ATTACHMENT 3

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SONGS Unit 3 February 2012 Leaker Outage
Steam Generator Condition Monitoring Report

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SONGS Unit 3 February 2012 Leaker Outage - Steam Generator Condition Monitoring Report

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1.0 PURPOSE

In accordance with the EPRI Steam Generator Integrity Assessment Guidelines [2], a Condition Monitoring (CM) assessment must be performed at the conclusion of each steam generator eddy current examination. This process is described as "backward-looking," since its purpose is to determine whether Steam Generator (SG) integrity was maintained during the most recent operating period. It involves an evaluation of the as-found conditions of the SGs relative to established performance criteria for structural and leakage integrity. The performance criteria are defined in plant Technical Specifications [16] [17] and are based on NEI (Nuclear Energy Institute) 97-06 [1] (see Section 5.0 below).

In late January 2012 during Cycle 16, SONGS (San Onofre Nuclear Generating Station) Unit 3 entered a forced outage due to a SG tube leak, prompting a comprehensive examination of the SGs. This report documents the required SG CM assessment following that examination, and concludes that the tube structural and leakage integrity performance criteria were not satisfied by Unit 3 during Cycle 16 operation.

2.0 ABBREVIATIONS AND ACRONYMS

The following table provides a listing of abbreviations and acronyms used throughout this report.

Table 2-1: Abbreviations and Acronyms

Abbreviation or Acronym	Definition
01C to 07C	Tube Support Plate Designations for Cold Leg (7 Locations)
01H to 07H	Tube Support Plate Designations for Hot Leg (7 Locations)
2E-088	Unit 2 Steam Generator 88
2E-089	Unit 2 Steam Generator 89
3E-088	Unit 3 Steam Generator 88
3E-089	Unit 3 Steam Generator 89
3 NOPD	3 Times Normal Operating Pressure Differential
3ΔP	3 Times Normal Operating Pressure Differential
ADI	Absolute Drift Indication
AILPC	Accident Induced Leakage Performance Criterion
ANO	Arkansas Nuclear One
ASME	American Society of Mechanical Engineers
AVB	Anti-Vibration Bar
B01 to B12	AVB Designations (12 Locations)
BLG	Bulge
C	Column
CE	Combustion Engineering
CL or C/L	Cold Leg
CM	Condition Monitoring
DA	Degradation Assessment
DBE	Design Basis Earthquake
DNG	Ding
DNT	Dent
ECT	Eddy Current Testing
EFPD	Effective Full Power Days
EOC	End of Operating Cycle
EPRI	Electric Power Research Institute
ETSS	Examination Technique Specification Sheet
FOSAR	Foreign Object Search and Retrieval
GMD	Geometric Distortion
GPD	Gallons per Day
GPM	Gallons per Minute

Table 2-1: Abbreviations and Acronyms

Abbreviation or Acronym	Definition
HL or H/L	Hot Leg
INPO	Institute of Nuclear Power Operators
kHz	Kilohertz
KSI	Thousand Pounds per Square Inch
LER	Licensee Event Report
MBM	Manufacturing Burnish Mark
MHI	Mitsubishi Heavy Industries
MSLB	Main Steam Line Break
NDE	Non Destructive Examination
NEI	Nuclear Energy Institute
NN	Nuclear Notification
NOPD	Normal Operating Pressure Differential
NQI	Non-Quantifiable Indication
NRC	Nuclear Regulatory Commission
NSAL	Nuclear Safety Advisory Letter
OA	Operational Assessment
OE	Operating Experience
OTSG	Once Through Steam Generator
PDA	Percent Degraded Area
PLP	Possible Loose Part
POD	Probability of Detection
PRX	Proximity Indication
PSI	Pounds per Square Inch
PSIG	Pounds per Square Inch Gage
PST	Pacific Standard Time
PVN	Permeability Variation
PWR	Pressurized Water Reactor
QA	Quality Assurance
R	Row
RB	Retainer Bar
RCS	Reactor Coolant System
REPL	Replacement
ROLLED	Rolled Plug Designation
ROLLSTAB	Rolled Plug with a Stabilizer
RPC	Rotating Probe Coil
RSG	Recirculating Steam Generator

Table 2-1: Abbreviations and Acronyms

Abbreviation or Acronym	Definition
SCE	Southern California Edison
SG	Steam Generator
SIPC	Structural Integrity Performance Criteria
SL2	St. Lucie Unit 2
SLB	Steam Line Break
SONGS	San Onofre Nuclear Generating Station
SSA	Secondary Side Anomaly
SSI	Secondary Side Inspection
SVI	Single Volumetric Indication
TMI	Three Mile Island
TSP	Tube Support Plate
TTW	Tube to Tube Wear
TW	Through Wall
U3F16B	Unit 3 Outage Designation
UB	U-bend

3.0 SCOPE

This evaluation pertains to the SONGS Unit 3 replacement SGs, which are reactor coolant system components. The CM assessment is required to be completed prior to plant entry into Mode 4 during start up after a SG inspection. The operational assessment (OA) will be documented separately.

4.0 BACKGROUND

SONGS Unit 3 is a two loop Combustion Engineering (CE) PWR (Pressurized Water Reactor) plant which began commercial operation in 1984. The original CE steam generators were replaced in 2010-2011 with new SGs designed and manufactured by Mitsubishi Heavy Industries (MHI) [21]. The replacements, referred to by MHI as model 116TT-1, incorporate thermally treated Inconel Alloy 690 (I-690TT) tubing which has demonstrated, through laboratory testing and industry experience, superior resistance to stress corrosion cracking as compared with the I-600 tubing used in the original SGs. Other design features include full tubesheet depth hydraulic tube expansion and seven stainless steel trefoil broach Tube Support Plates (TSPs); features chosen primarily to minimize the potential for tube corrosion.

There are 9727 tubes in each SG, in 142 rows and 177 columns, in a triangular pitch arrangement. The tubes in rows 1-13 are thermally stress-relieved to further minimize the potential for in-service stress corrosion cracking in the U-bends.

The tube bundle U-bend region is supported by a floating Anti-Vibration Bar (AVB) structure consisting of six V-shaped AVBs between each tube column. The AVBs were fabricated from ASME (American Society of Mechanical Engineers) SA-479, Type 405 ferritic stainless steel and are equipped with two Alloy 690 (ASME SB-168 UNS N06690) end caps. Each AVB end cap is welded to an Alloy 690 retaining bar. The retaining bars with AVBs attached are supported by twenty four chrome-plated Alloy 690 retainer bars that anchor the assembly to the tubes. Thirteen Alloy 690 bridges run perpendicular to the retaining bars, and hold the entire assembly together. The AVB structure is not attached to any steam generator component. Figure 4-1 illustrates the general layout of the tube support structures. Figure 4-2 and Figure 4-3 illustrate the arrangements of the retainer bars and retaining bars.

Figure 4-1: SONGS Steam Generator Support Structure Layout

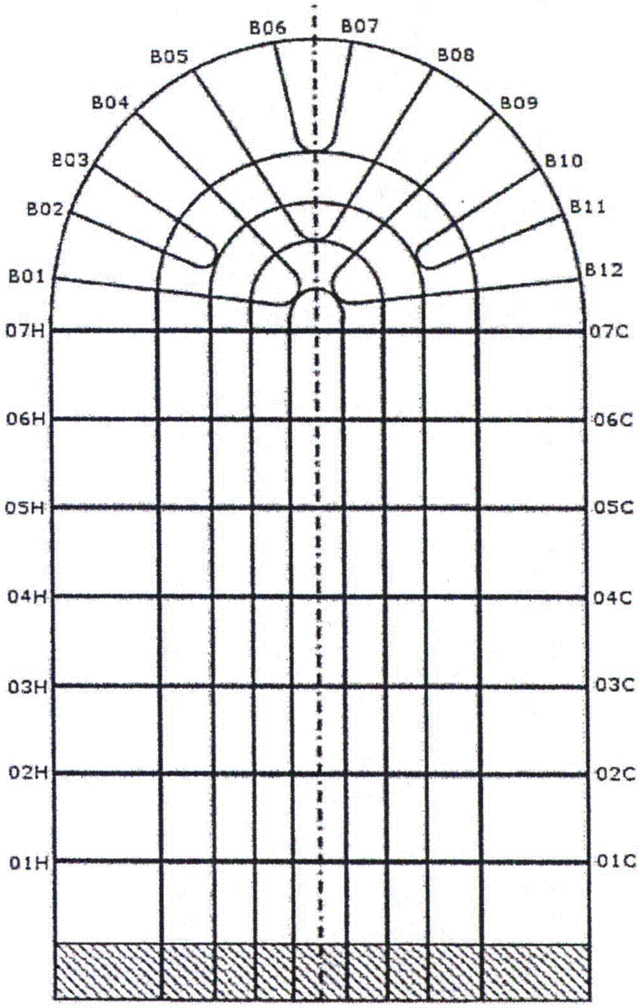
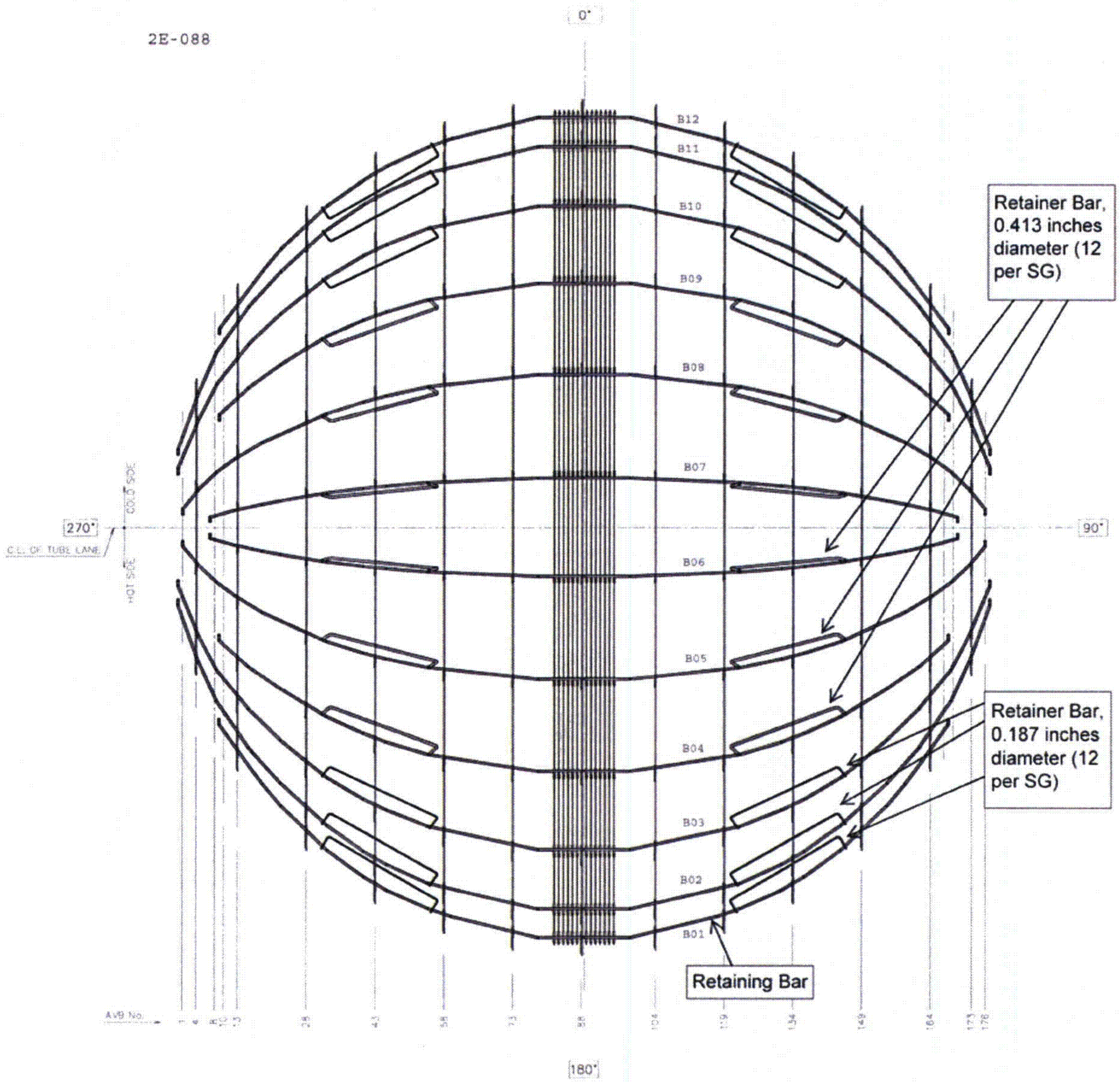
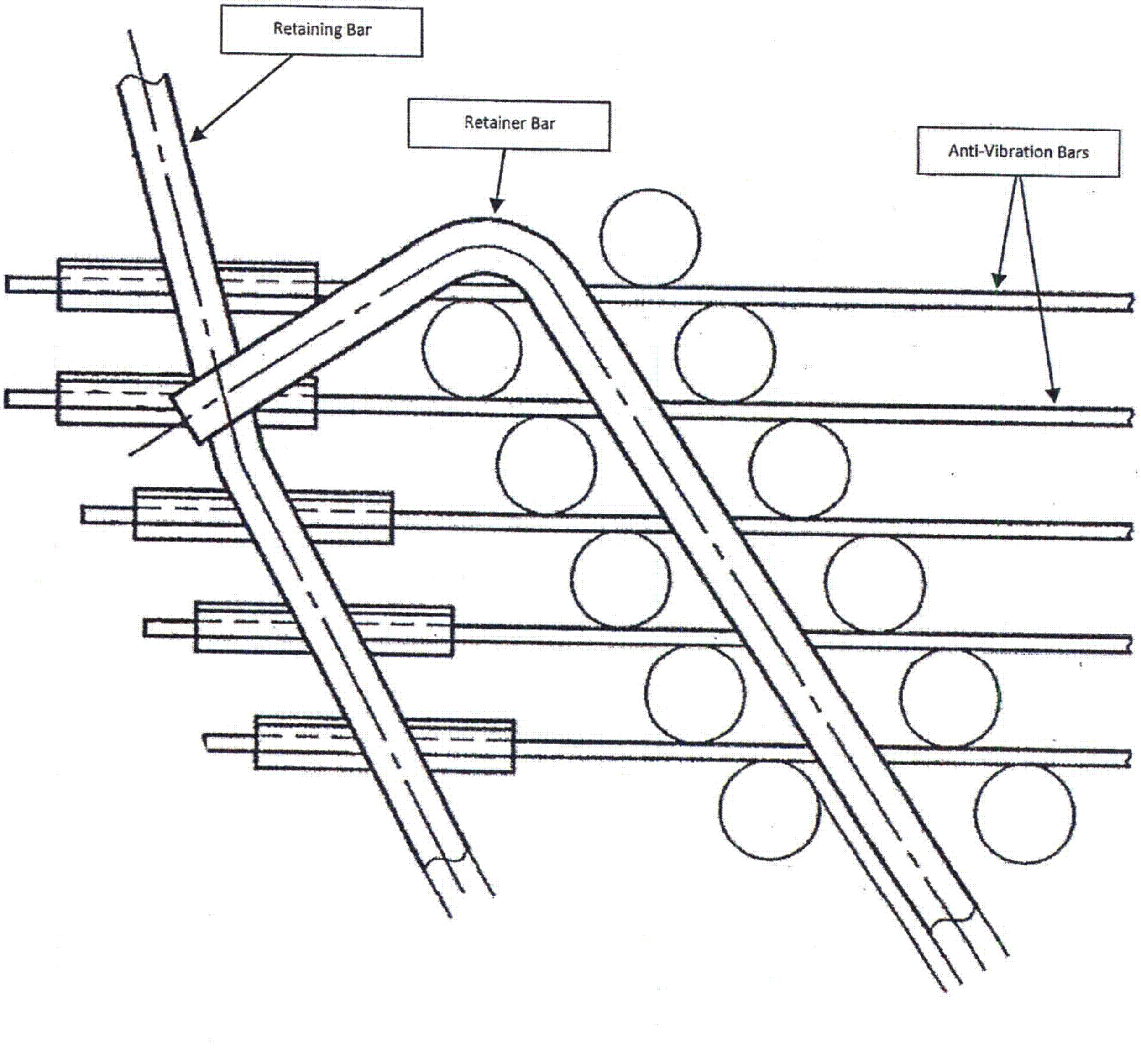


Figure 4-2: View From Above Bundle Showing Retainer Bar Locations



3: Sketch Showing Retainer/Retaining Bar Configuration



4.1 Previous Operating Experience (OE) Related to Tube-to-Tube Wear

Prior to the SONGS Unit 3 shutdown in January of 2012, the recent operating experience related to tub-to-tube wear was limited to once-through steam generators (OTSGs). In December 2011, INPO (Institute of Nuclear Power Operators) OE 34946 [18] was released. This Operating Experience Report discusses experience at Three Mile Island Unit 1 (TMI-1). In July 2012, the NRC (Nuclear Regulatory Commission) released Information Notice 2012-07 [19]. This Information Notice contains information on the experience at TMI-1 as well as Oconee as well as ANO-1 (Arkansas Nuclear One – Unit 1). This section summarizes the experiences at these plants with OTSGs.

