not observed	Yes	Not observed	Clearly visible is a single tube with 2-sided wear indications at BW interfaces.	1			
32-14	SG32 #1	1:08:14	CL	Zone A	Unknown	No	No	Not observed	Not observed	Not observed	BW cut into tube wall.	1			
32-15	SG32 #1	1:18:20	CL	Zone A	Yes	No	Not observed	Not observed	No	No	Noted potential BW impact wear, image is unclear and from a distance.				
32-16	SG32 #1	1:19:57	CL	Zone A	Yes	No	No	Not observed	Yes	Not observed	Single tube with two sided through-wall wear scars.	1			
32-17	SG32 #1	1:20:02	CL	Zone A	Yes	No	No	Not observed	Yes	Not observed	Single tube with two sided through-wall wear scars. Adjacent to indication 32-16.	1			
32-18	SG32 #1	1:20:30	CL	Zone A	Yes	No	No	Not observed	Yes	Not observed	Single tube with two sided through-wall wear scars. Adjacent to indication 32-17.	1			
32-19	SG32 #1	1:20:55	CL	Zone A	Yes	No	No	Not observed	Yes	Not observed	Single tube with two sided through-wall wear scars. Adjacent to indication 32-18.	1			

Attachment 1 - 45° Through-Tube Bundle Inspection Summary and Selected Still Pictures

Indication No	Disc	Disc Time	Leg	Entry Pt	Thru Wall	> 1/3TD	New Wear	Stabilizer Visible	2 Sided Wear	2nd Row Wear	Comments **(See NOTE at end of table)**	Old Wear	New Wear	Intrados Wear	2nd Row Wear
32-20	SG32 #1	1:20:11	CL	Zone A	Yes	No	No	Yes	Not observed	Not observed	Through-wall BW wear with visible stabilizer, oxidized wear location. Tube next to 32-21.	1			
32-21	SG32 #1	1:20:13	CL	Zone A	Yes	No	No	Yes	Not observed	Not observed	Through-wall BW wear with visible stabilizer, oxidized wear location. Tube next to 32-22.	1			
32-22	SG32 #1	1:23:13	CL	Zone A	Yes	No	No	Yes	Not observed	Not observed	Through-wall wear just above top of BW.	1			
32-23	SG32 #1	1:23:10	CL	Zone A	Yes	No	No	Not observed	Not observed	Yes	Through-wall BW wear in second row out from the center cavity.	1			1
32-24	SG32 #1	1:23:52	CL	Zone A	Yes	No	No	Not observed	Not observed	Yes	Through-wall BW wear in second row out from the center cavity. Appears to be old BW wear.	1			1
32-25	SG32 #1	1:24:02	CL	Zone A	Yes	No	No	Yes	Not observed	Not observed	Through-wall BW wear, no degradation noted on cable.	1			
32-26	SG32 #1	1:25:28	CL	Zone A	Yes	No	No	Yes	Not observed	Not observed	Two tubes with through-wall wear indications are visible in the same video frame. Both tubes have visible stabilizers.	1			
32-27	SG32 #1	1:26:19	CL	Zone A	Yes	No	No	Yes	Yes	Not observed	Single tube with double sided BW wear. Potential small amount of new wear.	1			
32-28	SG32 #1	1:26:35	CL	Zone A	Yes	No	No	Not observed	Yes	Not observed	Through-wall BW wear on both sided of tube.	1			
32-29	SG32 #1	1:26:43	CL	Zone A	Yes	No	No	Yes	Not observed	Not observed	Through-wall BW wear with visible stabilizer. No significant wear noted on cable.	1			

***Attachment 1* - 45° Through-Tube Bundle Inspection Summary and Selected Still Pictures**

Indication No	Disc	Disc Time	Leg	Entry Pt	Thru Wall	> 1/3TD	New Wear	Stabilizer Visible	2 Sided Wear	2nd Row Wear	Comments **(See NOTE at end of table)**	Old Wear	New Wear	Intrados Wear	2nd Row Wear
32-30	SG32 #1	1:28:00	CL	Zone A	Yes	No	No	Not observed	Yes	Not observed	Single tube with 2-sided BW wear. Potential localized new wear.	1			
32-31	SG32 #1	1:28:43	CL	Zone A	Yes	No	No	Not observed	Not observed	Not observed	Through-wall BW wear with potentially new wear.	1			
32-32	SG32 #1	1:29:00	CL	Zone A	Yes	No	No	Not observed	Not observed	Not observed	Single tube with three separate through-wall wear indications.	1			
32-33	SG32 #1	1:29:50	CL	Zone A	Yes	No	No	Yes	Yes	Not observed	Two through-wall wear indications visible on separate tubes in same video frame. Both tubes have stabilizers.	1			
32-34	SG32 #1	1:30:04	CL	Zone A	Yes	No	No	Yes	Not observed	Not observed	First and second row tubes can be seen with through-wall wear in same video frame.	1			
32-35	SG32 #1	1:45:39	HL	Zone A	Yes	No	No	Not observed	Not observed	Not observed	Through-wall wear scar noted on one side of tube location.	1			
32-36	SG32 #1	1:47:50	HL	Zone A	Yes	No	No	Not observed	Not observed	Not observed	Through-wall wear noted with BW in original location.	1			
32-37	SG32 #2	0:06:19	HL	Zone A	Yes	No	No	Yes	Not observed	Not observed	Through wall wear noted on adjacent tubes.	1			
	SG32 #2	0:12:08	HL	Zone B							Unclear view, shiny spots in distance. Oxidation brushed off of tubes.				
32-38	SG32 #2	0:40:23	HL	Zone C	Yes	No	No	Not observed	Not observed	Not observed	Through-wall wear on one side of single tube.	1			
32-39	SG32 #2	0:41:30	HL	Zone C	Yes	No	No	Not observed	Not observed	Not observed	Single tube with through-wall BW wear on both sides.	1			
32-40	SG32 #2	0:43:43	HL	Zone C	No	No	Yes	No	No	No	Shiny spots, new wear, not through-wall. Intrados wear?		1	1	

Attachment 1 - 45° Through-Tube Bundle Inspection Summary and Selected Still Pictures

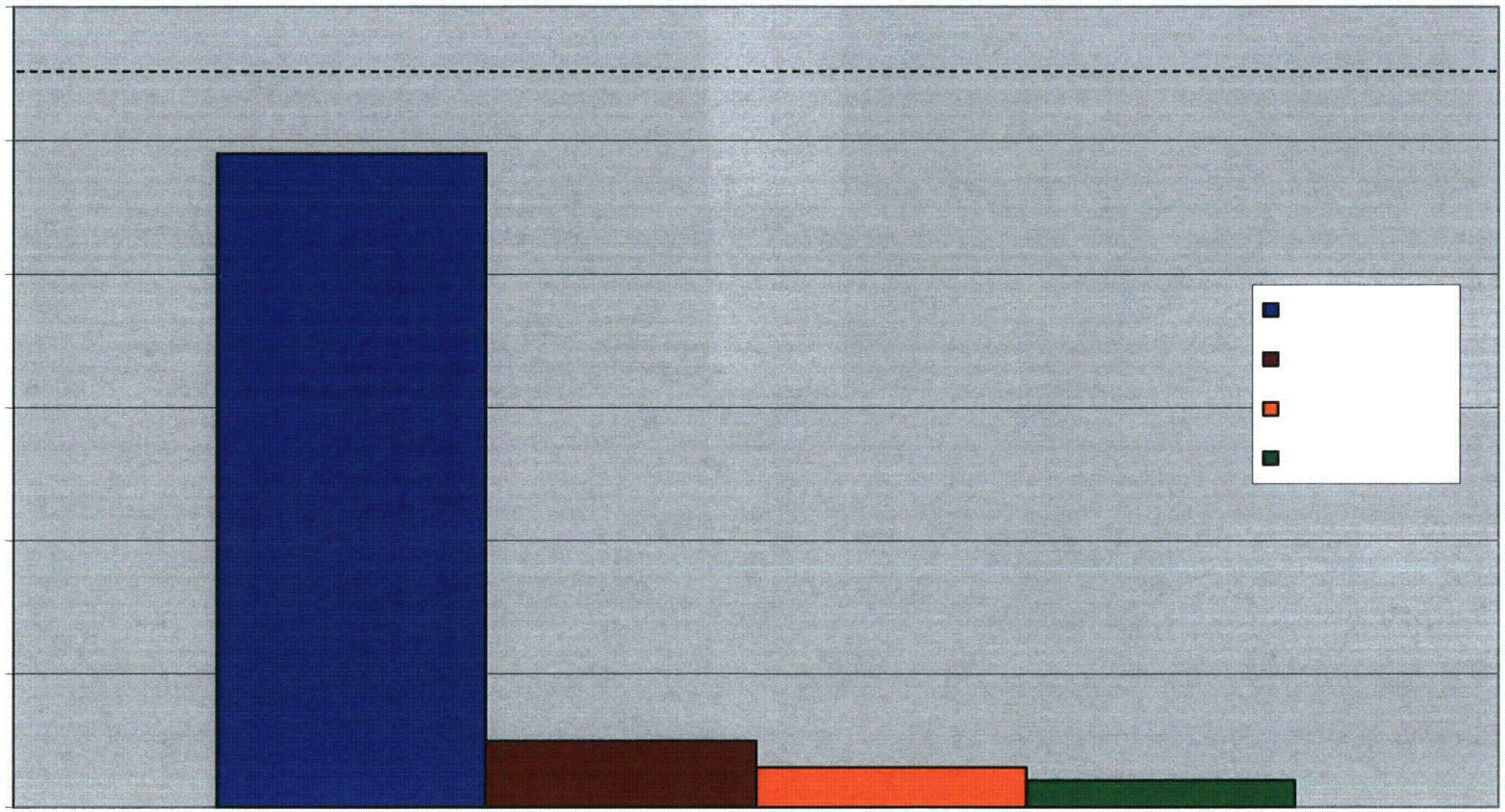
Indication No	Disc	Disc Time	Leg	Entry Pt	Thru Wall	> 1/3TD	New Wear	Stabilizer Visible	2 Sided Wear	2nd Row Wear	Comments **(See NOTE at end of table)**	Old Wear	New Wear	Intrados Wear	2nd Row Wear
32-41	SG32 #3	0:43:34	HL		No	No	Yes	No	No	No	Shiny wear scar on tube. Intrados wear?		1	1	
32-42	SG32 #3	0:47:47	HL	Zone A	No	No	Yes	No	No	No	Shiny spot, corrosion brushed off tube.		1		
32-43	SG32 #3	0:48:13	HL	Zone A	No	No	Yes	No	No	Not observed	Potential new wear at dropped BW location.		1		
32-44	SG32 #3	0:48:24	HL	Zone A	Unknown	No	No	Not observed	Not observed	Not observed	BW shaped wear scar adjacent to BW section.	1			
32-45	SG32 #3	0:56:50	HL	Zone A	Yes	No	No	Not observed	Yes	Not observed	Single tube with through-wall BW wear on both sides.	1			
32-46	SG32 #3	0:58:11	HL	Zone A	Unknown	No	No	Not observed	No	Not observed	Tube wear in distance, view is unclear.	1			
32-47	SG32 #3	0:59:47	HL	Zone A	Yes	No	Yes	Not observed	Not observed	Not observed	Collection of shiny wear scars, one appears to be through wall. Possible intrados wear identified during mid-cycle inspections.		1	1	
32-48	SG32 #3	1:41:05	HL	Zone A	Unknown	No	No	Not observed	Not observed	Not observed	Wear scar visible adjacent to BW.	1			
32-49	SG32 #3	1:04:57	HL	Zone A	Yes	No	No	Not observed	Yes	Not observed	Single tube with through-wall BW wear on both sides.	1			
32-50	SG32 #3	1:05:43	HL	Zone A	Yes	No	No	Not observed	No	Not observed	Wear scar on tube adjacent to BW elevation.	1			
32-51	SG32 #3	1:11:07	HL	Zone B	Yes	No	No	Not observed	Yes	Not observed	Two tubes visible in video frame, both with wear scars adjacent to BW elevations.	1			
32-52	SG32 #3	1:12:25	HL	Zone B	Yes	No	No	Not observed	Yes	Not observed	Single tube with through-wall BW wear on both sides.	1			
32-53	SG32 #3	0:16:04	HL	Zone C	Yes	No	No	Not observed	Yes	Not observed	Two through-wall tube wear locations visible in single video frame.	1			

Attachment 1 - 45° Through-Tube Bundle Inspection Summary and Selected Still Pictures

Indication No	Disc	Disc Time	Leg	Entry Pt	Thru Wall	> 1/3TD	New Wear	Stabilizer Visible	2 Sided Wear	2nd Row Wear	Comments **(See NOTE at end of table)**	Old Wear	New Wear	Intrados Wear	2nd Row Wear
32-54	SG32 #3	0:17:06	HL	Zone C	Yes	No	No	Yes	Yes	Not observed	Through-wall tube wear with visible cable stabilizer, no significant wear noted on cable.	1			
32-55	SG32 #4	0:21:30	HL	Zone C	Yes	No	No	Yes	Yes	Not observed	Through-wall tube wear on both sides of two adjacent tubes.	1			
											TOTALS	49	5	3	2

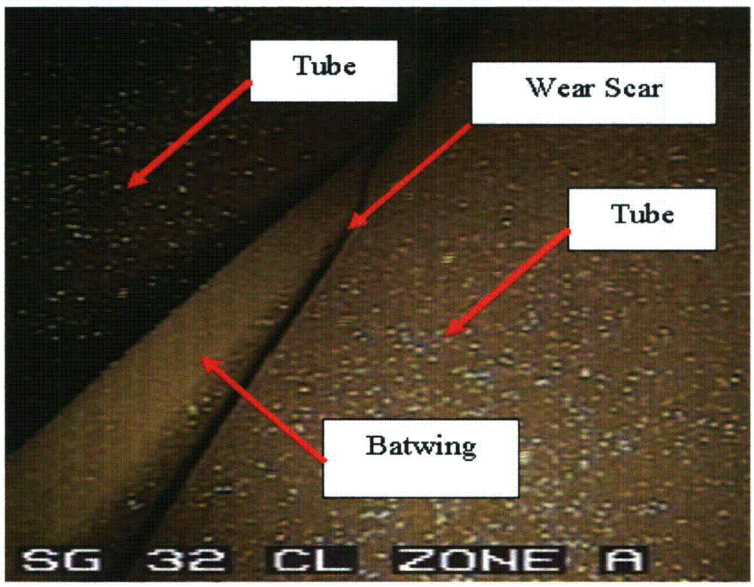
NOTE: All indications meet established acceptance criteria.

Attachment 1 - 45° Through-Tube Bundle Inspection Summary and Selected Still Pictures



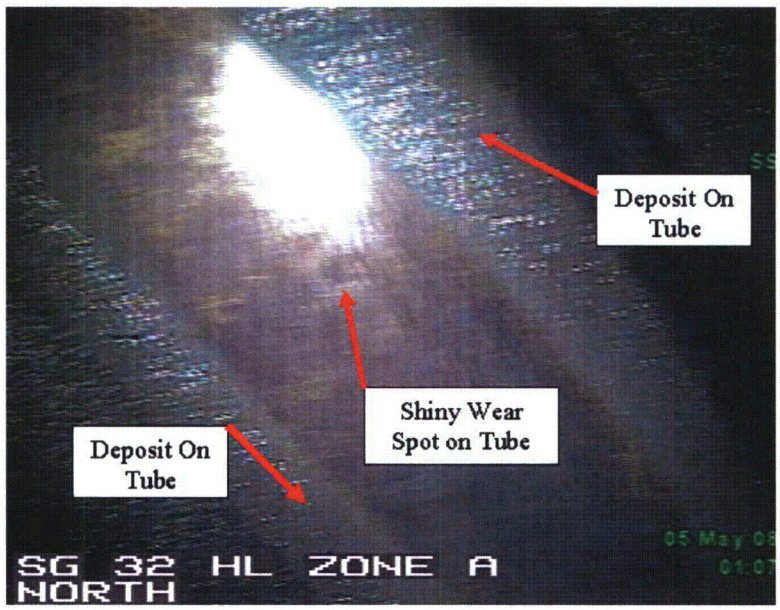
Note – The value for 'New Wear' includes 2 indications that are included in the 'Intrados Wear' and 2 indications from the '2nd Row Wear' column.

***Attachment 1* - 45° Through-Tube Bundle Inspection Summary and Selected Still Pictures**



Indication 31-10

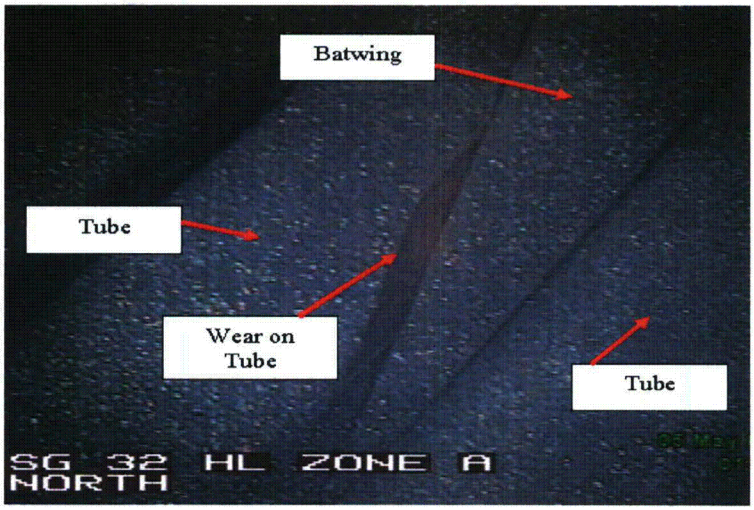
Active Wear: Tube being worn by adjacent batwing. Wear is not through wall.