TMI-1 completed replacement of its original OTSGs in 2010. The design of the OTSG differs from the recirculating SG design in that the tubes are straight. The tubes are supported by 15 tube support plates. The first inspection of the TMI-1 replacement SGs took place in the fall of 2011. During this examination, indications were detected on the absolute channel with no discernible response on the differential channel. The indications were designated as Absolute Drift Indications (ADIs). A comprehensive review of all of the ADIs identified tubes with long shallow wear signals between the eighth and ninth tube support plates. The indications were in adjacent tube combinations of either 2 or 3 tubes (the tube pattern is a triangular pitch). A more detailed investigation led to the conclusion that these wear indications were the result of tube-to-tube contact wear. The lengths ranged from 2 to 8 inches and from 1 to 21 percent through-wall.

As a result of the TMI-1 findings, and because TMI and ANO both have AREVA replacement steam generators, the licensee for Arkansas Nuclear One, Unit 1 (ANO-1) was notified. Upon a review of previously recorded eddy current examination data, it was determined that ANO-1 also had similar indications of tube-to-tube wear. The depth and length of the ANO-1 indications were similar to those recorded at TMI-1

In the spring of 2012, the licensee for Oconee, also detected wear attributed to tube-to-tube contact in their Unit 3 replacement SGs. Because the design of the Oconee OTSG are built by BWI and are not the same as the TMI or ANO generators, the location of the tube-to-tube wear was different, but the characteristics were similar. The lengths ranged from 1 to 9 inches and the depths ranged up to 20 percent through-wall.

The severity of the replacement OTSG tube-to-tube wear was evaluated and was not found to compromise tube integrity.

The combined experience from the above discussion demonstrated several significant points:

- New or unexpected forms of degradation may be difficult to identify. Robust inspection planning is an important part of identifying new degradation as well as properly characterizing known degradation.
- A comprehensive review of examination data from different perspectives is valuable. By considering the change in indications over time, responses to different channels or techniques, or the spatial distribution of the indications, important information may be found.
- The reporting criteria are critical to proper identification of new or existing damage mechanisms.
- Comprehensive examination of new or replacement steam generators is necessary to ensure that performance is as expected.

4.2 Previous Operating Experience Related to Tube-to-AVB Wear

INPO OE 35359 [20] discusses the results of the first two inspections at St. Lucie Unit 2. The recirculating SGs at St. Lucie Unit 2 were replaced during 2007. During the Cycle 18 Refueling Outage (SL2-18, April 2009), eddy current testing of the replacement SGs reported over 5800 AVB wear indications in more than 2000 tubes. Fourteen tubes were plugged as a result of the wear indications. None of the indications challenged the condition monitoring limits.

Based on the high number of wear indications reported during the SL2-18 inspection, and to further establish growth rates, the St. Lucie Unit 2 SGs were examined again during the next refueling outage at SL2-19 in January 2011. Approximately 3000 new AVB wear indications were reported during the SL2-19 examination. As a result of the SL2-19 inspection, an additional twenty-one (21) tubes were plugged, only one of which exceeded the Plant Technical Specification limit of > 40 %TW (throughwall). None of the indications detected in SL2-19 challenged the condition monitoring limits.

The OE reinforces the importance of inspecting replacement SGs with the bobbin coil at the end of the first cycle of operation, post-replacement. The diagnostic examinations performed with the +Point™ rotating coil concluded that the AVB wear indications could be flat or tapered, single or double sided. These wear characteristics are important to consider when selecting the proper depth-sizing technique(s).

4.3 Pre-Service Examination Results

The pre-service inspection of the Unit 3 replacement SGs was performed during June of 2010 at the MHI manufacturing facility in Kobe Japan. The examination consisted of 100 % bobbin coil inspection of all tubes (9727 tubes), 100 % inspection of the Hot Leg (HL) and Cold Leg (CL) Tubesheet region with the +Point™ probe (9727 tubes), and a 100 % inspection of the row 1-15 U-bend regions with the +Point™ probe (1314 tubes).

No significant degradation was detected during this examination. There were a number of geometric type indications reported in each SG (dings, geometric distortions, proximity, bulge). The following table provides a count of the number of tubes and total number of indications for each Unit 3 SG.

Table 4-1: Summary of Pre-Service Inspection Results

Indication Code	SG 3E-088		SG 3E-089	
	Tube Count	Indication Count	Tube Count	Indication Count
BLG (Bulge)	10	11	3	3
DNG (Ding)	364	395	706	831
GMD (Geometric Distortion)	3	3	5	5
MBM (Manufacturing Burnish Mark)	0	0	0	0
NQI (Non-Quantifiable Indication)	0	0	0	0
PLP (Possible Loose Part)	6	6	3	3
PRX (Proximity)	106	106	128	128
PVN (Permeability Variation)	0	0	0	0

5.0 PERFORMANCE CRITERIA

The SONGS Unit-3 performance criteria, based on NEI 97-06 [1], are shown below. The structural integrity and accident-induced leakage criteria were taken from Section 5.5.2.11 [16] from the SONGS Unit-3 Technical Specifications. The operational leakage criterion was taken from Section 3.4.13 [17] of the SONGS Technical Specifications.

- *Structural Integrity Performance Criterion*: All in-service steam generator tubes shall retain structural integrity over the full range of normal operating conditions (including startup, operation in the power range, hot standby, and cooldown, and all anticipated transients included in the design specification) and design basis accidents. This includes retaining a safety factor of 3.0 against burst under normal steady state full power operation primary-to-secondary pressure differential and a safety factor of 1.4 against burst applied to the design basis accident primary-to-secondary pressure differentials. Apart from the above requirements, additional loading conditions associated with the design basis accidents, or combination of accidents in accordance with the design and licensing basis, shall also be evaluated to determine if the associated loads contribute significantly to burst or collapse. In the assessment of tube integrity, those loads that do significantly affect burst or collapse shall be determined and assessed in combination with the loads due to pressure with a safety factor of 1.2 on the combined primary loads and 1.0 on axial secondary loads.

- *Accident-Induced Leakage Performance Criterion*: The primary to secondary accident-induced leakage rate for any design basis accident, other than a SG tube rupture, shall not exceed the leakage rate assumed in the accident analysis in terms of total leakage rate for all SGs and leakage rate for an individual SG. Leakage is not to exceed 0.5 gpm per SG and 1 gpm through both SGs.

- *Operational Leakage Performance Criterion*: "RCS operational leakage shall be limited to 150 gallons per day primary to secondary leakage through any one steam generator."

6.0 MID-CYCLE 16 OPERATIONAL LEAKAGE

On January 31, 2012 while operating under nominal conditions and at full power, a high radiation alarm from the condenser air ejector monitor indicated a tube leak in one of the two SGs. Following is a verbatim excerpt from the abstract section of the Licensee Event Report [15] describing the leakage and subsequent shutdown.

> *"On 01/31/2012 at 1505 PST, SONGS Unit 3 was in Mode 1 operating at 100 percent power, when a high radiation alarm from the condenser air ejector monitor indicated a tube leak in one of the two steam generators (SGs). A rapid power reduction was commenced in accordance with plant procedures when the primary to secondary leak rate was determined to be greater than 75 gallons per day (gpd) with an increasing rate of leakage exceeding 30 gpd per hour. At 1731 PST, the operators manually tripped the reactor at 35 percent power as directed by procedure, resulting in actuation of the Reactor Protection System which is reportable."*

After cooling to Mode 5 and draining the primary coolant system to midloop, the leaking SG tube (SG 3E-088 R106 C78) was located by filling the secondary side of the SG and pressurizing to 80 psig with nitrogen. The leak location was confirmed by eddy current testing to be within the U-bend portion of the tube bundle, in the tube freespan. The tube degradation which resulted in the leak was tube-to-tube wear (TTW) caused by tube movement caused by fluid-elastic instability (FEI).

Prior to the forced shutdown, the replaced Unit 3 SGs had been operated for approximately 338 EFPD (Effective Full Power Days) in fuel Cycle 16. The tube leak occurred in Unit 3 while Unit 2 was in the midst of a refueling outage. The utility designated the shutdown as U3F16B.

7.0 INSPECTION SUMMARY

The SONGS Unit 3 leaker outage work scope included the following inspection and testing activities in each of the two replacement SGs (SG 3E-088 and SG 3E-089):

- Bobbin probe and rotating probe examinations using site validated ECT techniques [7] [13]
- Secondary side visual examinations [22]
- In-situ pressure testing [11]

The initial examination following shutdown was a visual examination of the tubesheets of both SG 3E-088 and SG 3E-089 with the goal of identifying the tube(s) exhibiting signs of leakage. The leaking tube was visually identified as SG 3E-088 R-106 C-78. This tube and a two tube bounding pattern surrounding this tube (19 tubes total) were examined full length with the bobbin coil probe to determine the location of the leak and to define the type of degradation associated with the leak. Once this was determined, SCE decided on the initial inspection scope which included the following:

- 100% bobbin coil probe (610 mil diameter) examination of the complete tube length in both Steam Generators.
- 100% of all newly reported bobbin "I" codes, PLP, MBM, NQI, SSA, PRX and PVN locations with a rotating +Point™/pancake coil probe.
- 100% of all reported bobbin coil ding (DNG) and dent (DNT) locations measuring >/= 2.0 volts with a rotating +Point™/pancake coil probe.
- All reported bobbin AVB %TW wear measuring >/= 25 %TW and all TSP %TW measuring >/= 30 %TW.

Based on the examination results, a series of seven (7) examination expansions were performed to better characterize and bound the tube-to-tube wear damage.

The subsections below describe findings that are relevant to the condition monitoring assessment.

7.1 Eddy Current Inspections Performed

A summary of the total number of bobbin probe and rotating probe examinations performed during the current outage is provided in Table 7-1. As indicated in Table 7-1, the examination scope was expanded subsequent to completion of the initial plan. These expansions were implemented in some cases to further characterize identified degradation, and in other cases to further bound regions of potential degradation with the more sensitive +Point™ probe.

7.2 Tube-to-Tube Wear Detection

At the start of the U3F16B inspection, the suspected leaking tube (SG 3E-088 R-106 C-78) along with 18 surrounding tubes were inspected with the bobbin coil probe to determine the axial location of the flaw responsible for the leak and to get an understanding as to what type of degradation was associated with the area of the tube with the through wall indication. The degradation observed in the first nineteen tubes examined included AVB wear, deep wear at the TSP's (both hot and cold leg) and long wear type indications in the U-bend region which were eventually classified as Tube-to-Tube Wear (TTW). It was ultimately determined that the Tube-to-Tube Wear was the type of degradation responsible for the tube leak.

The SONGS eddy current inspection procedure was updated to include enhanced screening of the U-bend area of the tube using the 100 kHz absolute channel with no voltage criteria for the reporting of small amplitude signals in the U-bend area of the tube. All analysts assigned to the SONGS inspection were made aware of the revised procedure and screening process and bobbin coil data was screened according to the new requirements set forth in the bobbin coil technique Examination Technique Specification Sheet (ETSS).

The TTW indications were initially identified as NQI during the bobbin coil analysis with the "from-to" fields of the report line entry defining the overall length. No depth was assigned to the NQI bobbin coil entries. Over 300 NQI's were reported in the U-bend area of each SG. All of the tubes with reported U-bend NQI's were examined with the rotating 1-coil +Point™ probe through the complete region of the U-bend (07H to 07C). Most of the NQI's were confirmed to be degradation categorized as TTW and were reported as Single Volumetric Indications (SVI's).

The TTW indications were very long and ranged in length from approximately 1.0" to 41.0" and in depth from 4% to 100% through wall. In many cases, the region of the tube with the TTW present would have two separate indications, one on the intrados of the tube and one on the extrados of the tube. In this case, two separate SVI's would be reported with measured depth and length. In addition to the tubes with reported bobbin coil NQI's, additional tubes surrounding the TTW region were also examined with the 1-coil rotating +Point™ probe. With these supplemental inspections, a total of 1375 contiguous tubes in each SG were examined the full length of the U-bend (07H-07C) specific to the detection of TTW. As a result of these inspections, 407 TTW SVI indications (161 tubes) were reported in SG 3E-088 and 416 TTW SVI indications (165 tubes) were reported in SG 3E-089.

The TTW indications were depth sized using EPRI ETSS 27902.2 even though it was known to be very conservative. Selected TTW SVI indications based on depth were line by line sized using the ETSS 27902.2 technique.

The Unit 3 experience in the detection and sizing of the TTW damage mechanism was reflected back into the Unit 2 examination which had just been completed.

7.3 Tube-to-Tube Wear Sizing

Upon detection of tube-to-tube wear in the Unit 3 SG's, a determination was made that the most appropriate technique for sizing the wear was EPRI ETSS 27902.2 or 27902.5. However, with some initial review, it was apparent that the techniques produced very conservative depth estimates. The depth estimates reported for the deepest indications were near throughwall, however the tubes had maintained structural integrity at normal operating differential pressure (NODP). Using the actual tube operational performance, the throughwall depth values should have been around 80 %TW or smaller. Based on the best understanding of the tube-to-tube wear degradation morphology, a wear standard was designed with two machined wear flaws. Although the sample had only two separate flaws, the flaws were fabricated to a maximum depth of 81 % TWD. The length of the flaws made it possible to measure multiple discrete depth sizing grading units. On the basis of these multiple points, a polynomial function was developed to adjust the depth estimates. The revised technique was documented in Reference 13.

The actual flaw sizing was performed using the 27902.2 technique. Screening for selection of In-Situ pressure test candidates was based on the 27902.2 sizing data without the polynomial correction in Reference 13. This produced a conservative population for the In-Situ pressure testing.

7.4 Degradation Identified

The following tube wear categories (types) were identified during the current outage inspections:

- Anti-vibration bar (AVB) wear
- Tube support plate (TSP) wear
- Retainer bar (RB) wear
- Tube-to-tube wear (TTW)

Table 7-2 summarizes the number of identified degradation indications for each of the wear categories identified (AVB wear, TSP wear, RB wear, and TTW). A complete accounting of the number of tubes plugged and stabilized is provided in Table 7-3, and the plugging/stabilization lists for both SGs are provided in Appendices A and B. The plugging and stabilization information provided in this table and the appendices is current as of June 2012. Due to the ongoing SG recovery efforts, the plugging strategy and, hence, the plugging and stabilization information shown in this report may change prior to startup.

Table 7-4 through Table 7-7 summarize the reported throughwall depths for each category. Because only four RB wear indications were identified, Table 7-6 lists these indications by tube number and provides the structurally equivalent length and depth, as well as the overall length and maximum depth of the wear. The structurally equivalent dimensions correspond to a rectangular flaw which would burst at the same pressure as the measured flaw; determined using the methods described in Section 5.1.5 of Reference 4.

While AVB wear accounts for the largest number of indications and affected tubes, it is the least structurally challenging damage mechanism among those identified.

Figure 7-1 provides histograms of reported AVB wear depths for both SGs which demonstrate that the vast majority of AVB wear was less than 25 %TW. Approximately 50% more AVB wear indications were identified in Unit 3 than in Unit 2; however, the depth distributions at both units were very similar (Figure 7-2). However, since Unit 3 operated for only part of a cycle, it must be concluded that AVB wear is progressing more aggressively at Unit 3 than at Unit 2.

Figure 7-3 provides histograms of reported TSP wear depths for both SGs. This data illustrates that a significant number of tubes experienced TSP wear with throughwall depths in excess of the criteria for plugging. This contrasts sharply with the relatively minor TSP wear identified at Unit 2 after a full cycle of operation (Figure 7-4).

Only four tubes experienced RB wear but three of the four indications exceeded the 35 %TW plugging criteria.

Figure 7-6 through Figure 7-17 provide tubesheet maps illustrating the locations of degradation reported in each SG. The AVB wear is most prevalent in the central region of the tubesheet matrix, in longer tube rows. The most severe TSP wear occurred in the same region as the TTW: a discrete centralized region of the bundle in higher row tubes (Figure 7-14 through Figure 7-17).

7.5 Secondary Side Visual Examination Results

Due to the wear degradation detected, significant secondary side inspections (SSI) were performed. The main purposes of these inspections were to provide confirmation of the eddy current results and obtain additional information to help with the root cause evaluation. These visual inspections included the following:

1. All small diameter retainer bars.
2. Retaining bars and AVB end caps associated with B04 and B09.
3. 7^{th} tube support plate
4. Inner bundle passes at B01, B04, and B09.

The retainer bars, retaining bars, and AVB end caps appeared to be structurally sound with no evidence of corrosion, broken welds, etc. The 7^{th} TSP inspection revealed no unexpected or unusual conditions.

The inner bundle passes in the U-bend were performed by going through the transition cone handhole above the 7^{th} TSP and entering the tube bundle at either 90 degree or 30 degree angles. The 90-degree inspections included many passes between Columns 73 and 87. These inspections showed some wear indications that extended slightly outside of the AVB intersection. This phenomenon was confirmed with eddy current. Additional passes were made between Columns 50 and 60. These inspections did not show any AVB wear outside the AVB intersections.

During the secondary side examination activities described above, no foreign objects were identified. In addition, during the eddy current inspection, no potential loose parts were identified. Therefore, no unscheduled secondary side FOSAR (Foreign Object Search and Retrieval) activities were required.

Table 7-1: Steam Generator Tube Inspection Scope Summary

SCOPE DESCRIPTION			S/G 3E-088			S/G 3E-089		
Leg	*Exam Description*	*Extents*	*Analyzed*	*Scope*	*%Completed*	*Analyzed*	*Scope*	*%Completed*
Hot / Cold	100 % Bobbin F/L	TEH-TEC	9,727	9,727	100.00%	9,727	9,727	100.00%
Hot	HL Special Interest	Various	283	283	100.00%	309	309	100.00%
Cold	CL Special Interest	Various	218	218	100.00%	242	242	100.00%
Hot	UB Special Interest	Various	16	16	100.00%	3	3	100.00%
Cold	UB Special Interest	Various	5	5	100.00%	0	0	N/A
Hot/Cold	UB NQI Rows<70	07H-07C	19	19	100.00%	1	1	100.00%
Hot	HL UB NQI Rows>=70	07H-B07	150	150	100.00%	168	168	100.00%
Cold	CL UB NQI Rows>=70	07C-B07	150	150	100.00%	168	168	100.00%

Expansion 1 – Retainer Bar Region

SCOPE DESCRIPTION			S/G 3E-088			S/G 3E-089		
Hot	HL U-Bend Retainer Bar Tubes	07H-B07	90	90	100.00%	93	93	100.00%
Cold	C/L U-Bend Retainer Bar Tubes	07C-B07	90	90	100.00%	93	93	100.00%

Expansion 2 – Bound Tube-to-Tube Wear (TTW) Region

SCOPE DESCRIPTION			S/G 3E-088			S/G 3E-089		
Hot	H/L U-Bend Bounding Region #1	07H-B07	72	72	100.00%	63	63	100.00%
Cold	C/L U-Bend Bounding Region #1	07C-B07	72	72	100.00%	63	63	100.00%

Expansion 3 – Additional Characterization of Wear

SCOPE DESCRIPTION			**S/G 3E-088**			**S/G 3E-089**		
Hot	**H/L Straight TWD>20% Not Already RPC'd**	**Various**	**N/A**	**N/A**	**N/A**	**3**	**3**	**100.00%**
Hot	**H/L U-Bend TWD>20% Not Already RPC'd**	**Various**	**23**	**23**	**100.00%**	**11**	**11**	**100.00%**
Cold	**C/L U-Bend TWD>20% Not Already RPC'd**	**Various**	**2**	**2**	**100.00%**	**N/A**	**N/A**	**N/A**

Expansion 4 – Additional Bounding of TTW Region

SCOPE DESCRIPTION			**S/G 3E-088**			**S/G 3E-089**		
Hot	**HL U-Bend Freespan Wear Zone Bounding #1**	**07H-B07**	**146**	**146**	**100.00%**	**183**	**183**	**100.00%**
Cold	**C/L U-Bend Freespan Wear Zone Bounding #1**	**07C-B07**	**146**	**146**	**100.00%**	**183**	**183**	**100.00%**

Expansion 5 - Additional Characterization of Wear

SCOPE DESCRIPTION			**S/G 3E-088**			**S/G 3E-089**		
Hot	**H/L TSP +Point**	**TSP +/-3**	**133**	**133**	**100.00%**	**N/A**	**N/A**	**N/A**
Cold	**C/L TSP +Point**	**TSP +/-3**	**133**	**133**	**100.00%**	**N/A**	**N/A**	**N/A**
Hot	**H/L U-Bend +Point**	**07H-B07**	**19**	**19**	**100.00%**	**N/A**	**N/A**	**N/A**
Cold	**C/L U-Bend +Point**	**07C-B07**	**19**	**19**	**100.00%**	**N/A**	**N/A**	**N/A**
	Total Plan		**11,513**	**11,513**	**100.00%**	**11,310**	**11,310**	**100.00%**

Expansion 6 – Post In-Situ Pressure Testing

SCOPE DESCRIPTION			**S/G 3E-088**			**S/G 3E-089**		
Hot/Cold	**Bobbin F/L**	**TEH-TEC**	**73**	**73**	**100.00%**	**56**	**56**	**100.00%**
Hot	**H/L U-Bend RPC**	**07H-B07**	**73**	**73**	**100.00%**	**56**	**56**	**100.00%**
Cold	**C/L U-Bend RPC**	**07C-B07**	**73**	**73**	**100.00%**	**56**	**56**	**100.00%**
Hot	**H/L Straight TSP Wear**	**Various**	**232**	**232**	**100.00%**	**179**	**179**	**100.00%**
Cold	**C/L Straight TSP Wear**	**Various**	**180**	**180**	**100.00%**	**172**	**172**	**100.00%**
	Total Plan		**631**	**631**	**100.00%**	**519**	**519**	**100.00%**

Expansion 7 – U-Bend RPC

SCOPE DESCRIPTION			**S/G 3E-088**			**S/G 3E-089**		
Hot	**H/L U-Bend RPC**	**07H-B07**	**993**	**993**	**100.00%**	**964**	**964**	**100.00%**
Cold	**C/L U-Bend RPC**	**07C-B07**	**993**	**993**	**100.00%**	**964**	**964**	**100.00%**
	Total Plan		**1,986**	**1,986**	**100.00%**	**1,928**	**1,928**	**100.00%**

Table 7-2: Wear Indication Summary

Steam Generator SG3E88 (Through-Wall Wear)	Anti-Vibration Bar	Tube Support Plate	Tube-to-Tube Wear	Retainer Bar	Foreign Object	Total Indications	Tubes with Indications (out of 9727 total per SG)
≥ 50%	0	117	48	0	0	165	74
35 - 49%	3	217	116	2	0	338	119
20 - 34%	156	506	134	1	0	797	197
10 - 19%	1380	542	98	0	0	2020	554
< 10%	1818	55	11	0	0	1884	817
TOTAL	3357	1437	407	3	0	**5204**	**919***

* This value is the number of tubes with wear indications at any depth and at any location. Since many tubes have indications in more than one depth and locations, the total number of tubes is less than the total number of indications.

Steam Generator SG3E89 (Through-Wall Wear)	Anti-Vibration Bar	Tube Support Plate	Tube-to-Tube Wear	Retainer Bar	Foreign Object	Total Indications	Tubes with Indications (out of 9727 total per SG)
≥ 50%	0	91	26	0	0	117	60
35 - 49%	0	252	102	1	0	355	128
20 - 34%	45	487	215	0	0	747	175
10 - 19%	940	590	72	0	0	1602	450
< 10%	2164	94	1	0	0	2259	838
TOTAL	3149	1514	416	1	0	**5080**	**887***

* This value is the number of tubes with wear indications at any depth and at any location. Since many tubes have indications in more than one depth and locations, the total number of tubes is less than the total number of indications.

Table 7-3: Plugging Summary

Reason for Plugging	Steam Generator		Total*
	3E-088	3E-089	
U-bend TTW**	161	165	326
Retainer Bar Wear	3	1	4
AVB Wear >=35%	1		1
Preventative (TTW - MHI Screening)	151	112	263
Preventative (TTW Fence)***	11	14	25
Preventative (Six Consecutive AVB Wear Inds)	2	2	4
Preventative - Retainer Bar	91	93	184
Total	420	387	807

* The plugging status shown in this table is current as of June 2012. Due to the ongoing SG recovery efforts, the plugging strategy and, hence, the numbers shown in this table may change prior to startup.

** Many tubes with TTW also have support wear >=35%. These tubes are only included in the TTW category.

*** "TTW Fence" refers to the plugging and stabilization of tubes to bound tubes with TTW.

Table 7-4: AVB Wear Depths (%TW) (Bobbin ETSS 96004.1)

SG	Average	Upper 95th	Maximum
3E-088	10.2	19	37
3E-089	8.8	16	30
Both SGs	9.5	18	37

Table 7-5: TSP Wear Depths (%TW) (Bobbin ETSS 96004.1)

SG	Average	Upper 95th	Maximum
3E-088	25.8	55	72
3E-089	24.7	52	79
Both SGs	25.2	53	79

Table 7-6: Retainer Bar Wear (+Point™ ETSS 27903.1)

SG	Row	Col	Location	Circ Extent (in)	Axial Extent (in)	Structural Depth (%TW)	Structural Length (in)
3E-088	117	137	B10-0.42"	0.36	0.32	44	0.26
3E-088	125	49	B11-0.50"	0.26	0.31	29	0.27
3E-088	128	126	B10-0.44"	0.26	0.29	39	0.24
3E-089	124	130	B11-0.47"	0.31	0.32	45	0.27

Table 7-7: Tube-to-Tube Wear (%TW) (+Point™ ETSS 27902.2)

SG	Average	Upper 95th	Maximum
3E-088	32.5	60	99
3E-089	30.4	51	66
Both SGs	31.4	57	99

Figure 7-1: Unit 3 AVB Wear Depth Distribution (Indication Count)

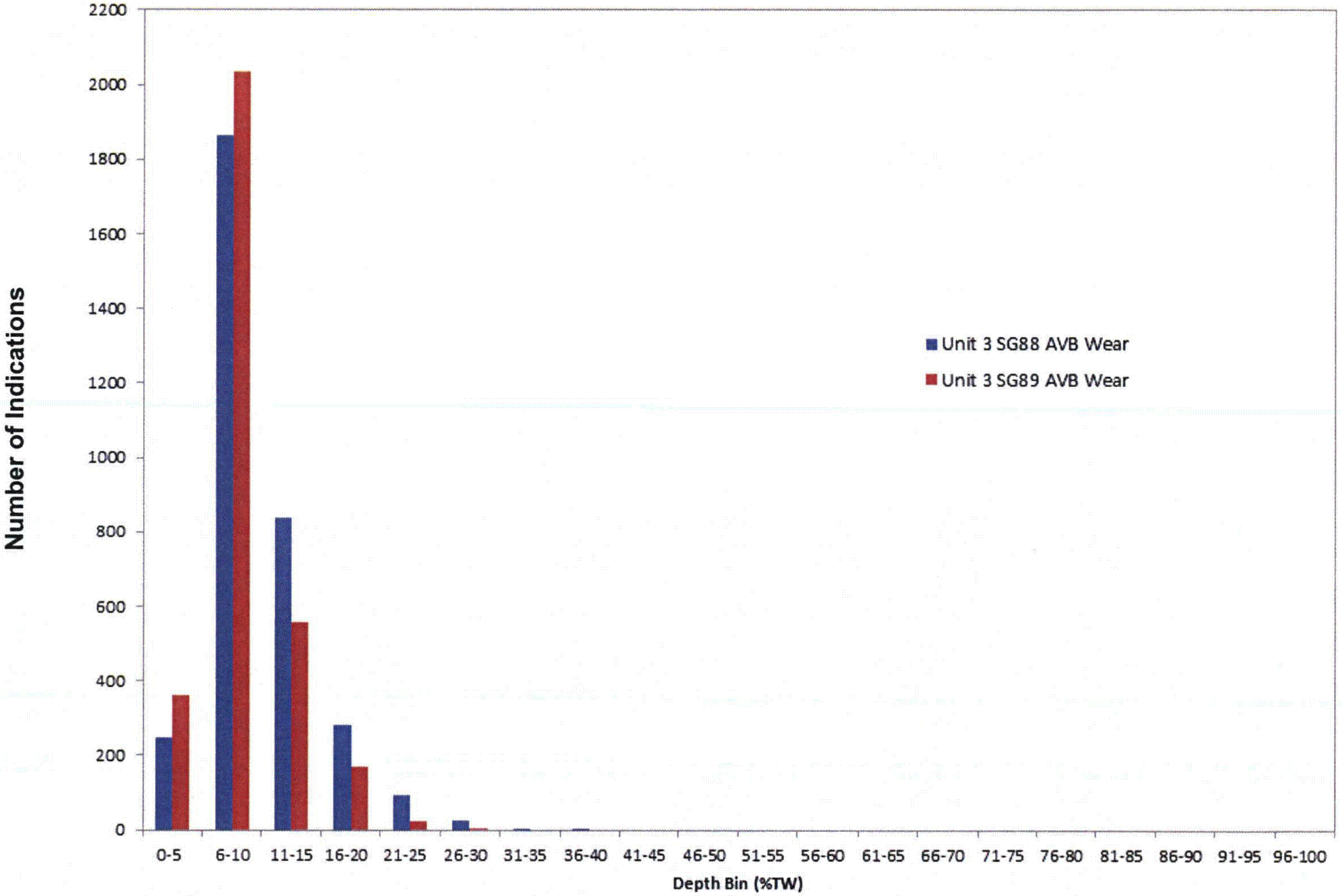


Figure 7-2: Comparison of Unit 2 and Unit 3 AVB Wear Depth Distribution (Indication Count)

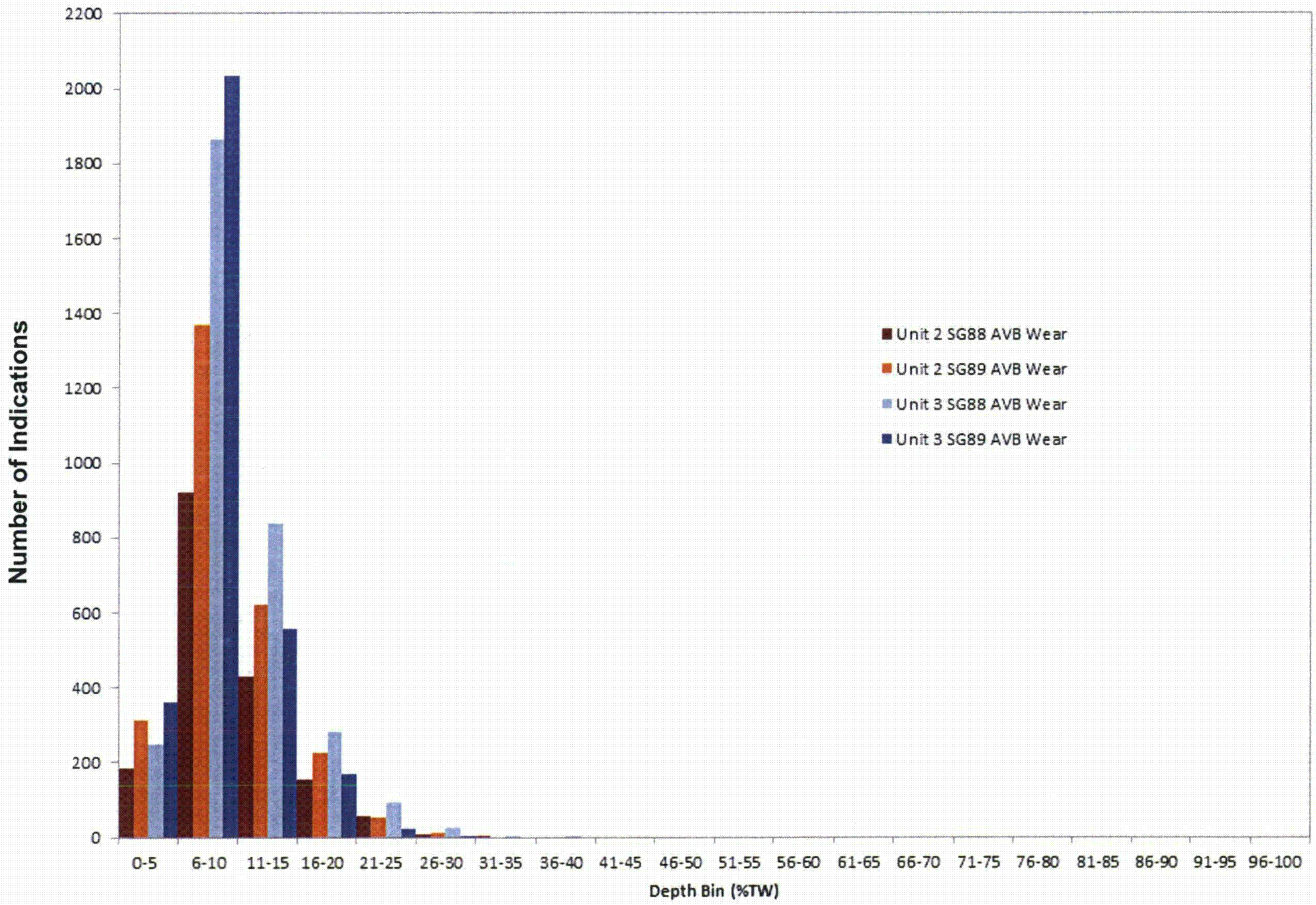


Figure 7-3: Unit 3 TSP Wear Depth Distribution (Indication Count)