Indication 32-41

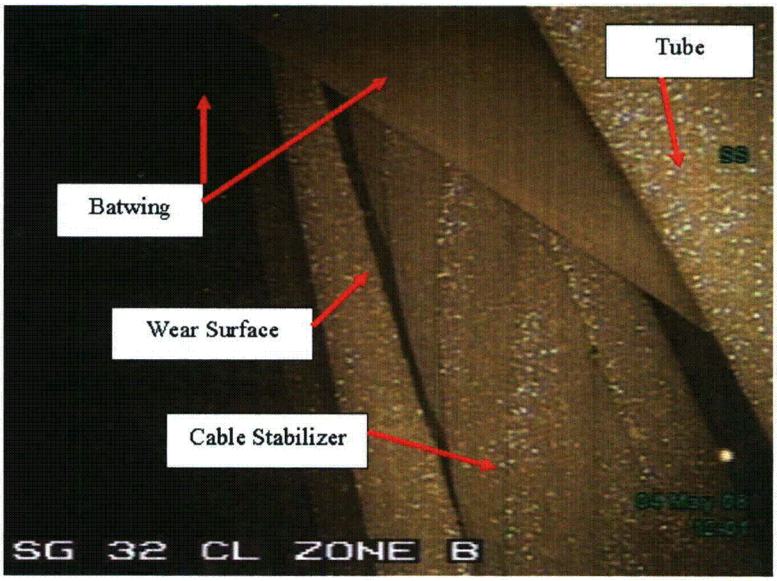
Active Wear: Exterior sludge deposits have been worn away by contact with a broken batwing. The shiny area is the tube surface. Wear is not through wall

***Attachment 1* - 45° Through-Tube Bundle Inspection Summary and Selected Still Pictures**



Indication 32-43

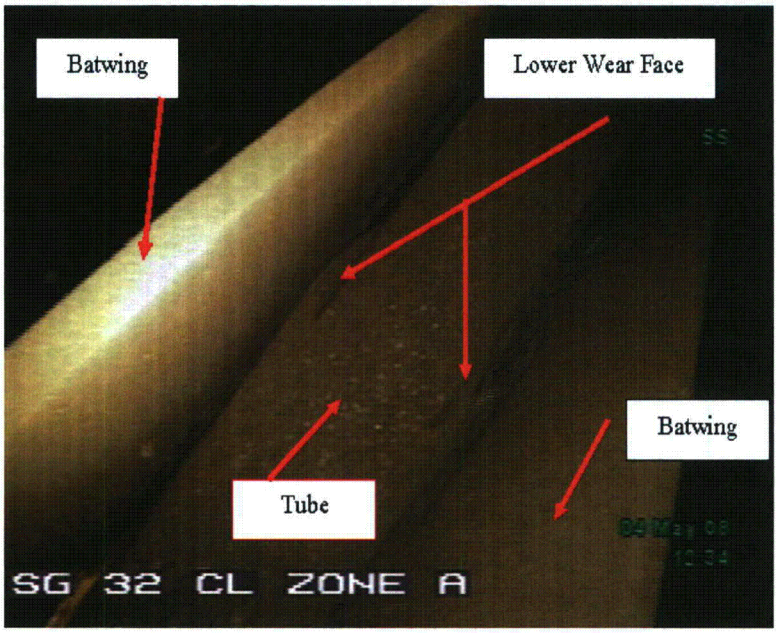
Active Wear: Exterior Sludge deposits have been worn away by contact with an intact batwing. The shiny area is the tube surface. Wear is not through wall.



Indication 32-05-2

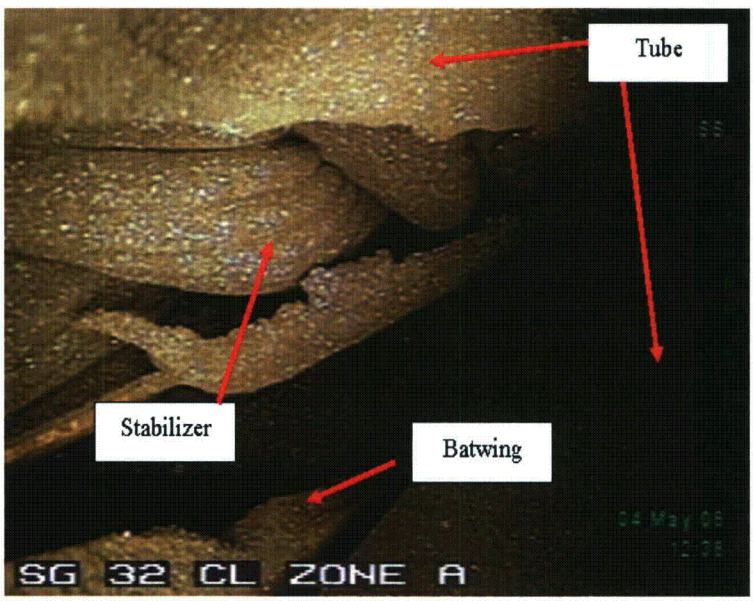
Slide Down Wear: Through wall tube wear showing the stabilizer cable. Observed wear is at the original batwing to tube interface. The batwing has now dropped and wear is not continuing. The stabilizer cable shows no indication of wear. The worn section is on the order of 4 inches long and does not exceed 1/3 tube diameter. Exceeding 1/3 tube diameter would require wear of the stabilizer cable. Since the stabilizer cable is not worn then wear does not exceed 1/3 tube diameter. Slide Down Wear is wear associated with original batwing wear issues. The batwing has now slid down exposing the wear area.

***Attachment 1* - 45° Through-Tube Bundle Inspection Summary and Selected Still Pictures**



Indication 32-17

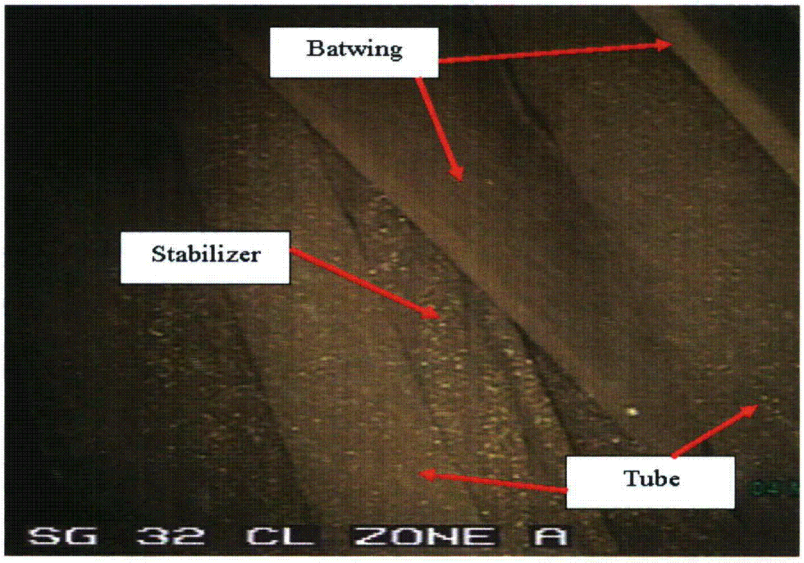
Slide Down Wear: Two sided tube wear. The stabilizer cable shows no indication of wear.



Indication 32-25

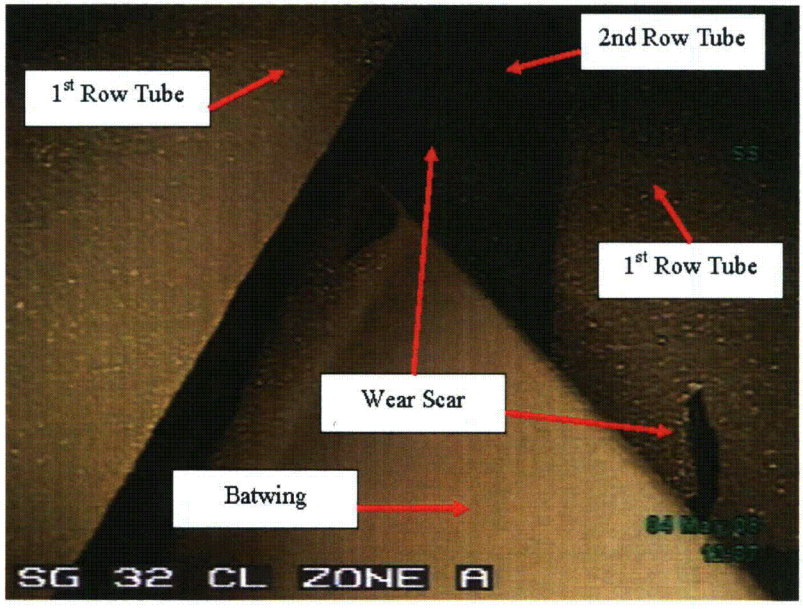
Slide Down Wear: Through wall tube wear showing the stabilizer cable

***Attachment 1* - 45° Through-Tube Bundle Inspection Summary and Selected Still Pictures**



Indication 32-26

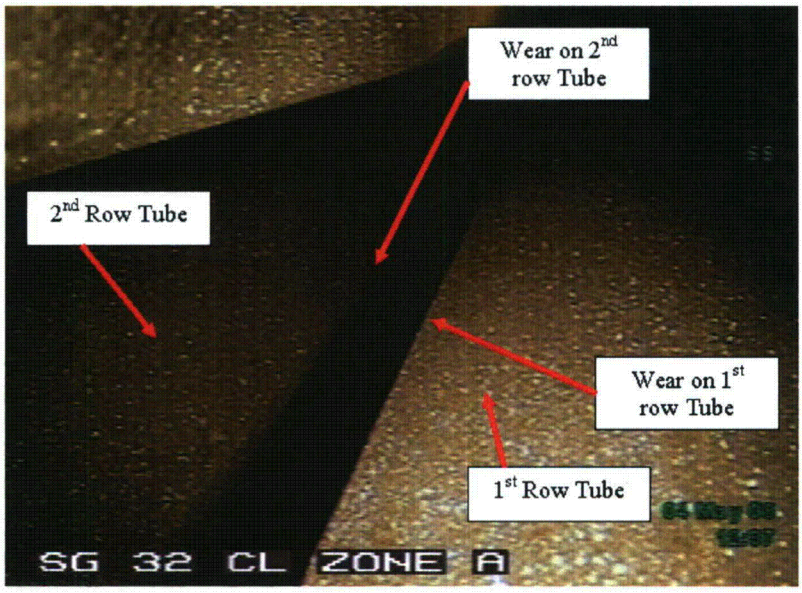
Slide Down Wear: Through wall tube wear showing the stabilizer cable



Indication 32-23-1

Second Row Tube Wear: Example showing both 1st and 2nd row tube wear.

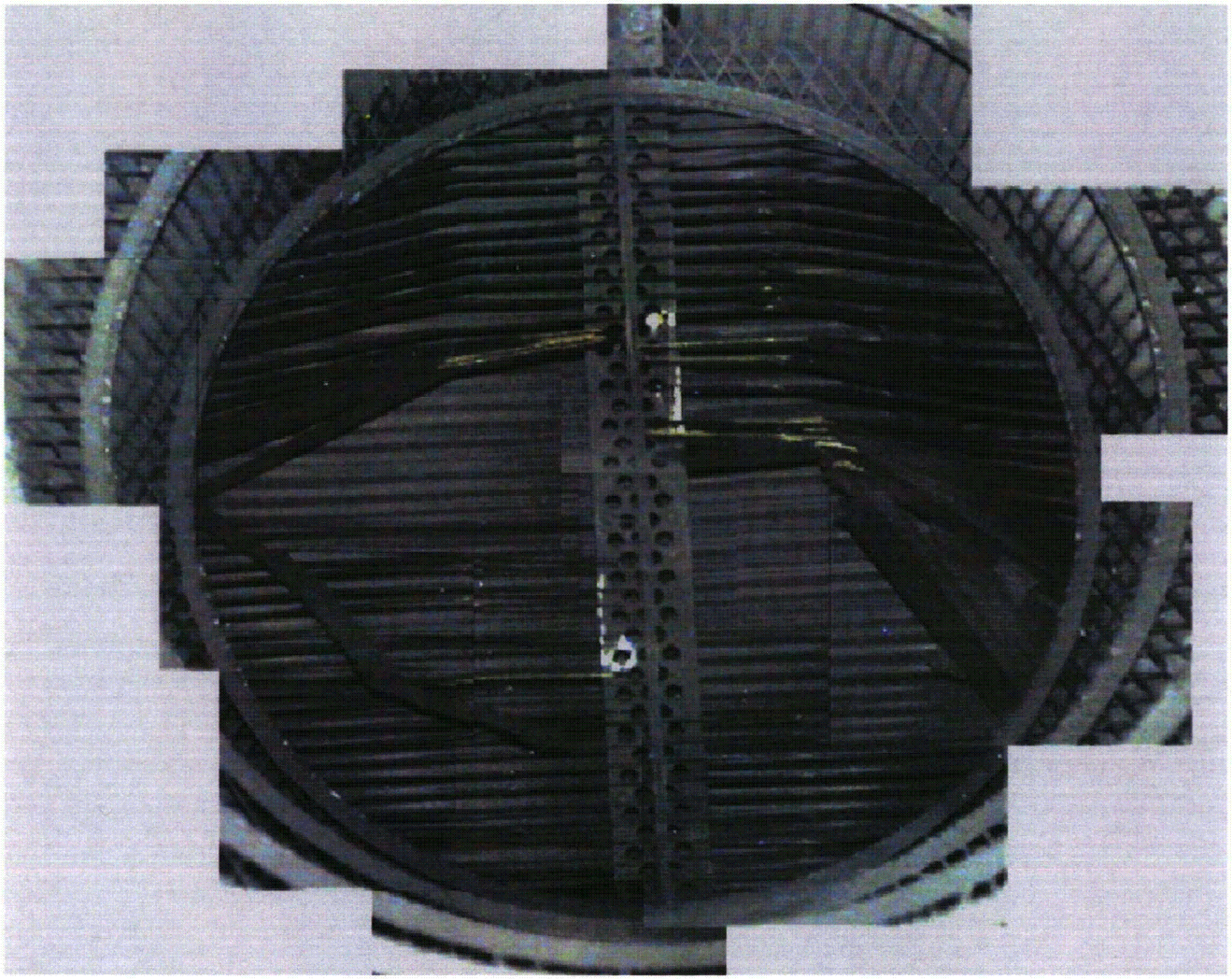
***Attachment 1* - 45° Through-Tube Bundle Inspection Summary and Selected Still Pictures**



Indication 32-24

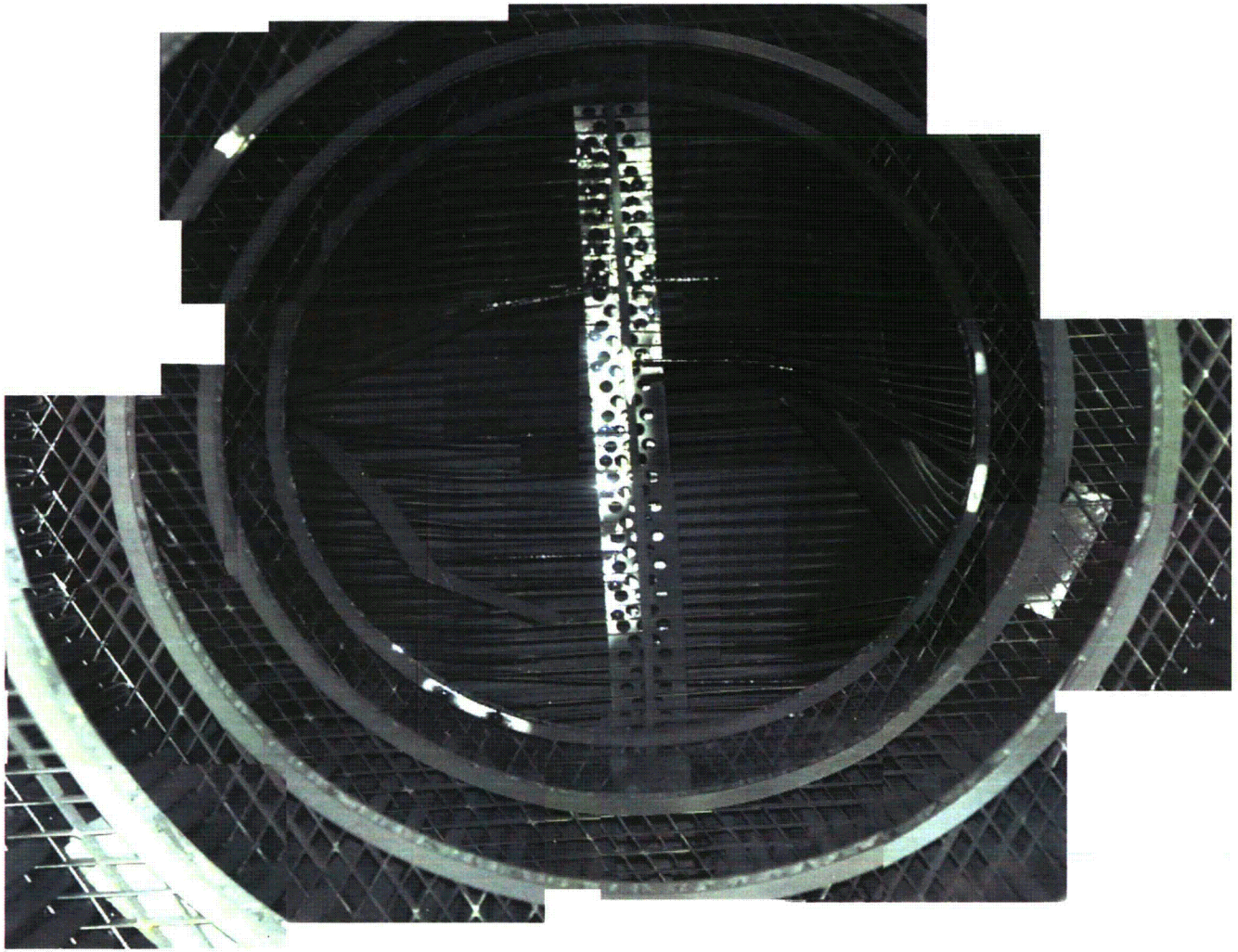
Second Row Tube Wear: Through wall batwing wear in second row out from the center cavity; Appears to be 'old' batwing wear.