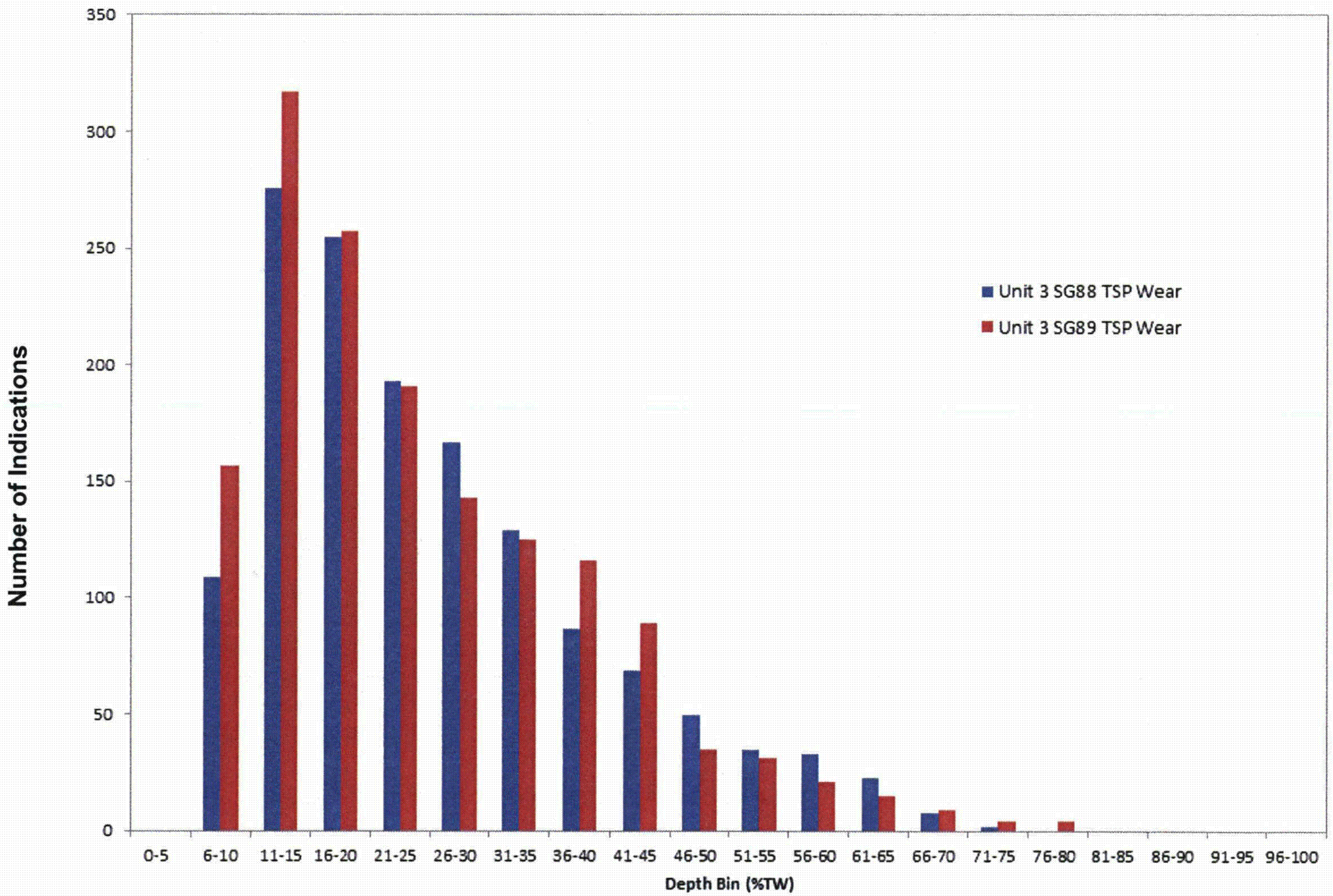


Figure 7-4: Comparison of Unit 2 and Unit 3 TSP Wear Depth Distribution (Indication Count)

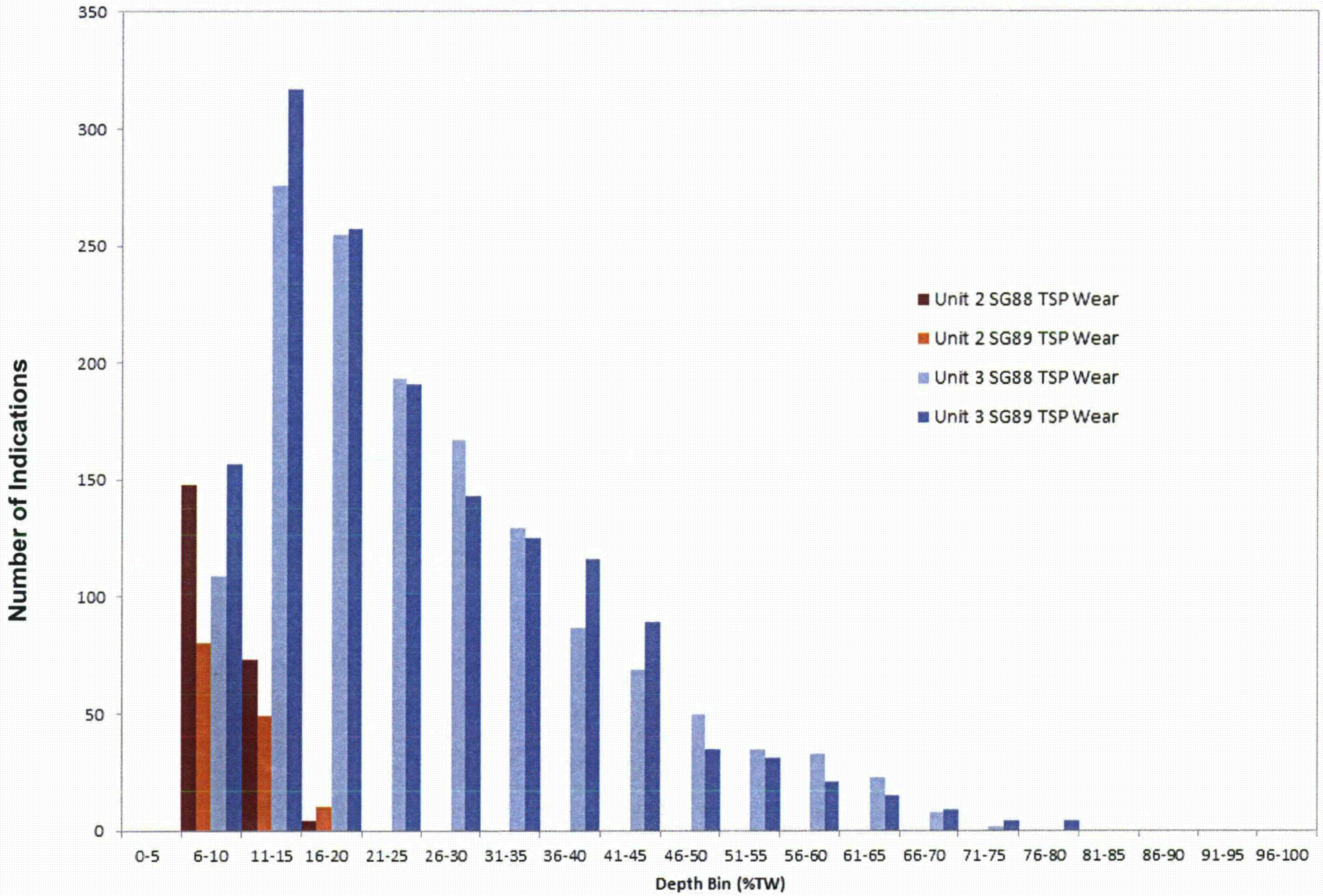


Figure 7-5: Unit 3 TTW Depth Distribution (Indication Count)