Attachment 2 *- As-Found Condition of Waterford 3 SG32 Batwings*



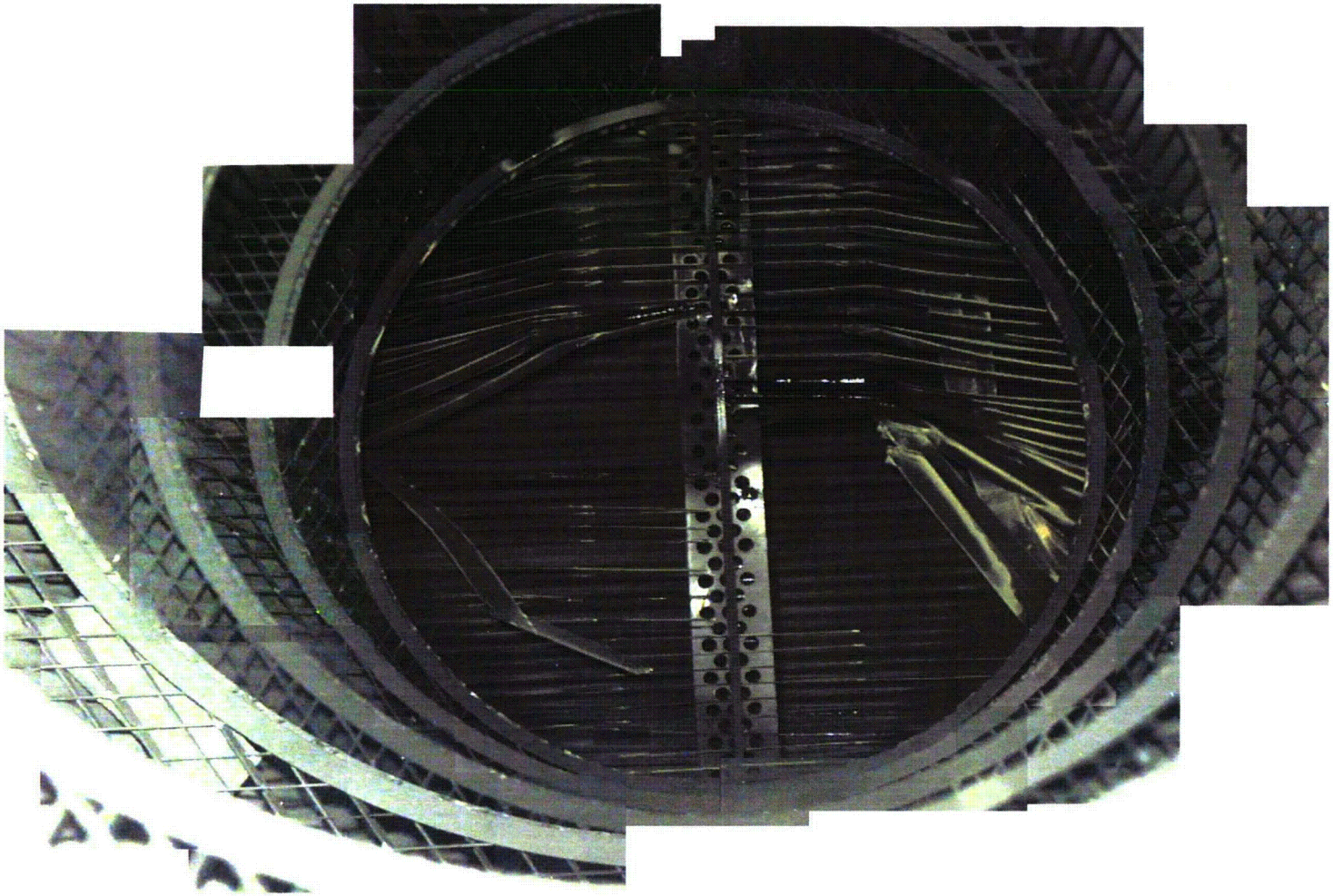
RF14 - SG32 Bottom-Up Inspection View

Attachment 2 *- As-Found Condition of Waterford 3 SG32 Batwings*



PO-07-01 (Mid Cycle 15) - SG32 Bottom-Up Inspection View

Attachment 2 - As-Found Condition of Waterford 3 SG32 Batwings



RF15 - SG32 Bottom-Up Inspection View

Attachment 3 - Summary of SG32 Batwing Condition

Table entries in ***Bold Italics*** refer to severed batwing pieces. Figure 1, referred to in the "Detailed Observations During RF15" column, is located after the following tables in this Attachment.

SG32 Hot Leg

Batwing **Location HL** (tube columns on each side of BW)	**As-Found Condition RF15** 1 = intact 2 = dangling 3 = broken 4 = bowed 5 = shifted, 6 = horizontal segment broken off	**Identified as broken during RF14**	**Identified as broken during PO-07-01**	**Identified as broken during RF15**	**Detailed Observations During RF15**
68/69	1				
69/70	1				
70/71	1,4				Contact with BW 71/72
71/72	1				
72/73	1				
73/74	1				
74/75	1				
75/76	1				
76/77	1				
77/78	3,5	X	X	X	Broken at notch (Figure 1, Area 4)
78/79	3,5		X	X	Broken at notch
79/80	3	X	X	X	Broken at notch; Contact with BW 80/81
80/81	**3,5**	**X**	**X**	**X**	***Broken at weld with horizontal piece severed [LOOSE PART] (See Figure 1, Area 7)***
81/82	3	X	X	X	Broken at notch (Figure 1, Area 4)
82/83	3	X	X	X	Broken at notch (Figure 1, Area 4)
83/84	3	X	X	X	Appears to be broken at notch (Figure 1, Area 4)
84/85	3,5	X	X	X	Broken at notch (Figure 1, Area 4)
85/86	3,5	X	X	X	Broken at notch. Contact with BW 86/87 (Figure 1, Area 4)

Attachment 3 - Summary of SG32 Batwing Condition

Batwing **Location HL** (tube columns on each side of BW)	**As-Found Condition RF15** 1 = intact 2 = dangling 3 = broken 4 = bowed 5 = shifted, 6 = horizontal segment broken off	**Identified as broken during RF14**	**Identified as broken during PO-07-01**	**Identified as broken during RF15**	**Detailed Observations During RF15**
86/87	3,5	X	X	X	Broken at notch (Figure 1, Area 4)
87/88	3,5	X	X	X	Broken at notch (Figure 1, Area 4)
88/89	3,5	X	X	X	Broken at notch (Figure 1, Area 4)
89/90	3,5	X	X	X	Broken at notch (Figure 1, Area 4)
90/91	3,5	X	X	X	Broken at notch; piece dangling below batwings in same position as mid cycle. (Figure 1, Area 6)
91/92	3,5	X	X	X	Broken at notch; Contact with BW 92/93. (Figure 1, Area 4)
92/93	3,5	X	X	X	Broken at notch; Contact with BW 91/92 and BW 93/94. (Figure 1, Area 4)
93/94	3,5	X	X	X	Broken at notch; Contact with BW 92/93 and BW 94/95. (Figure 1, Area 4)
94/95	3,5	X	X	X	Broken at notch; Contact with BW 93/94 and BW 95/96. (Figure 1, Area 4)
95/96	3,5	X	X	X	Broken at notch; Contact with BW 94/95 and BW 96/97. (Figure 1, Area 4)
96/97	3 ,5	X	X	X	Broken at notch; Contact with BW 95/96 and BW 97/98
97/98	1				Contact with BW 96/97. (Figure 1, Area 4)
98/99	1				
99/100	1				
100/101	1				

Attachment 3 - Summary of SG32 Batwing Condition

Batwing **Location HL** (tube columns on each side of BW)	**As-Found Condition RF15** 1 = intact 2 = dangling 3 = broken 4 = bowed 5 = shifted, 6 = horizontal segment broken off	**Identified as broken during RF14**	**Identified as broken during PO-07-01**	**Identified as broken during RF15**	**Detailed Observations During RF15**
101/102	1				
102/103	1				
103/104	1				
104/105	1				
105/106	1				
106/107	1				
107/108	1				

Attachment 3 - Summary of SG32 Batwing Condition

SG32 Cold Leg

Batwing Location CL (tube columns on each side of BW)	**As-Found Condition in RF15** 1 = intact 2 = dangling 3 = broken 4 = bowed 5 = shifted, 6 = horizontal segment broken off	**Identified as broken during RF14**	**Identified as broken during PO-07-01**	**Identified as broken during RF15**	**Detailed Observations during RF15**
68/69	1				
69/70	1				
70/71	1				
71/72	1				
72/73	1				
73/74	1				
74/75	1				
75/76	***3***	X	X	X	***Broken at weld. Upper portion folded over toward the south. BW horizontal segment connected at notch as seen in mid cycle.*** (Figure 1, Areas 1 and 5)
76/77	***3***	X	X	X	***Broken at weld. Upper portion folded over toward the south. BW horizontal segment connected at notch as seen in mid cycle.*** (Figure 1, Areas 1 and 5)
77/78	***3,6***	X	X	X	***Broken at weld. Upper portion folded over toward the south with horizontal piece severed [LOOSE PART]*** (Figure 1, Area 1)
78/79	3	X	X	X	Broken at notch; Bent over above other BWs with horizontal piece still attached (hockey stick). (Figure 1, Areas 2 and 3)

Attachment 3 - Summary of SG32 Batwing Condition

Batwing Location CL (tube columns on each side of BW)	**As-Found Condition in RF15** 1 = intact 2 = dangling 3 = broken 4 = bowed 5 = shifted, 6 = horizontal segment broken off	**Identified as broken during RF14**	**Identified as broken during PO-07-01**	**Identified as broken during RF15**	**Detailed Observations during RF15**
79/80	***3,6***	X	X	X	***Broken at notch; Bent over above other BWs with horizontal piece severed.*** (Figure 1, Areas 2 and 3)
80/81	***3,6***	X	X	X	***Broken at weld, horizontal piece severed [LOOSE PART]. Batwing is bent over and above other batwings.*** (Figure 1, Areas 2 and 3)
81/82	3,5	X	X	X	Broken at notch (Figure 1, Area 4)
82/83	3,5	X	X	X	Broken at notch (Figure 1, Area 4)
83/84	3,5	X	X	X	Broken at notch (Figure 1, Area 4)
84/85	3,5	X	X	X	Broken at notch (Figure 1, Area 4)
85/86	3,5	X	X	X	Broken at notch (Figure 1, Area 4)
86/87	3,5	X	X	X	Broken at notch (Figure 1, Area 4)
87/88	3,5	X	X	X	Broken at notch (Figure 1, Area 4)
88/89	3,5	X	X	X	Broken at notch (Figure 1, Area 4)
89/90	3,5	X	X	X	Broken at notch (Figure 1, Area 4)
90/91	3,5	X	X	X	Broken at notch; Contact with BW 91/92
91/92	3,5	X	X	X	Broken at notch; Contact with BW 90/91 (Figure 1, Area 4)
92/93	3,5	X	X	X	Broken at notch. (Figure 1, Area 4)

Attachment 3 - Summary of SG32 Batwing Condition

Batwing Location CL (tube columns on each side of BW)	**As-Found Condition in RF15** 1 = intact 2 = dangling 3 = broken 4 = bowed 5 = shifted, 6 = horizontal segment broken off	**Identified as broken during RF14**	**Identified as broken during PO-07-01**	**Identified as broken during RF15**	**Detailed Observations during RF15**
93/94	3,5	X	X	X	Broken at notch; Appears to be broken at weld; Contact with BW 94/95 (Figure 1, Area 4)
94/95	3,5	X	X	X	Broken at notch; Contact with BW 93/94 (Figure 1, Area 4)
95/96	3,5	X	X	X	Broken at notch; Contact with BW 96/97 (Figure 1, Area 4)
96/97	3	X	X	X	Broken at notch; Contact with BW 95/96 (Figure 1, Area 4)
97/98	1				
98/99	1				
99/100	1				
100/101	1				
101/102	1				
102/103	1				
103/104	1				
104/105	1				
105/106	1				
106/107	1				
107/108	1				

Inspection Results Summary

Broken Batwings

- Broken Batwings identified at RF 14 Inspection: 22
- Broken Batwings identified at PO-07-01 Inspection: 22
    - Broken Batwing locations at PO-07-01 Inspection were verified to be the same as identified at RF 14 Inspection (LTR-CDME-06-195 Rev. 0)

Attachment 3* - *Summary of SG32 Batwing Condition

- Broken Batwings identified at RF 15 Inspection: 22
    - Broken Batwing locations at RF 15 Inspection have been verified to be the same as identified at PO-07-01 Inspection (WO-102365)

Loose Batwing Segments

- Loose batwing segments identified during RF 14 inspection: 2 (LTR-CDME-06-195)
- Loose batwing segments identified during PO-07-01 inspection: 4 (WO -102365)
    - Change in number of new loose batwing segments from RF14: 2
- Loose batwing segments identified during RF 15 inspection: 4
    - Change in number of new loose batwing segments from PO-07-01: 0
    - The batwing segment on the top of egg crate 6 observed during the Bottom-up inspection in PO-07-01 is no longer at that location. It is believed that this piece moved to the upper bundle region and is the one observed to be lodged in the upper tube bundle in the vicinity of Row 35 Column 95.

The following are selected pictures from the SG32 Bottom-up and 45-degree inspections that show the batwing damage observed.

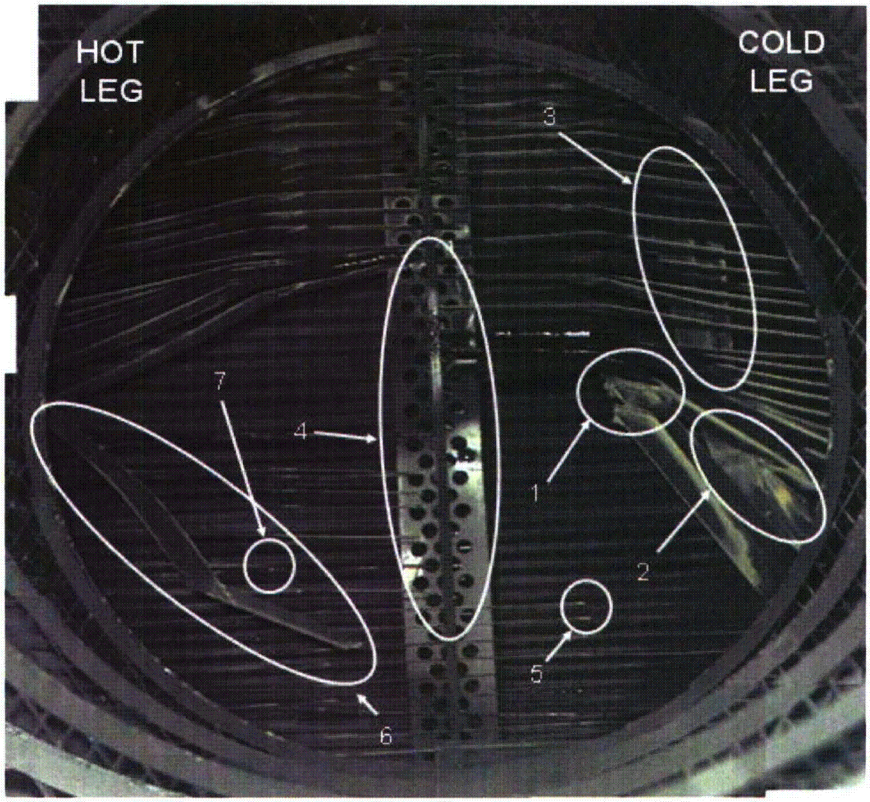


Figure 1

RF15 - Bottom-up View (areas of interest addressed in text are marked)

Attachment 3 - Summary of SG32 Batwing Condition

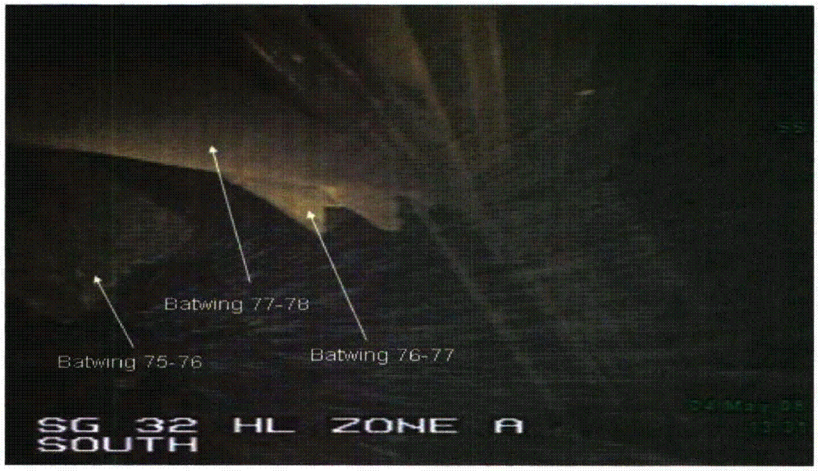


Figure 2

RF15 – View from above the horizontal batwing sections showing severed batwings

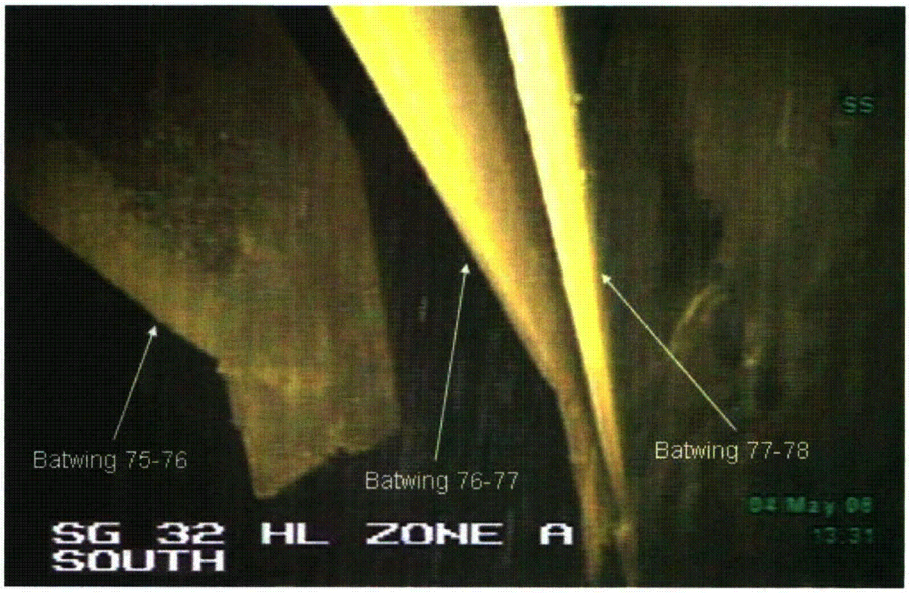


Figure 3

RF15 – Close-up View of severed batwings

Attachment 3 - Summary of SG32 Batwing Condition

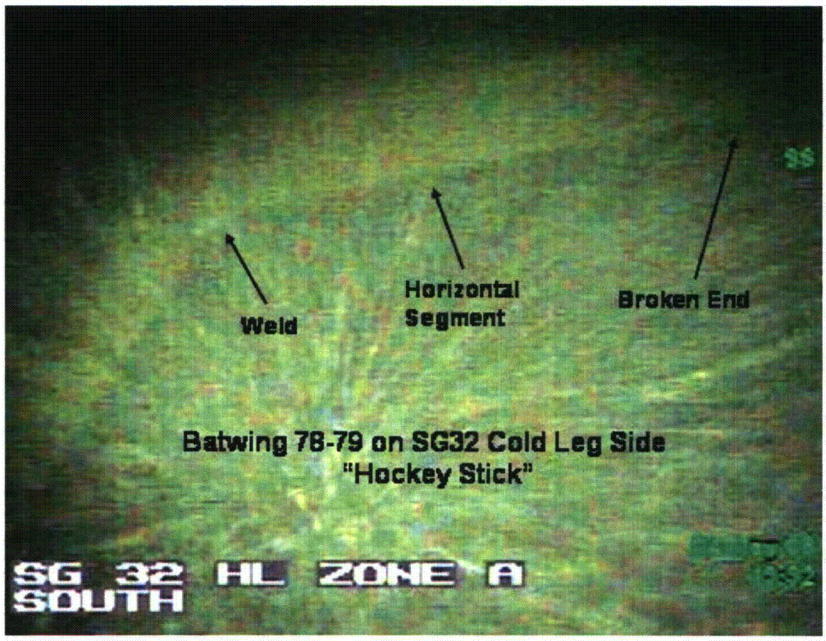


Figure 4

RF15 – Batwing Between Tube Columns 78 and 79
(This "Hockey Stick" is the end of the broken batwing that is curled up above the horizontal parts of the other batwings at the connection bar in the central cavity region)