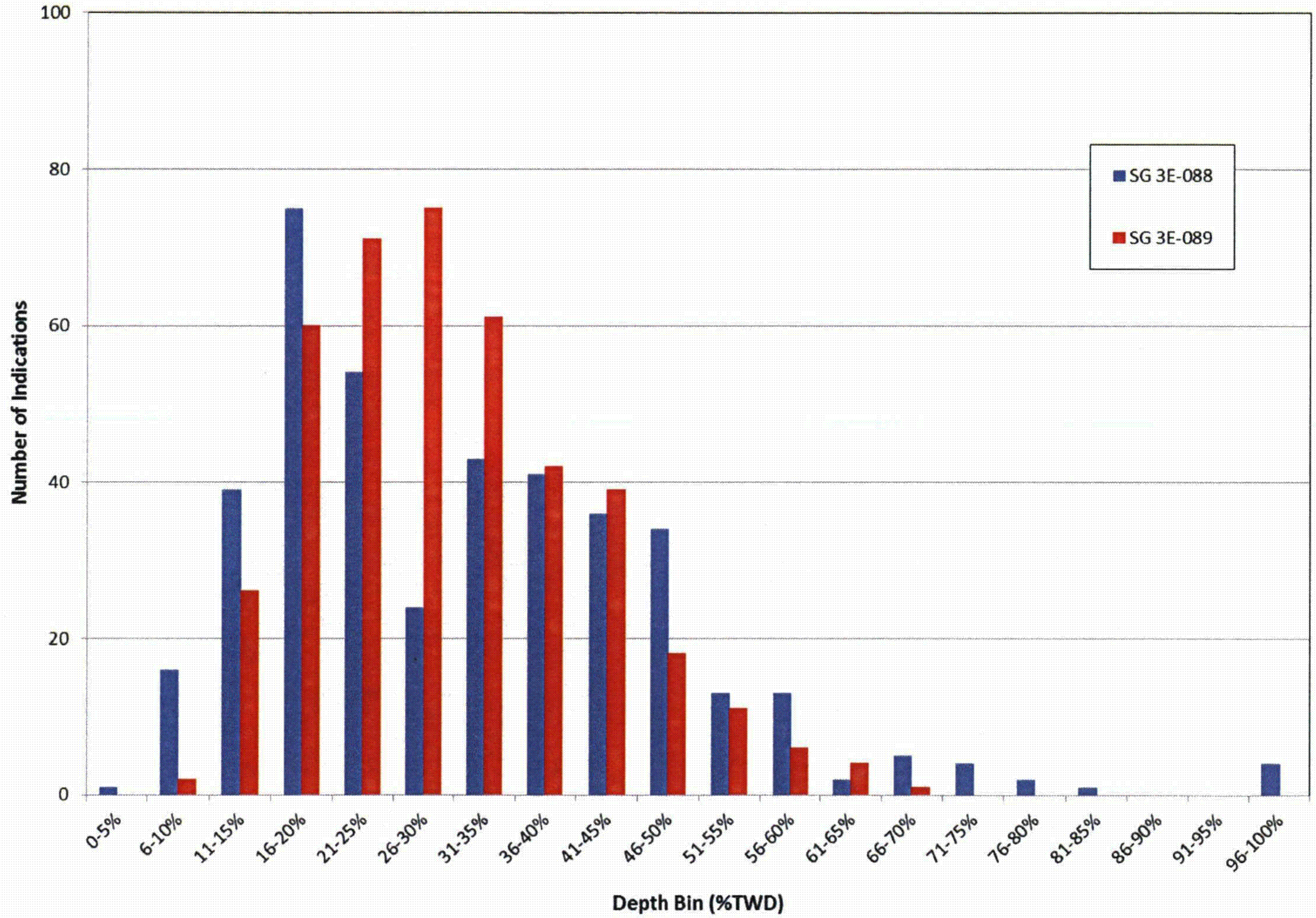


Figure 7-6: SG 3E-088 AVB Wear

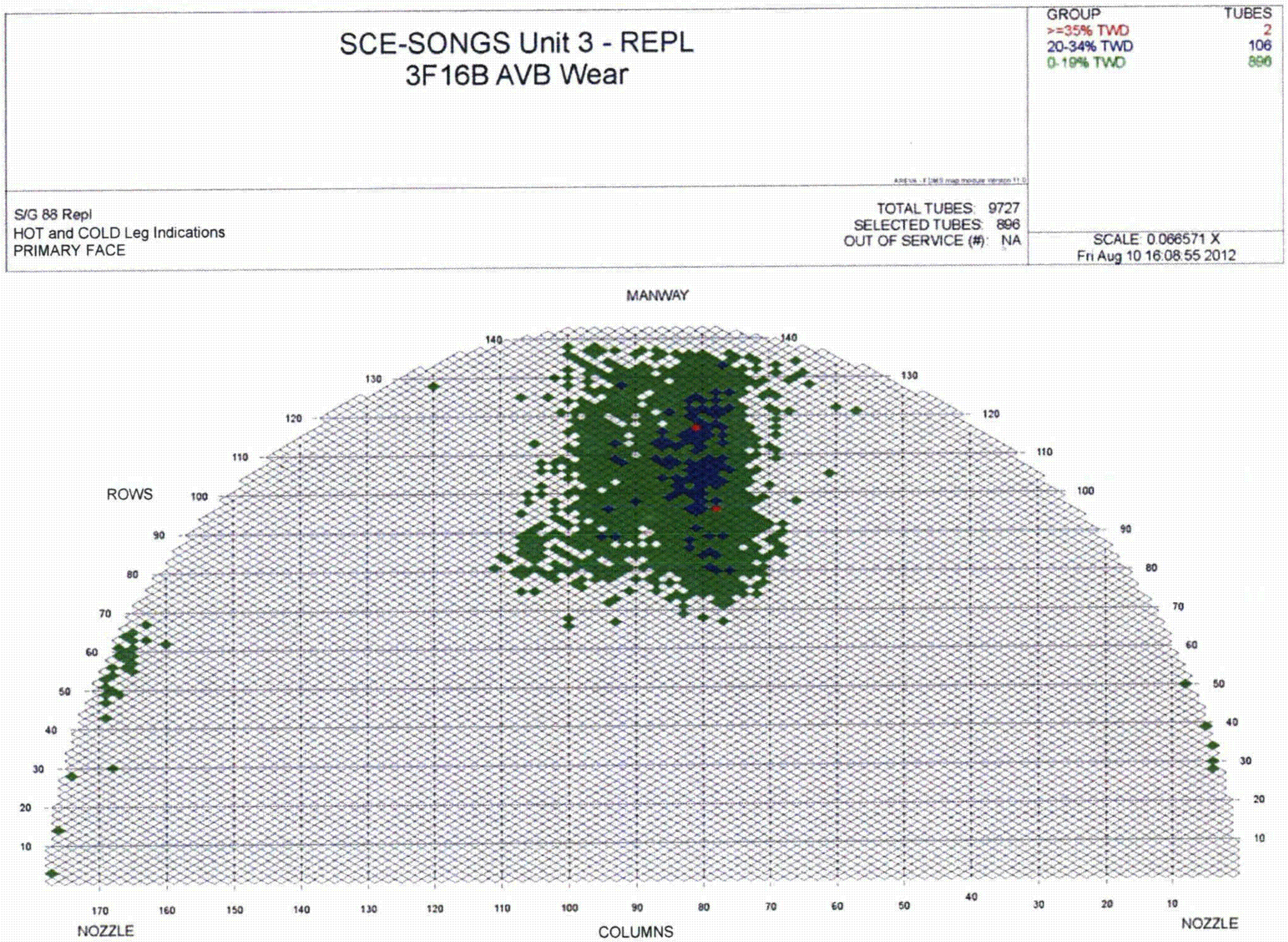


Figure 7-7: SG 3E-089 AVB Wear

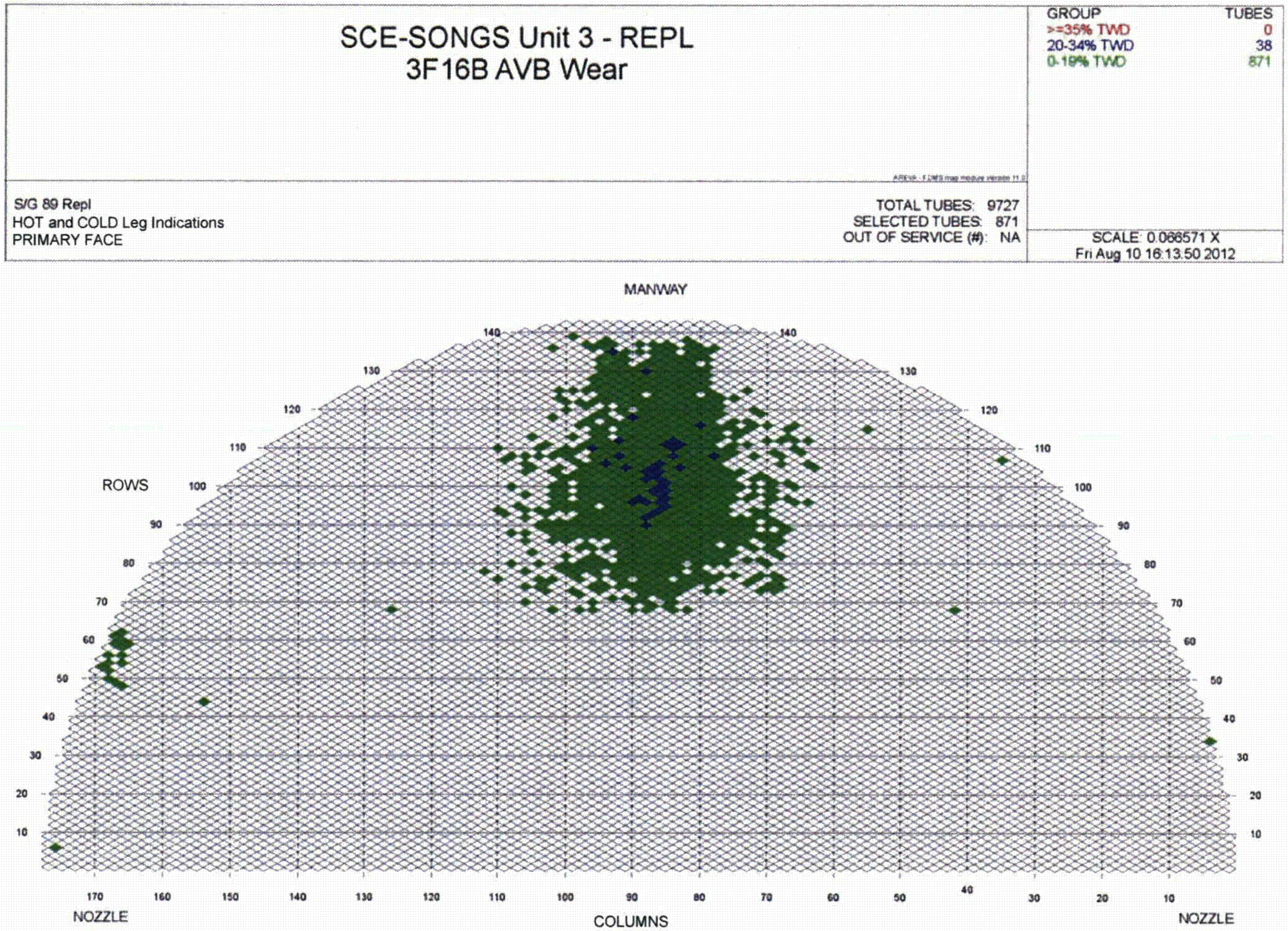


Figure 7-8: SG 3E-088 TSP Wear – Hot Leg

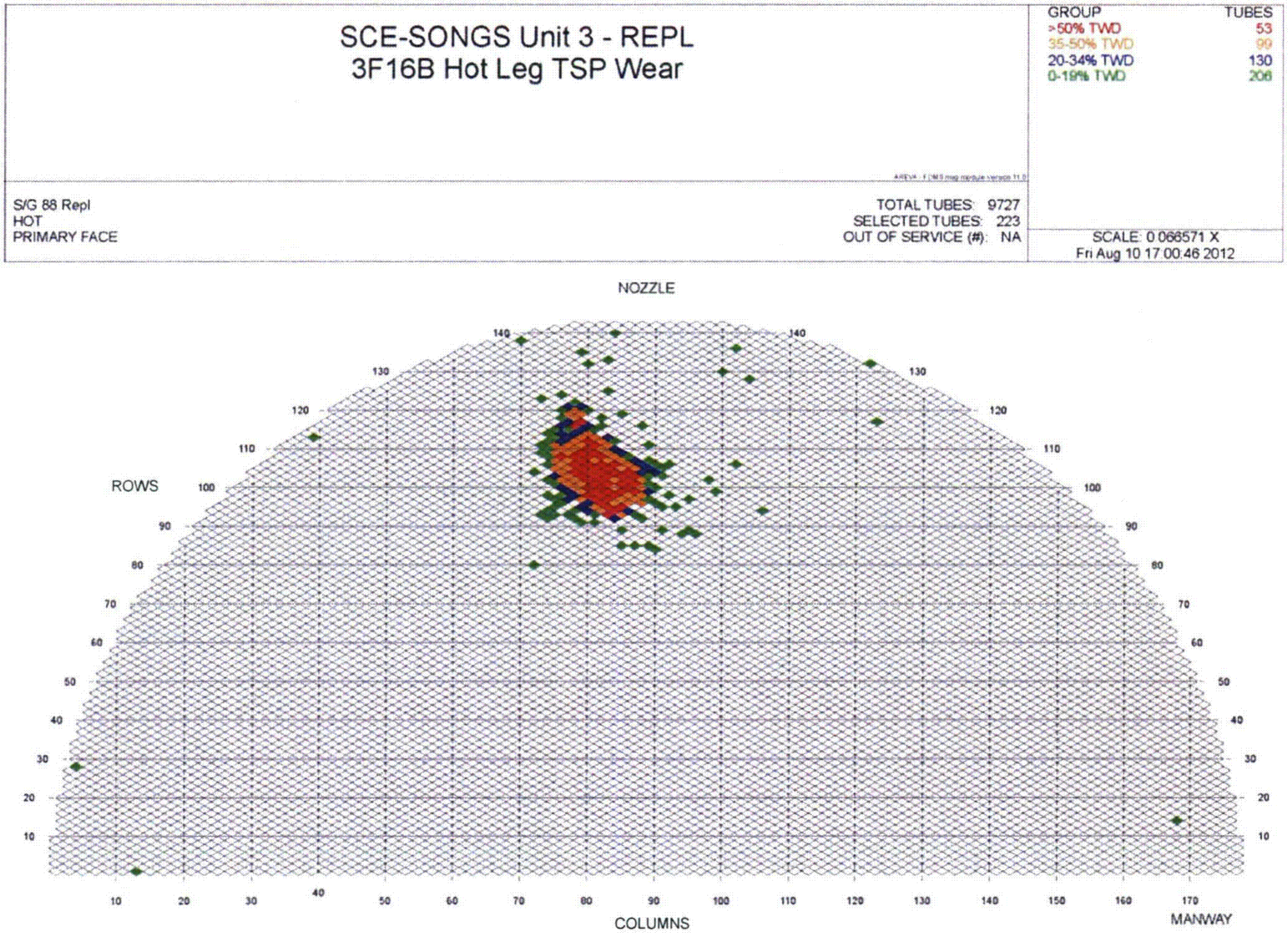


Figure 7-9: SG 3E-088 TSP Wear – Cold Leg

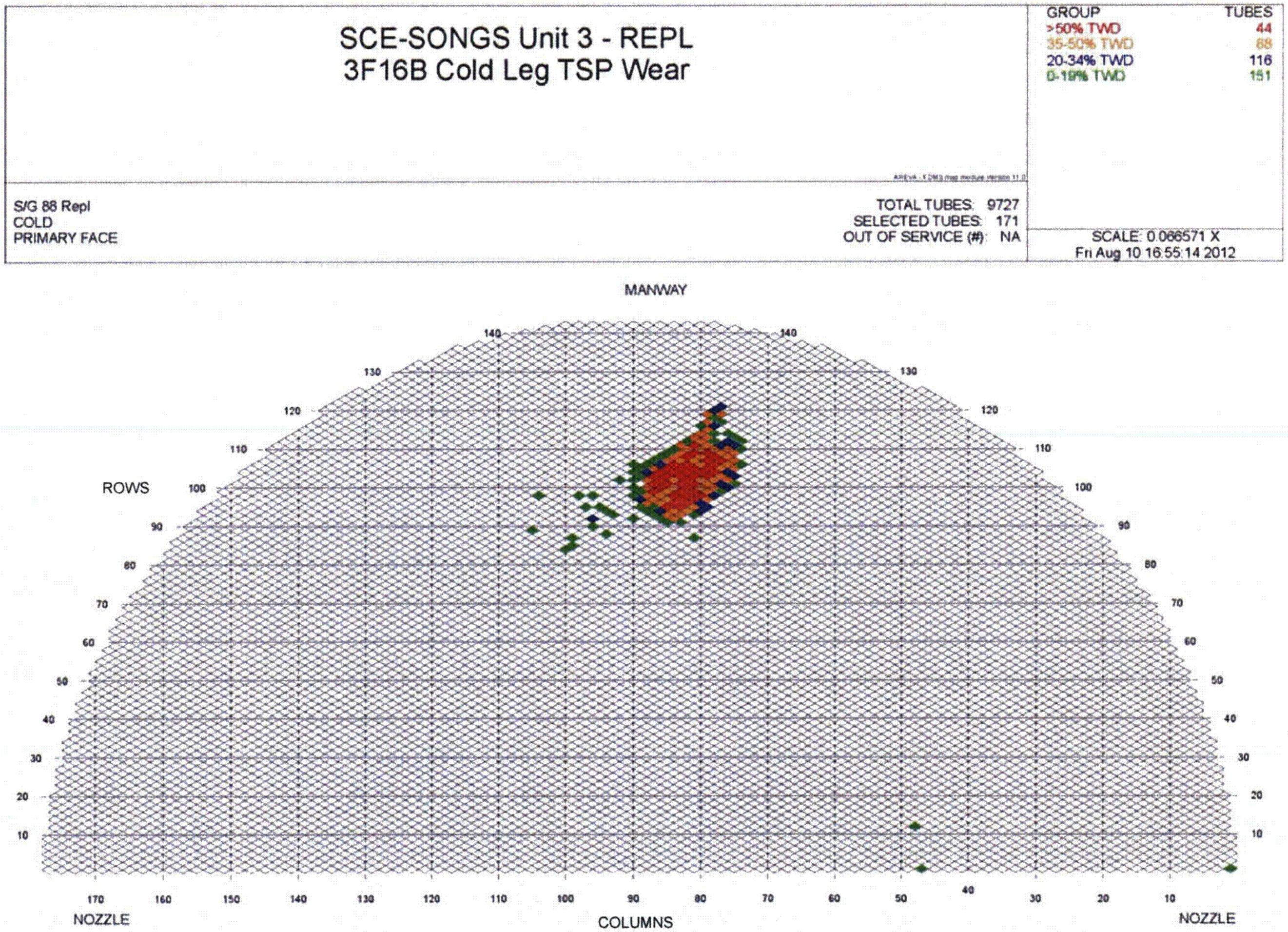


Figure 7-10: SG 3E-089 TSP Wear – Hot Leg

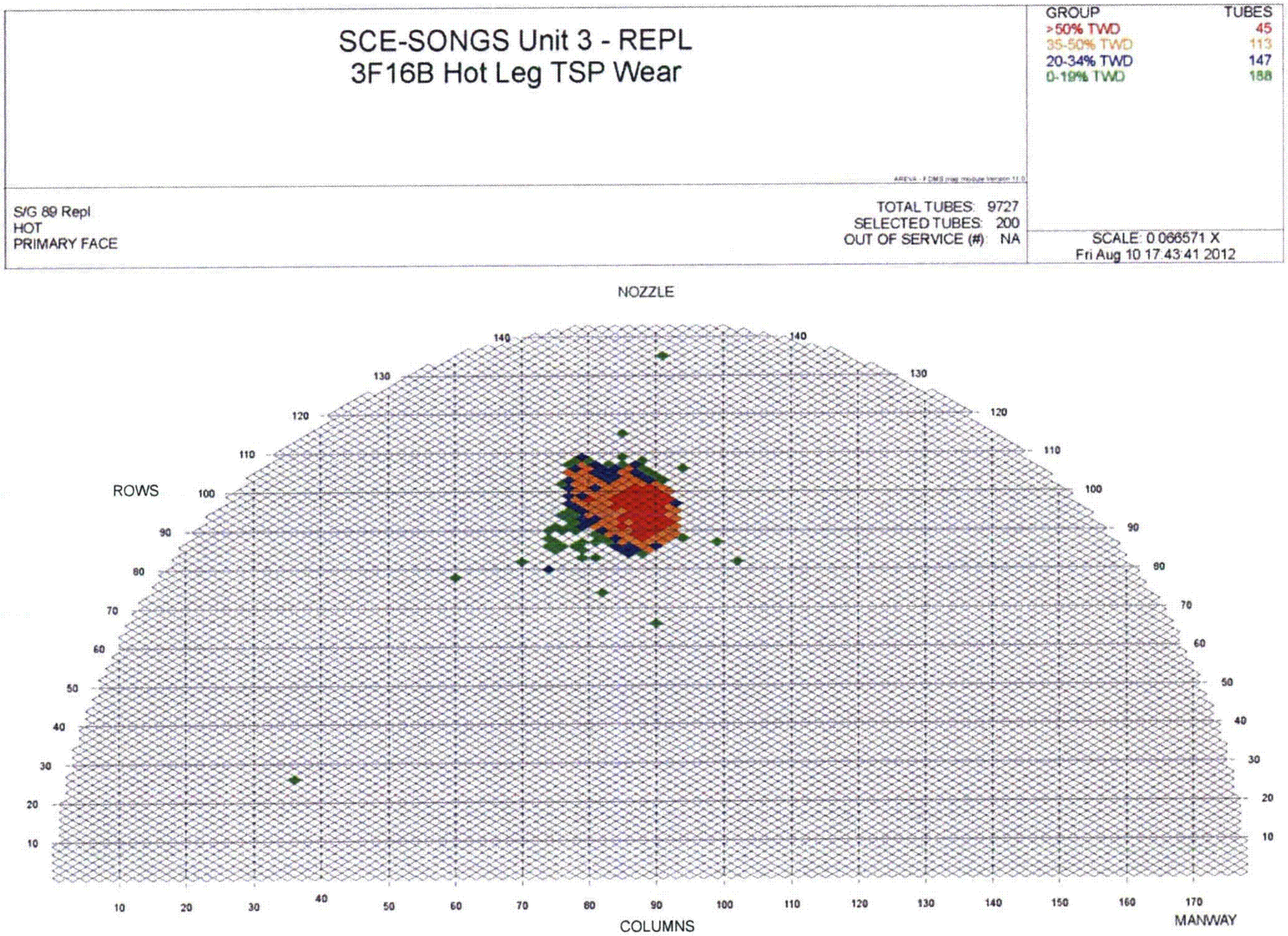


Figure 7-11: SG 3E-089 TSP Wear – Cold Leg

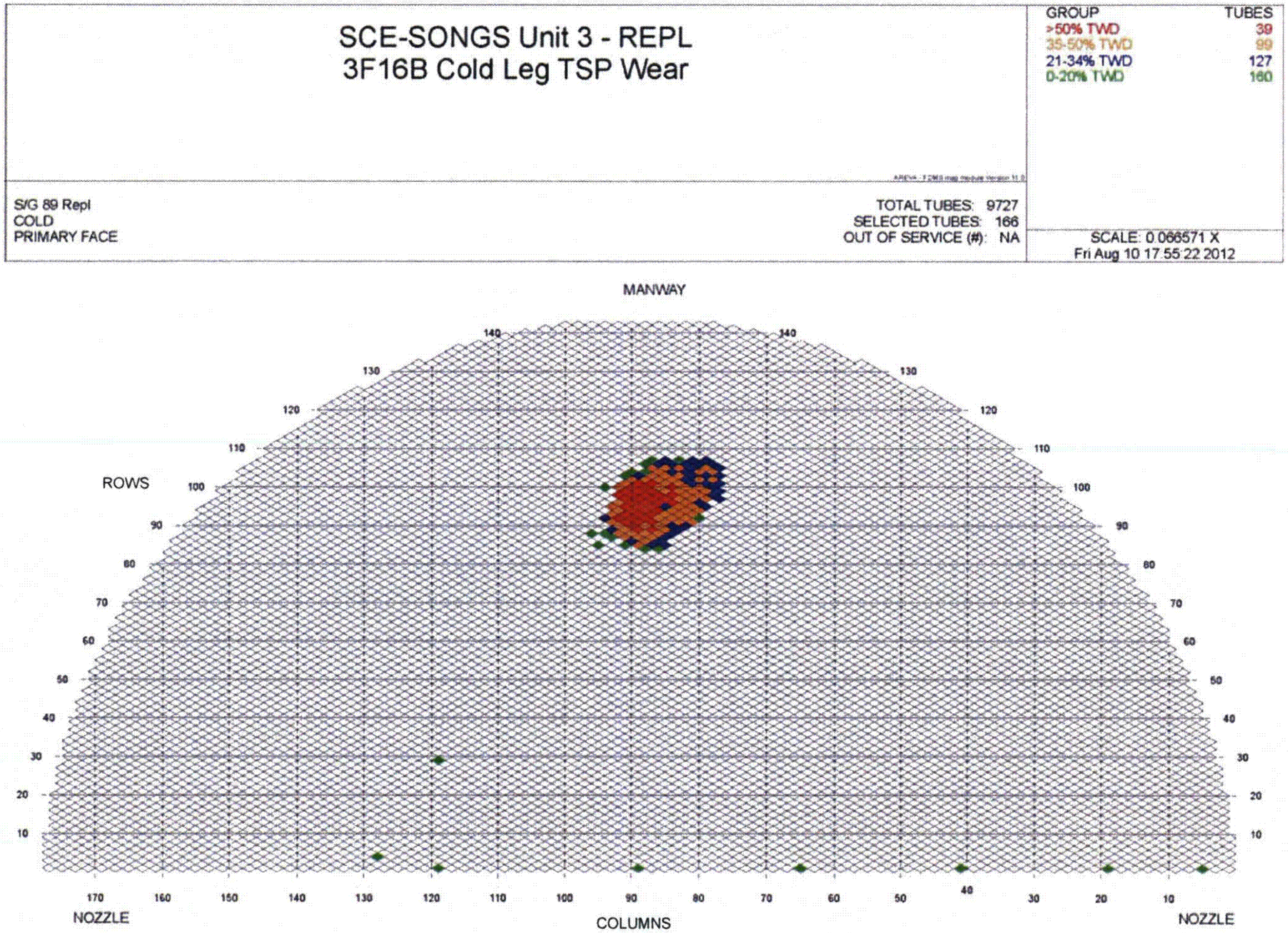


Figure 7-12: SG 3E-088 Retainer Bar Wear

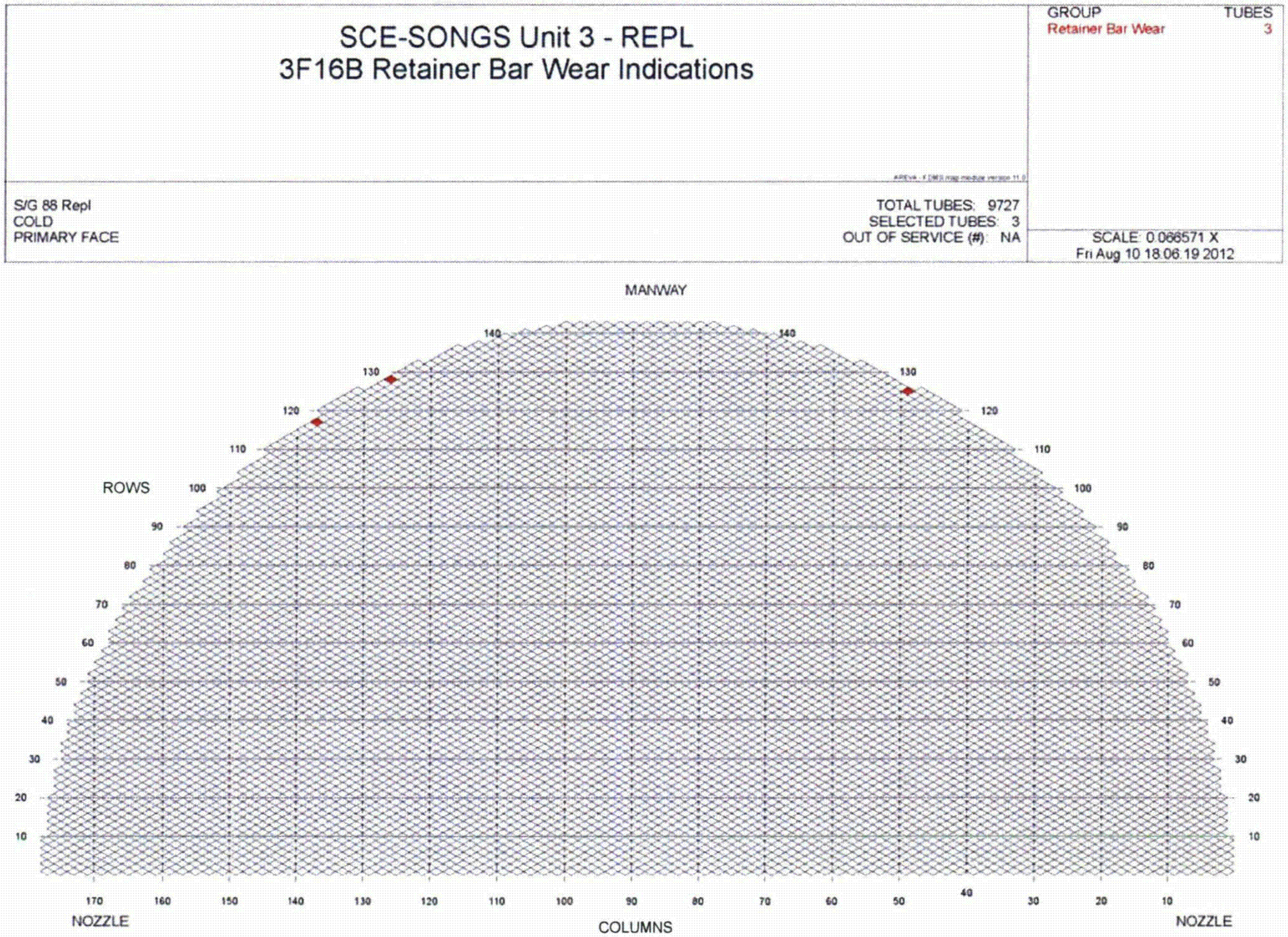


Figure 7-13: SG 3E-089 Retainer Bar Wear

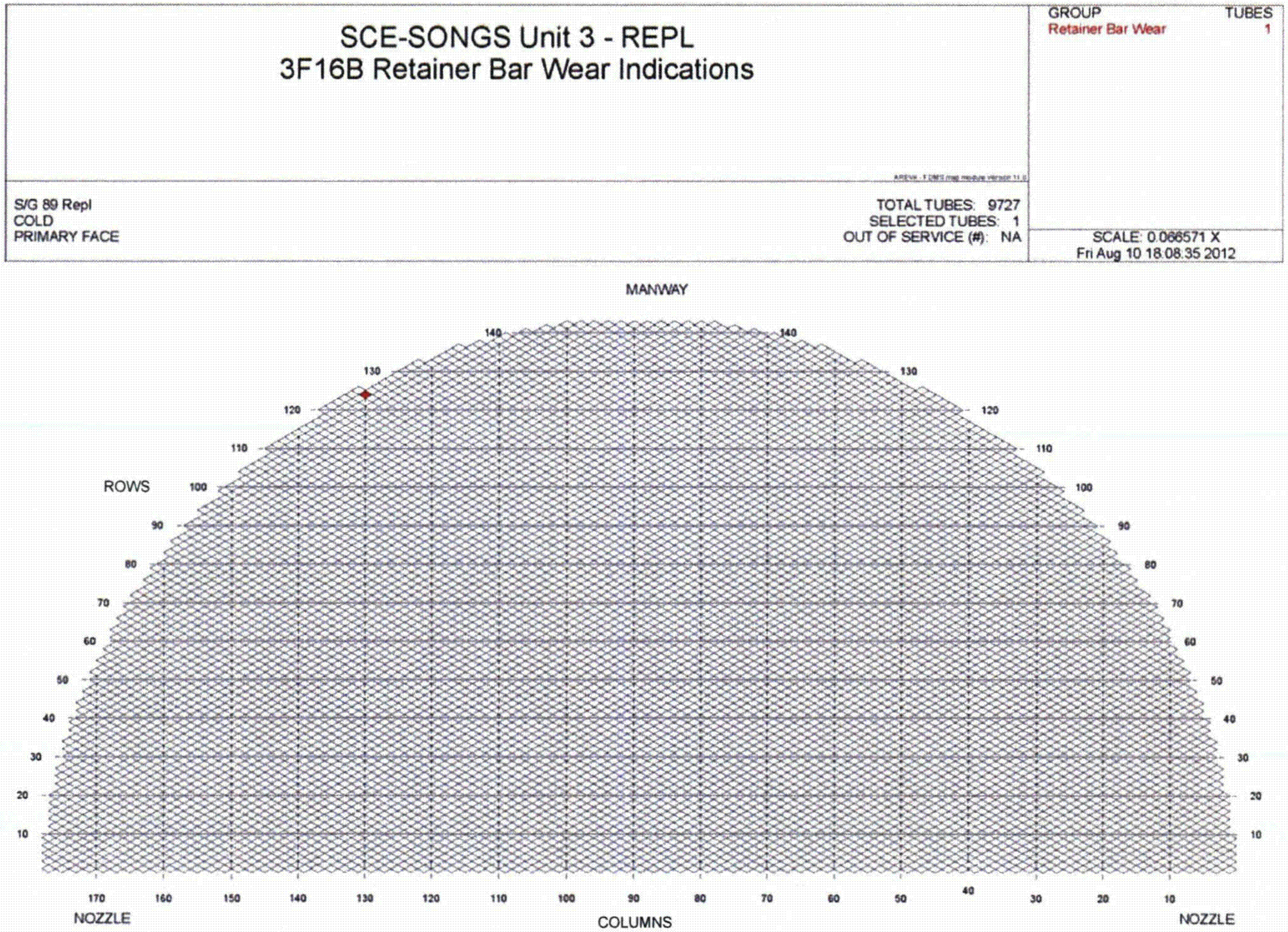


Figure 7-14: SG 3E-088 Tube-To-Tube Wear

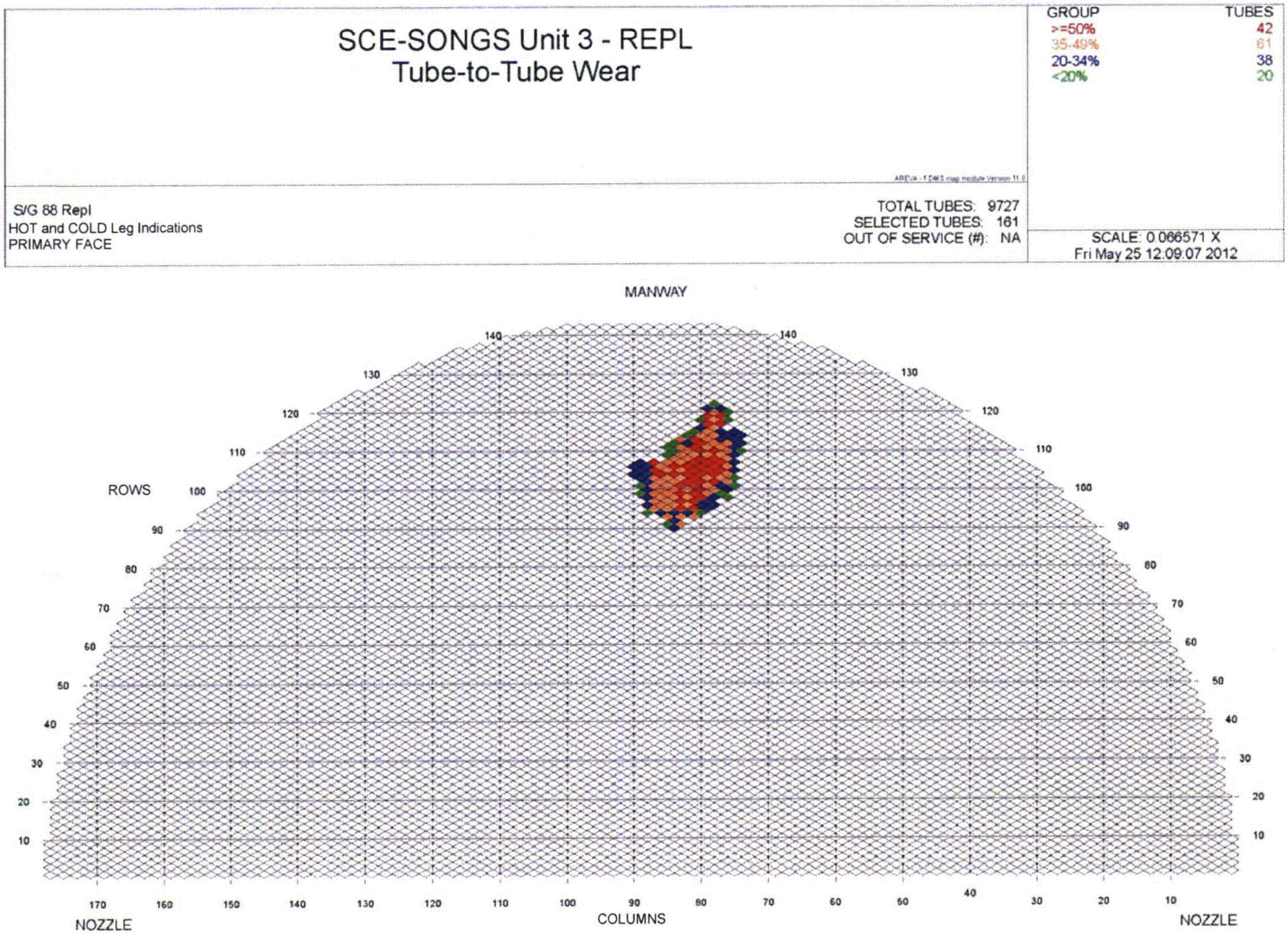


Figure 7-15: SG 3E-089 Tube-To-Tube Wear

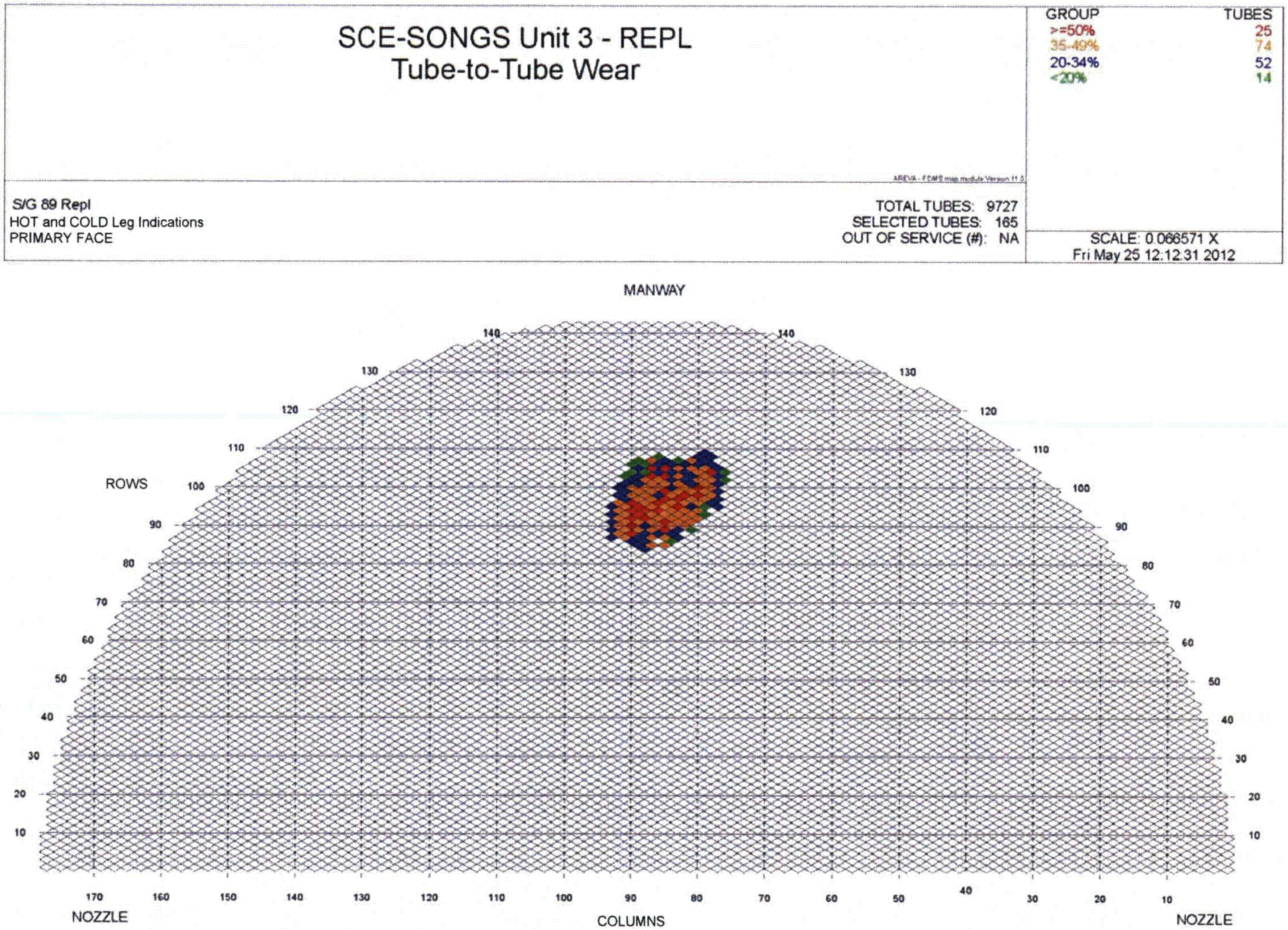


Figure 7-16: SG 3E-088 TTW Indications with In-Situ Results

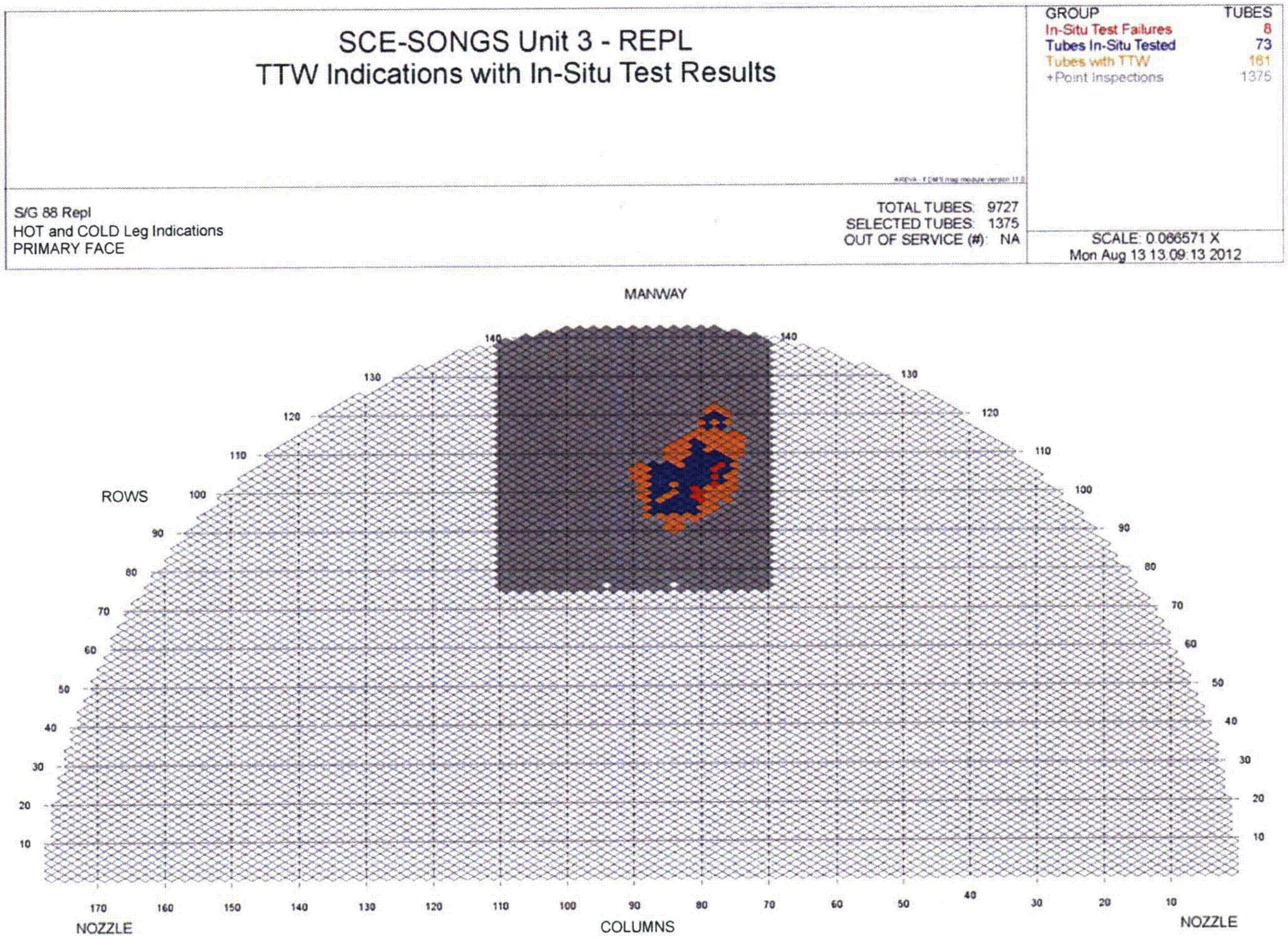
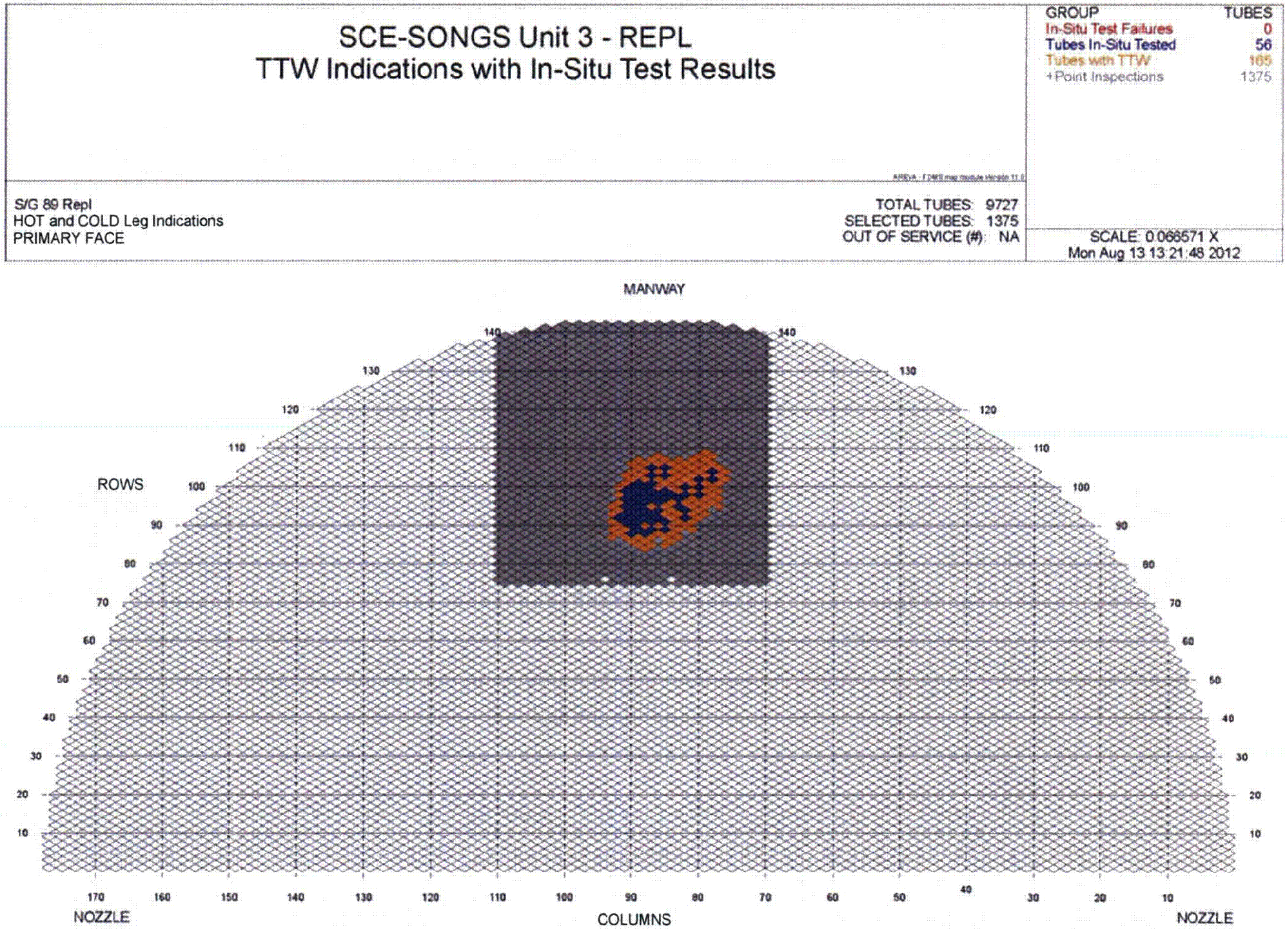


Figure 7-17: SG 3E-089 TTW Indications with In-Situ Results



8.0 CONDITION MONITORING ASSESSMENT

In order to satisfy condition monitoring requirements, all degradation mechanisms detected during the Unit 3 leaker outage must meet the structural and leakage performance criteria described in Section 5.0. Assessment of operational leak integrity is based entirely on whether the operating leakage performance criterion (150 GPD) was exceeded during operation. Because the operating leak rate prior to the forced outage remained below the performance criteria, the operational leakage integrity criterion was met.

Assessment of the structural and accident-induced leakage integrity CM criteria can be performed either analytically or through in-situ pressure testing [3]. An analytical assessment is based upon the degradation mechanism's characteristics, including circumferential extent, axial length, and through-wall depth. In-situ pressure testing provides a means of physically determining whether a tube has met the structural integrity and accident-induced leakage performance criteria. It involves pressurizing a tube, or a locally degraded region within a tube, such that the applied loads are prototypical of the required performance criteria loads. The response of the tube during the test is a direct indicator of whether the tube satisfied the performance criteria. Because the required loading is imposed directly onto the tube under test, some of the uncertainties which must be conservatively represented in an analytical evaluation may be eliminated (in particular, NDE sizing, material strength, and burst equation uncertainties). This improves the likelihood of demonstrating compliance with the CM criteria.

Consistent with the structural integrity criteria described in Section 5.0, the limiting pressure loading occurs at a value of three times the normal operating differential pressure. For Unit 3 this value is 4260 psi [9]. In addition to pressure loads, the CM must also consider the impact of non-pressure accident loads if they could have a significant effect on the burst pressure of the degraded tubes. A review of the screening guidance of Section 3.7.2 of Reference 2 provides the basis for concluding that design-basis, non-pressure accident loads are not limiting for the identified