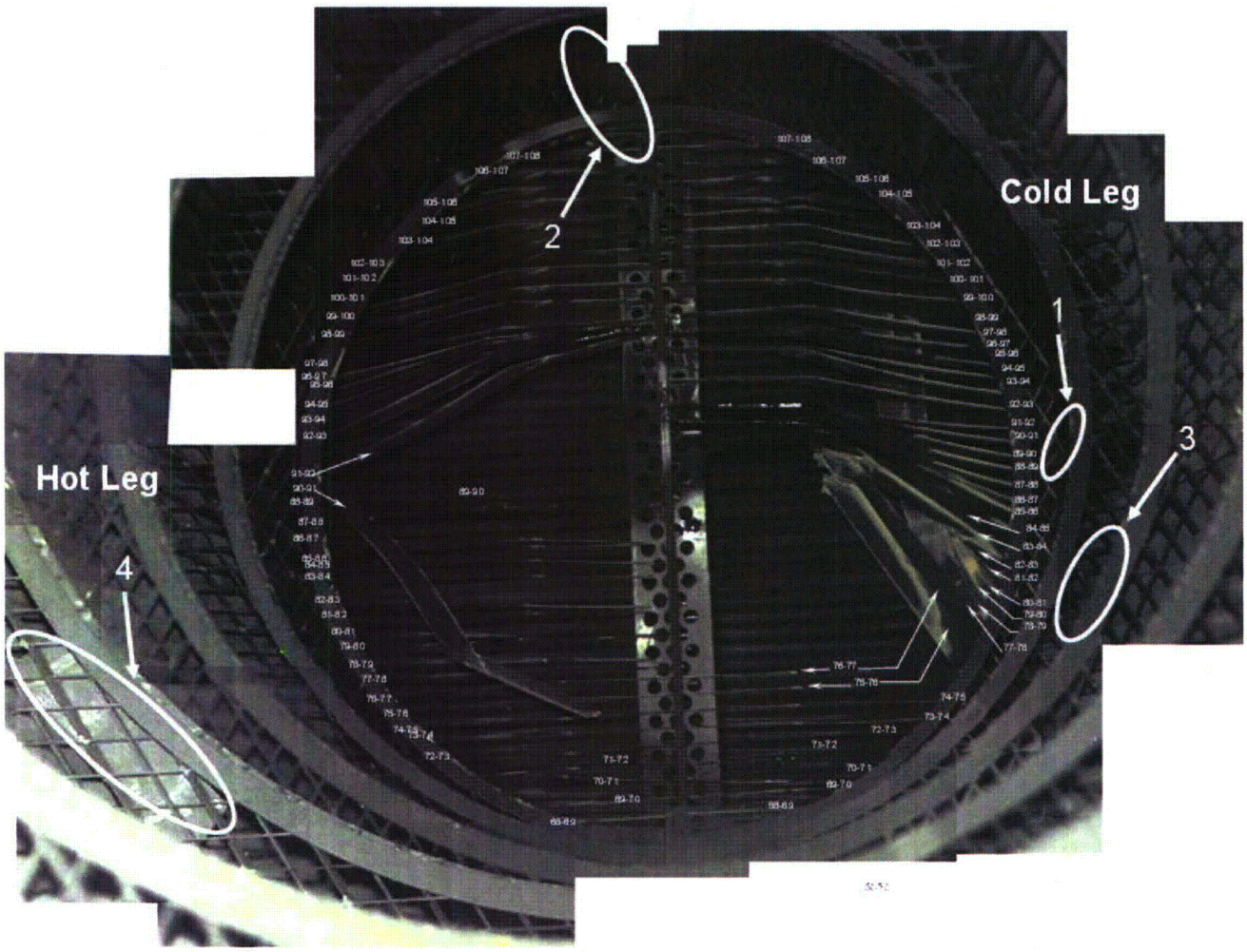
Attachment 4 - Batwing Inventory Evaluation

The following discussion and pictures provides an evaluation of the Waterford 3 RF15 steam generator outage results from secondary side visual inspections performed on SG32. The evaluation primarily focuses on the composite photograph generated from the "bottom-up" inspection and utilizes the video of that examination as well as the 45° Inspection of the upper stay cavity region in the area between the batwings and the tubing U-bends at the top of the SG32 tube bundle.

The results indicate there has been very little change in the batwings since the PO-07-01 outage. For comparison, the PO-07-01 composite photograph is included. The hot leg side is essentially identical to that found during PO-07-01. The cold leg side is also essentially the same with the exception that the loose part on egg crate #6 has moved. It is believed that this part has entered the tube bundle and is lodged in place.

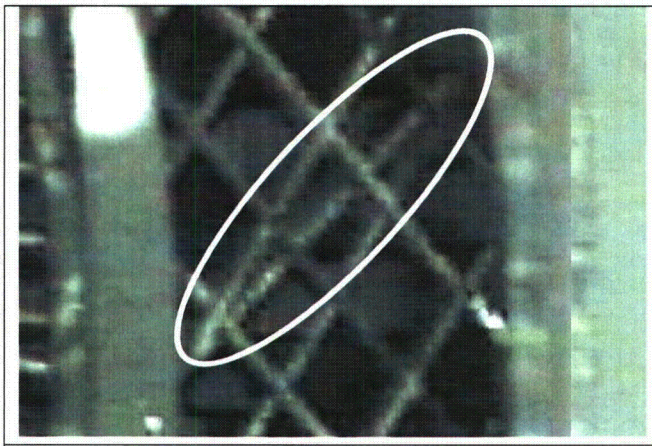
Following the composite photos, figures are provided, as available, to show the progression and status of loose batwing parts and their estimated locations over time (RF14, PO-07-01 and RF15).

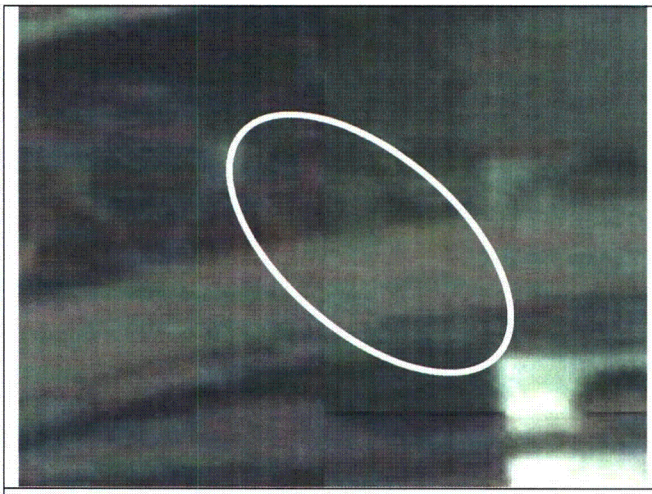
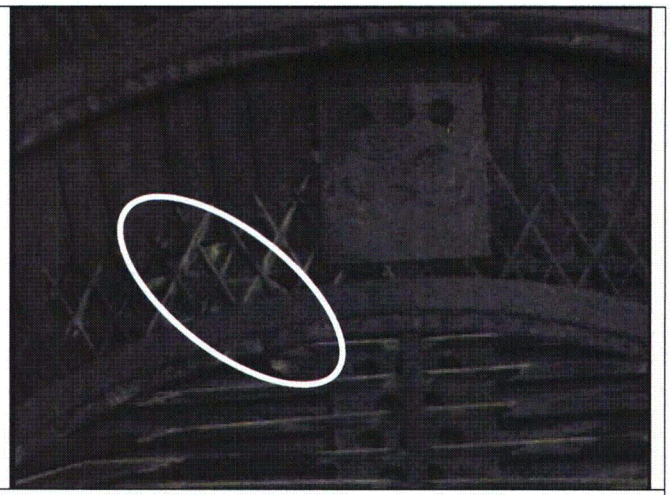
Attachment 4 - Batwing Inventory Evaluation



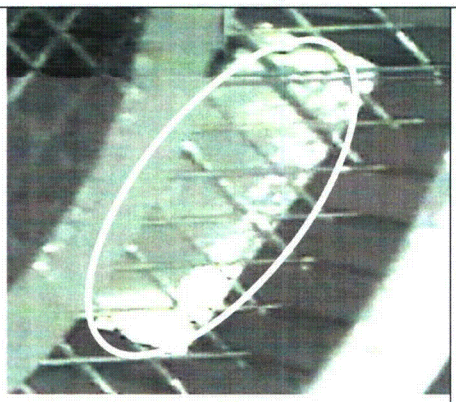
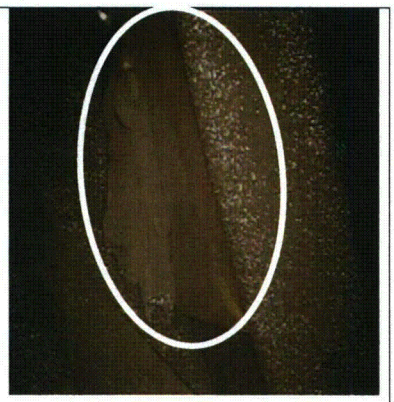
RF15 – SG32 Bottom-Up Inspection Composite Photo

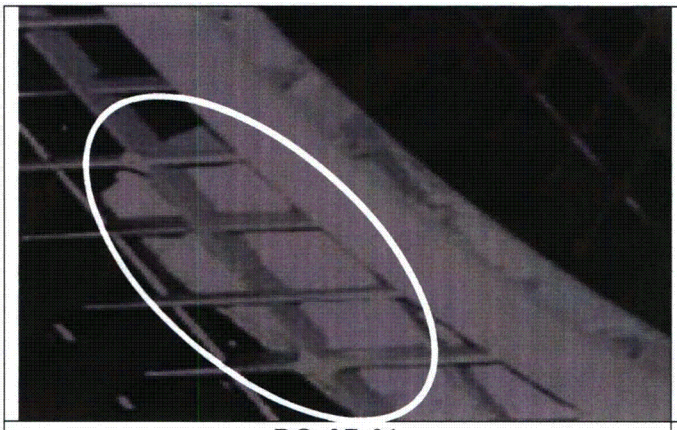
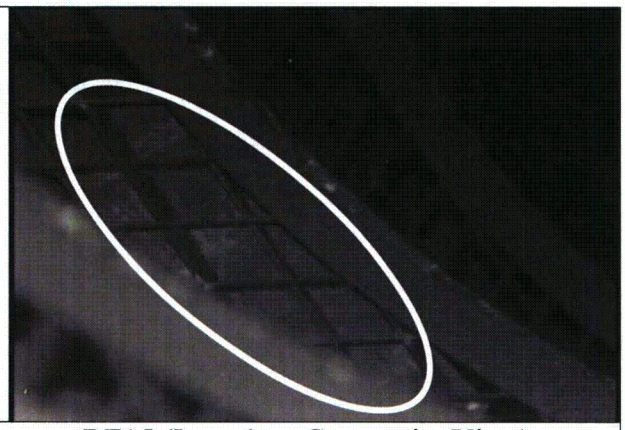
Attachment 4 - Batwing Inventory Evaluation

	
PO-07-01	RF15 (Item 1 on Composite View)
1A: The piece above did not appear to be part of the egg crate during PO-07-01 and was assumed to be a loose part.	1B: Picture above still shows what was assumed to be a loose part in figure 1A on the left. The location is the same.
Figure 1 – Cold Leg Side	

	
PO-07-01	RF15 (Item 2 on Composite View)
2A: A shadow at the same location (above egg crate on south side of hot leg) of a loose batwing piece identified during RF 14 was observed during PO-07-01.	2B: Improved composite quality during RF15 confirms that the shadow shown in 2A to the left is a loose batwing piece that remains in same location
Figure 2 – Hot Leg Side	

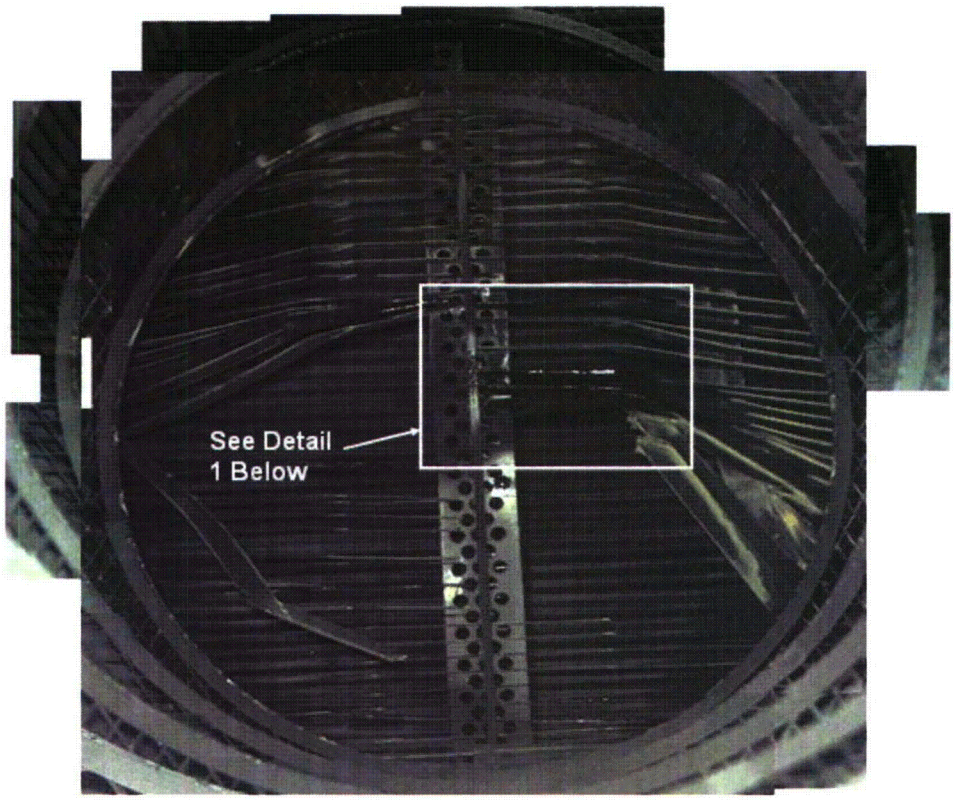
Attachment 4 - Batwing Inventory Evaluation

		
RF14	PO-07-01	RF15 (No longer at location depicted by Item 3 on Composite View)
3A: Batwing part on cold leg side estimated to be 5-6 inches long identified during RF14.	3B: At PO-07-01 the loose batwing part from figure 3A moved to location shown above on egg crate #6. Identification is made by size and batwing inventory.	3C: Batwing loose part shown to the left in 3B has moved. It appears based upon size and batwing inventory that the part shown in figure 3B is the same as the lodged piece of broken batwing in the tube bundle on the south side of the hot leg shown above.
Figure 3 – Cold Leg Side		

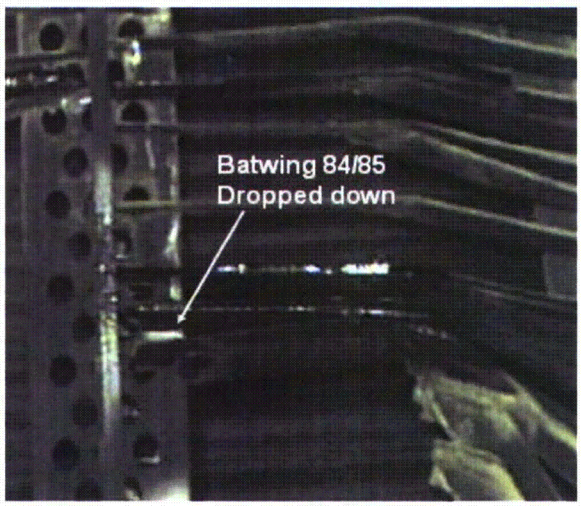
	
PO-07-01	RF15 (Item 4 on Composite View)
4A: Loose part on hot leg side estimated to be 5-6 inches long on egg crate #4 which was assumed to be a severed piece from batwing 80/81 during PO-07-01.	4B: Same loose part observed in 4B to the left is observed again in same location (egg crate #4).
Figure 4 – Hot Leg Side	

Attachment 5 - Post Tube Expansion Bottom-Up Inspection

The photo below was obtained from video data taken after the tube expansions were performed in SG32 to secure the detached batwing between tube columns 84 and 85 on the cold leg side. Comparison of this picture with the RF15 Bottom-Up view shown in Attachment 2 confirms that the expansion process did not alter the batwing configuration.



RF15 - SG32 Post Expansion Bottom-Up Inspection View



Detail 1

Enclosure 3

W3F1-2008-0039

Licensee-Identified Commitments

Table 1
Licensee-Identified Commitments
From Refuel 15 / Operating Cycle 16

This enclosure contains those actions committed to by Entergy in this document. Any other statements in this submittal are provided for information purposes and are not considered to be regulatory commitments.

COMMITMENT	TYPE (Check one)		SCHEDULED COMPLETION DATE (If Required)
	ONE-TIME ACTION	CONTINUING COMPLIANCE	
Waterford 3 will monitor trends in primary to secondary leakage rate in the steam generators. This monitoring will aid in understanding the probable cause(s) of the increase in leakage and assure early detection of an adverse trend prior to challenging one of the administrative limits below. A typical value of this operational leakage rate has been about 0.25 gpd.		X	Maintained in existing ODMI or plant procedures
Any change in the indicated primary to secondary leakage of greater than or equal to 2 gpd will result in increased monitoring to identify the leaking SG and to evaluate and stabilize the condition. The condition will also be evaluated by the Steam Generator Integrity Committee.		X	Maintained in existing ODMI or plant procedures
Should leakage of between 5 gpd and 15 gpd be detected, Waterford 3 will increase monitoring of the N-16 and Condenser Air Evacuation Radiation Monitors and evaluate data from the loose parts monitor to determine if loose parts exist in the stay cavity area of the steam generators. Waterford 3 procedure UNT-005-032 includes actions to address the loss of one of the radiation monitors, including analyzing the leak rate using grab samples from the main condenser evacuation system or the SG blowdown system. This condition will also be evaluated by the Steam Generator Integrity Committee.		X	Maintained in existing ODMI or plant procedures
The Waterford 3 Technical Specification 3.4.5.2 limit for steam generator primary to secondary leakage is 75 gallons per day (gpd). Waterford 3 will administratively invoke a limit of 15 gpd and require the plant be placed in Cold Shutdown within 36 hours if this limit is exceeded.		X	Maintained in existing ODMI or plant procedures

Table 1
Licensee-Identified Commitments
From Refuel 15 / Operating Cycle 16

If Waterford 3 is placed in Cold Shutdown due to violating either of these administrative limits, the steam generators will be inspected, the findings and steam generator condition will be analyzed and evaluated, and appropriate repairs will be made.		X	Maintained in existing ODMI or plant procedures
The installed accelerometers on the SG shell to aid in detecting possible batwing failures or loose parts in the batwing region of the SG will continue to be monitored thru the Loose Parts Monitoring system. The alarm response procedure actions include steps to increase monitoring of SG leakage for a valid loose parts alarm in the steam generator.		X	Maintained in existing ODMI or plant procedures
Waterford 3 will continue to perform augmented inspections of the secondary side of the steam generators in each subsequent refueling outage until the current steam generators are replaced. The augmented inspections will include the upper batwing to wrapper bar welds, inspection of the stay cavity region, and foreign object search and retrieval (FOSAR) of the secondary side.		X	RF16 (next outage)
Waterford 3 operator training will be updated to address the details of the condition of the steam generator.	X		60 days after startup
Steam generator leakage transient simulator scenarios will be used in the operator training in alternating cycles.		X	Maintained in existing training procedure NTP-101