tube wear in the Unit 3 SG tubes. Reference 2 indicates that the burst pressure of degradation less than 270° in circumferential extent at supports below the top TSP, and degradation with circumferential involvement less than 25 PDA (Percent Degraded Area) anywhere in the tube bundle; will not be significantly affected by non-pressure loads. Although significant tube degradation was identified during the forced outage, the circumferential involvement of all degradation was less than 25 PDA. Consequently, the limiting loading scenario for the evaluation of structural integrity is that involving pressure loads only (i.e., three times the normal operating differential pressure). The accident-induced leakage performance criteria must also be assessed, and in addition to the Steam Line Break (SLB) pressure (2560 psi), must also consider non-pressure loads where appropriate. This is discussed in more detail within this section.

In order for a degraded tube to be returned to service, the degradation must be measured using a qualified ECT sizing technique, and the degradation must be evaluated as acceptable for continued operation. The sizing techniques qualified for use at SONGS Unit-3 are identified in the degradation assessment [6] and are detailed in the ECT technique site validation documents [7][13]. If a degradation mechanism cannot be sized with appropriate sizing confidence, it is plugged upon detection. All degradation identified during the current outage was measured with a qualified ECT technique.

This was the first in-service inspection of the SONGS Unit 3 SG tubes; performed after 338 EFPD of operation following SG replacement. The potential for AVB, TSP, and retainer bar wear to develop was recognized prior to the examination. However, the occurrence and severity of tube-to-tube wear was not expected. Although the examination program as planned was fully capable of detecting this mechanism, the Degradation Assessment [6] was revised during the outage to include this new mechanism.

8.1 Input Parameters

Table 8-1 and Table 8-2 identify the input parameters used to perform the condition monitoring assessment. In particular, these inputs were used within the AREVA Mathcad tool which implements the SG Flaw Handbook equations [8], in order to generate the limit curves discussed in the following sections. The 4260 psid 3 NOPD value is based on a conservative assessment of Unit 3 secondary side steam pressure as measured during cycle 16.

Table 8-1: SONGS Unit-3 Steam Generator Input Values

Parameter	*Value*
Desired probability of meeting burst pressure limit	0.95
Tubing wall thickness	0.043 inch, [7]
Tubing outer diameter	0.750 inch, [7]
Mean of the sum of yield and ultimate strengths at temperature	116440 psi, [10]
Standard deviation of the sum of yield and ultimate strengths	2460 psi, [10]
3 X Normal Operating Pressure Differential (3 NOPD)	4260 psid, [9]
MSLB Pressure Differential	2560 psid, [18]
EFPD from SG Replacement through U3 2/12 Leaker Outage	338 EFPD, [9]
Expected EFPD from U3 2/12 Leaker Outage to EOC16	252 EFPD, [9]]

Table 8-2: Eddy Current ETSS Input Values [5]

Parameter	*ETSS 96004.1*	*ETSS 27903.1*	*ETSS 27902.2*	*ETSS 96910.1*
Probe Type	Bobbin Coil	+Point™	+Point™	+Point™
NDE depth sizing regression parameters	Slope = 0.98 Intercept = 2.89 %TW	Slope = 0.97 Intercept = 2.80 %TW	Slope = 1.02 Intercept = 0.94 %TW	Slope = 1.01 Intercept = 4.30 %TW
NDE depth sizing technique uncertainty (standard deviation)	4.19 %TW	2.11 %TW	2.87 %TW	6.68 %TW
NDE depth sizing analysis uncertainty (standard deviation)	2.10 %TW	1.06 %TW	1.44 %TW	3.34 %TW
Total NDE (Sizing and Technique) (standard deviation)*	4.69 %TW	2.36 %TW	3.22 %TW	7.48 %TW

* Total uncertainty is the technique and analysis uncertainties combined via the square root of the sum of the squares.

8.2 Evaluation of Structural and Leakage Integrity

8.2.1 AVB Wear

AVB wear was evaluated with the flaw model described in Reference 4 as "axial part-throughwall degradation < 135° in circumferential extent." The maximum circumferential extent of a single 100%TW wear scar formed by a long flat bar positioned tangentially to the tube surface (e.g., an AVB) is 55.4°. For double-sided AVB wear the total circumferential extent for this limiting case would be well below the 135° limit established by this model; hence, this flaw model is appropriate for AVB wear. In addition, the AVB geometries provide sufficient circumferential separation between the wear scars to permit each indication to be treated separately. The separation between centerline contact points for AVB wear is 180° and results in negligible circumferential interaction between separate wear locations in the same axial plane of the tube.

The topic of external loads must be addressed. As discussed earlier it has been established that due to the limited circumferential involvement of the AVB wear (i.e., <25 PDA), external loads present during design basis accidents, with required margins of safety, are less limiting than normal operating pressure loads evaluated with a safety factor of three. Hence external loads need not be included in the evaluation of AVB wear burst integrity.

The bobbin probe was used to measure the depth of AVB wear through the application of ETSS 96004.1. A CM limit curve for AVB wear based upon ETSS 96004.1 and the parameters provided in Table 8-1 and Table 8-2 is provided in Figure 8-1. This figure also includes the throughwall depth of each indication reported. The five largest indications are plotted at their measured axial length, while the rest are plotted at the assumed axial length of 1.8 inches. The assumed flaw length for AVB wear indications was derived from measurements taken on over 350 AVB wear indications in the Unit 3 SGs, wherein the maximum indicated length was 1.59 inches. The field of the eddy current probe extends beyond the dimensions of the coil and thus the probe will sense a flaw before the coil is physically over the flaw. This effect occurs on both ends of the flaw, and the effect becomes more significant as the flaw depth increases. This phenomenon is known as "probe look-ahead" and the net effect is that the axial length reported for a wear flaw will normally be longer than the actual flaw length. Because the above AVB wear measurements were not adjusted downward to reflect the impact of ECT probe look-ahead, these measurements are considered to be appropriately conservative.

Because all AVB wear lies below the CM limit curve, it is concluded that the structural integrity performance criterion was satisfied with respect to AVB wear during the operating period preceding the forced outage.

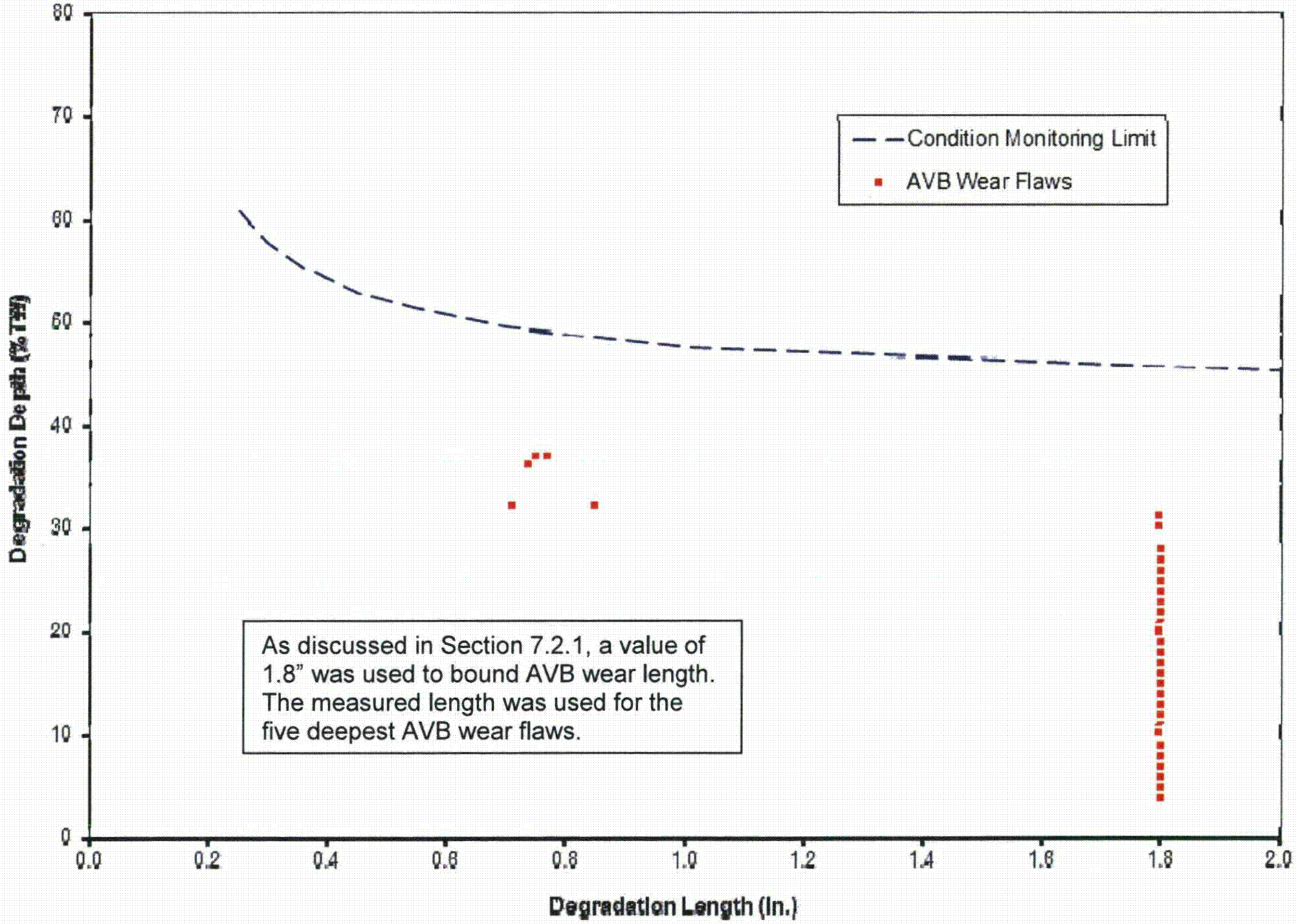
AVB wear must also be evaluated against the accident-induced leakage performance criterion (AILPC). Under accident conditions, pressure and/or mechanical loading can lead to mechanical tearing of partial depth degradation to create a 100% throughwall leak path. This mechanical tearing is referred to as "pop-through". Pop-through does not constitute a tube burst in regards to tube integrity but is important when determining leakage integrity.

AVB wear resides on the tube flanks (sides facing adjacent columns - not intrados or extrados) where bending stresses resulting from in-plane motion during analyzed events are negligible. In a typical RSG design, limited out-of-plane motion also produces negligible bending stress at the flanks. For the SONGS U-bend support design, moderate out-of-plane bending moments are anticipated during a design basis earthquake (DBE) [12], which would produce bending stress in the limiting tube flanks of approximately 8,500 psi.

The pressure at which circumferential pop-through and leakage will occur in the presence of pressure and external loads may be evaluated using the methods described in Section 9.6.1 of Reference 2. The maximum depth of identified AVB wear was 37%TW. Adjusting upwards to conservatively account for ETSS 96004.1 sizing uncertainty yields an upper bound estimate of 47%TW. Assuming that this limiting AVB wear flaw has a circumferential extent of 55.4° (see earlier discussion), and is subjected to a 20 ksi bending stress, circumferential pop-through would not occur at or below MSLB pressure. Consequently, it is concluded that external loads do not lead to failure to satisfy the AILPC in the circumferential orientation.

Volumetric degradation that is predominantly axial in orientation and is greater than 0.25 inch long will leak and burst at essentially the same pressure per section 9.6.3 of Reference 2. The Unit 3 AVB wear indications meet this description. Since the earlier evaluation demonstrated that the AVB wear identified during the current outage satisfied the burst integrity criteria at a pressure of 4260 psid, the leakage integrity of AVB wear at the much lower MSLB pressure differential of 2560 psid is also demonstrated by that evaluation. Hence, all of the AVB wear indications satisfied the SONGS AILPC during the operating period prior to the leaker outage.

Figure 8-1: CM Limit for AVB Wear, Both SGs, ETSS 96004.1



8.2.2 TSP wear

TSP wear was evaluated with the flaw model described in Reference 4 as "axial part-throughwall degradation < 135° in circumferential extent." The maximum circumferential extent of a single 100%TW wear scar formed by a long flat bar positioned tangentially to the tube surface (e.g., a TSP land contact) is 55.4°. For double- or triple-sided TSP wear this model is bounding because the TSP geometry provides sufficient circumferential separation between the wear scars to permit each indication to be treated separately. The separation between centerline contact points for TSP wear is 120°, and results in negligible circumferential interaction between separate wear locations in the same axial plane of the tube. With respect to external loads, each wear flaw at the same support elevation may be treated individually. An individual TSP wear flaw with a depth of 100%TW and a circumferential extent of 55.4° would be less than 16 PDA. Because the circumferential involvement of this limiting flaw is less than 25 PDA, external loads need not be considered in the evaluation of burst integrity for TSP wear.

The bobbin probe was used to estimate the depth of TSP wear through the application of ETSS 96004.1. A CM limit curve for TSP wear based upon ETSS 96004.1 and the parameters provided in Table 8-1 and Table 8-2, is provided in Figure 8-2. This figure also includes the throughwall depth of each indication reported. Indications for which axial length measurements were available are plotted using the bobbin-measured lengths. The rest of the indications are plotted at an assumed axial length of 1.8 inches. This value was derived from measurements taken on over 400 TSP wear indications in the Unit 3 SGs, wherein the maximum indicated length was 1.6 inches. Because these measurements were not adjusted downward to reflect the impact of ECT probe look-ahead, and because the actual flaw length is expected to be limited to the TSP thickness (1.38"), this assumption is considered to be appropriately conservative.

Figure 8-2 illustrates that a substantial number of TSP wear indications exceeded the CM limit. However, this result is based upon bobbin probe estimates of maximum indication depth, assumed to occur over the entire bounding indication length. This is a very conservative approach.

All TSP wear indications with bobbin depths ≥20%TW were inspected with +Point™. All +Point™ indications measuring ≥38%TW had axial depth profiles performed. The depth profiles were used to calculate each indication's structurally equivalent depth and length. The structural depth and length correspond to a rectangular flaw which would burst at the same pressure as would a flaw having the measured depth profile. The measurements were performed using +Point™ probe ETSS 96910.1, and the structurally equivalent dimensions were determined using the methods described in Section 5.1.5 of Reference 4.

CM limit curves for TSP wear based upon ETSS 96910.1 are provided for SG 3E-088 and SG 3E-089 in Figure 8-3 and Figure 8-4, respectively. This figure also depicts the structural dimensions of all indications for which axial depth profiling was performed, including those that exceeded the CM curve in Figure 8-2. Note that any given TSP elevation may have multiple wear flaws (i.e., at more than one land contact) and one of the flaws is typically deeper than the others. Since, in some cases, depth profiling was performed on all of the flaws at a given TSP elevation, the figures include many TSP wear indications of lesser significance than those that exceeded the CM curve in Figure 8-2.

The use of structurally equivalent dimensions provides the highest likelihood of analytically demonstrating compliance with the CM structural performance criteria. However, as illustrated in

Figure 8-3 and Figure 8-4, many TSP wear indications exceeded the CM curve thus; satisfaction of the CM criteria could not be analytically demonstrated. Consequently, all of the TSP wear flaws that exceeded the CM limit were subjected to in-situ pressure testing in an attempt to demonstrate CM criteria compliance.

Figure 8-5 and Figure 8-6 summarize the results of in-situ testing of TSP wear flaws in each SG. All tested TSP wear in SG 3E-089 satisfied the structural integrity and accident leakage performance criteria. In SG 3E-088 a number of indications could not be tested to the required pressure levels because more limiting TTW in the same tube failed below the target pressure thus terminating the test. These indications are depicted in Figure 8-5 as "Incomplete." In the absence of a successful in-situ pressure test, those indications identified as incomplete which lie above the CM curve must be considered to be CM structural integrity performance criteria (SIPC) failures. These indications are listed in Table 8-3.

All but four of the TSP wear indications listed in Table 8-3 were successfully tested at the MSLB hold point without leakage, thereby satisfying the AILPC. Compliance with the AILPC could not be demonstrated through in-situ testing for the four indications identified as "In Situ Test Indeterminate" due to the failure of a TTW flaw in the same tube.

Of the four, the indication at location SG 3E-088 R106 C78 07H-1 is the most limiting from a pop-through and leakage perspective. Figure 8-7 provides the axial depth profile for this indication which is predominantly axial in orientation with an overall measured length of 1.79 inches (based on line-by-line sizing), a measured maximum depth of 75%TW (ETSS 96910.1), and a conservatively assumed circumferential extent of 55.4°. Adjusting upwards to account for ETSS 96910.1 depth sizing uncertainty yields an upper bound depth estimate of 92.4%TW.

The pressure at which circumferential pop-through and leakage will occur in the presence of pressure and external loads may be evaluated using the methods described in Section 9.6.1 of Reference 2. For the top TSP, the limiting in-plane and out-of plane bending moment anticipated to occur during a DBE is approximately 209 in-lb [12], which would produce bending stress of approximately 13,100 psi. Under this loading condition and using the above methodology, a 55.4° circumferential flaw with maximum depth 88.9%TW would pop-through at slightly above 2560 psi. For the TSP wear indication in SG 3E-088 R106 C78 07H-1, circumferential pop-through and leakage is projected to occur at 1120 psi, well below the MSLB pressure. Axial pop-through is calculated to occur at less than 1000 psi using the methodology described in Section 9.6.2 of Reference 2. This tube was pressurized to 2874 psi at room temperature without pop-through of the subject wear location, which for comparison with the analytical results, equates to approximately 2400 psi at operating temperature. Clearly the analytical estimation of pop-through pressure is conservative; however, in the absence of a successful in-situ test result, it must be concluded that the TSP wear at location SG 3E-088 R106 C78 07H-1 did not satisfy the AILPC. The upper bound depths of the three remaining indications are below the depth required to pop-through at MSLB pressure; however, all three are projected to pop-through axially (see Figure 8-8).

In summary, 13 TSP wear flaws in seven tubes failed to satisfy the structural integrity performance criteria, and four of the flaws (in two tubes) failed to satisfy the accident-induced leakage performance criteria.

Table 8-3: Incomplete Proof Tests of TSP Wear Exceeding CM Limit Curve

SG	Row	Col	Structural Depth (%TW)	Structural Length (in.)	Location	Test Pressure at Termination (psi)	SIPC Success During In-Situ Test?	AILPC Success During In-Situ Test?	Maximum Measured Depth (%TW)	Overall Length (in.)	Upper Bound Depth (%TW)	Analytical Pop-Through Evaluation		
												Project Circ Pop-Thru Below MSLB?	Project Axial Pop-Thru Below MSLB?	AILPC Success Analytically?
88	98	80	53.3	0.52	07H	4886	No	Yes	NA	NA	NA	NA	NA	NA
88	98	80	46.0	1.00	07C	4886	No	Yes	NA	NA	NA	NA	NA	NA
88	99	81	49.1	1.18	07C	5026	No	Yes	NA	NA	NA	NA	NA	NA
88	99	81	50.8	0.94	07H	5026	No	Yes	NA	NA	NA	NA	NA	NA
88	100	80	44.3	0.61	07H	4732	No	Yes	NA	NA	NA	NA	NA	NA
88	100	80	42.8	1.10	07C	4732	No	Yes	NA	NA	NA	NA	NA	NA
88	101	81	53.1	1.20	07C	4889	No	Yes	NA	NA	NA	NA	NA	NA
88	101	81	50.1	0.88	07H	4889	No	Yes	NA	NA	NA	NA	NA	NA
88	104	78	49.7	0.84	07C	3180	No	In-Situ Test Indeterminate‡	57	1.57	74.2	No	Yes	No
88	104	78	48.6	0.73	07H	3180	No	In-Situ Test Indeterminate‡	58	1.59	75.2	No	Yes	No
88	106	78	64.6	0.96	07H	2874	No	In-Situ Test Indeterminate‡	75	1.79	92.4	Yes	Yes	No
88	106	78	55.3	0.69	07C	2874	No	In-Situ Test Indeterminate‡	65	1.02	82.3	No	Yes	No
88	107	77	47.2	1.56	07C	5160	No	Yes	NA	NA	NA	NA	NA	NA

‡ AILPC failed at a TTW flaw. Test inconclusive for this TSP wear flaw.

Figure 8-2: CM Limit for TSP Wear, Both SGs, ETSS 96004.1

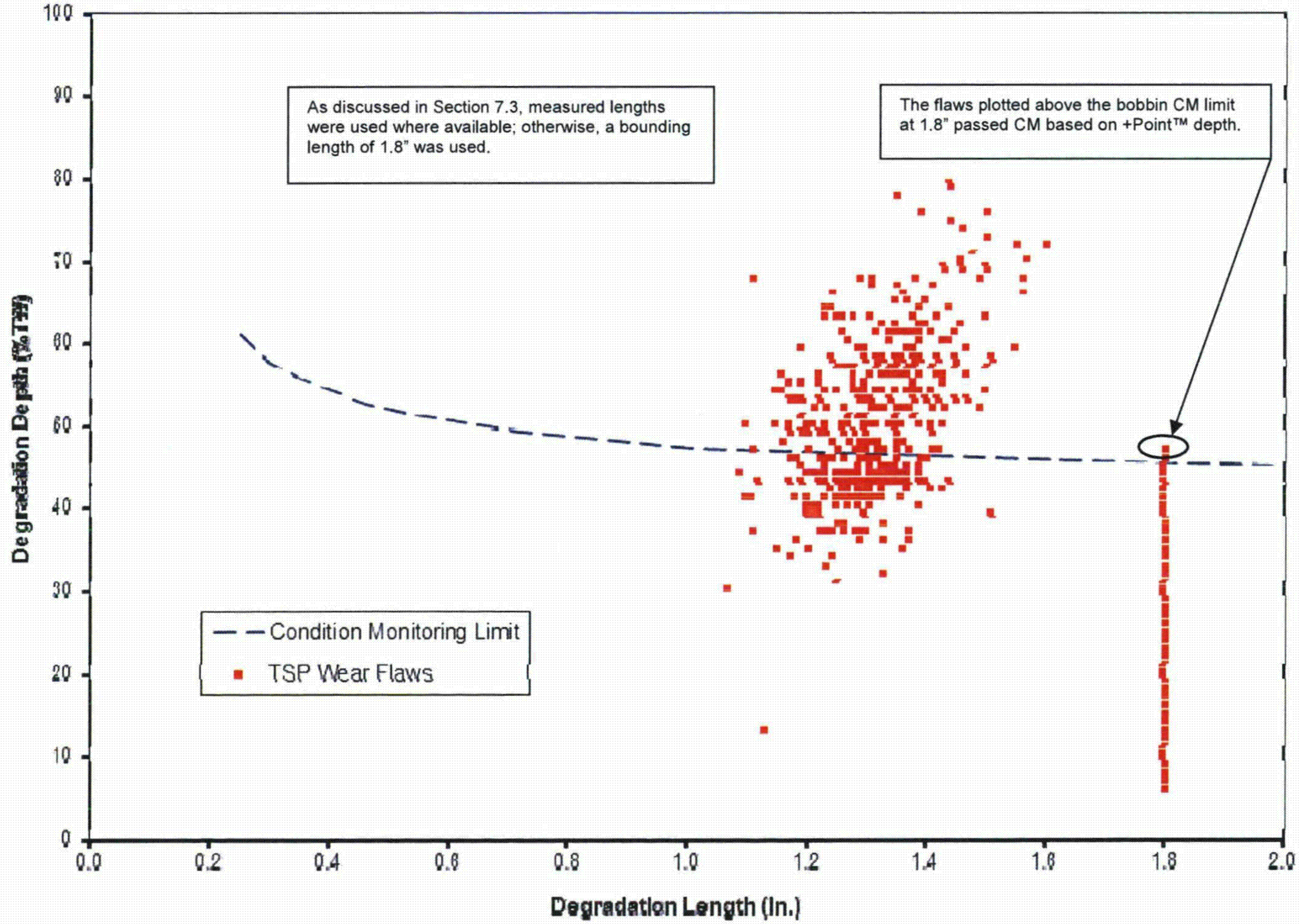


Figure 8-3: CM Limit for SG 3E-088 TSP Wear, ETSS 96910.1, Structural Dimensions

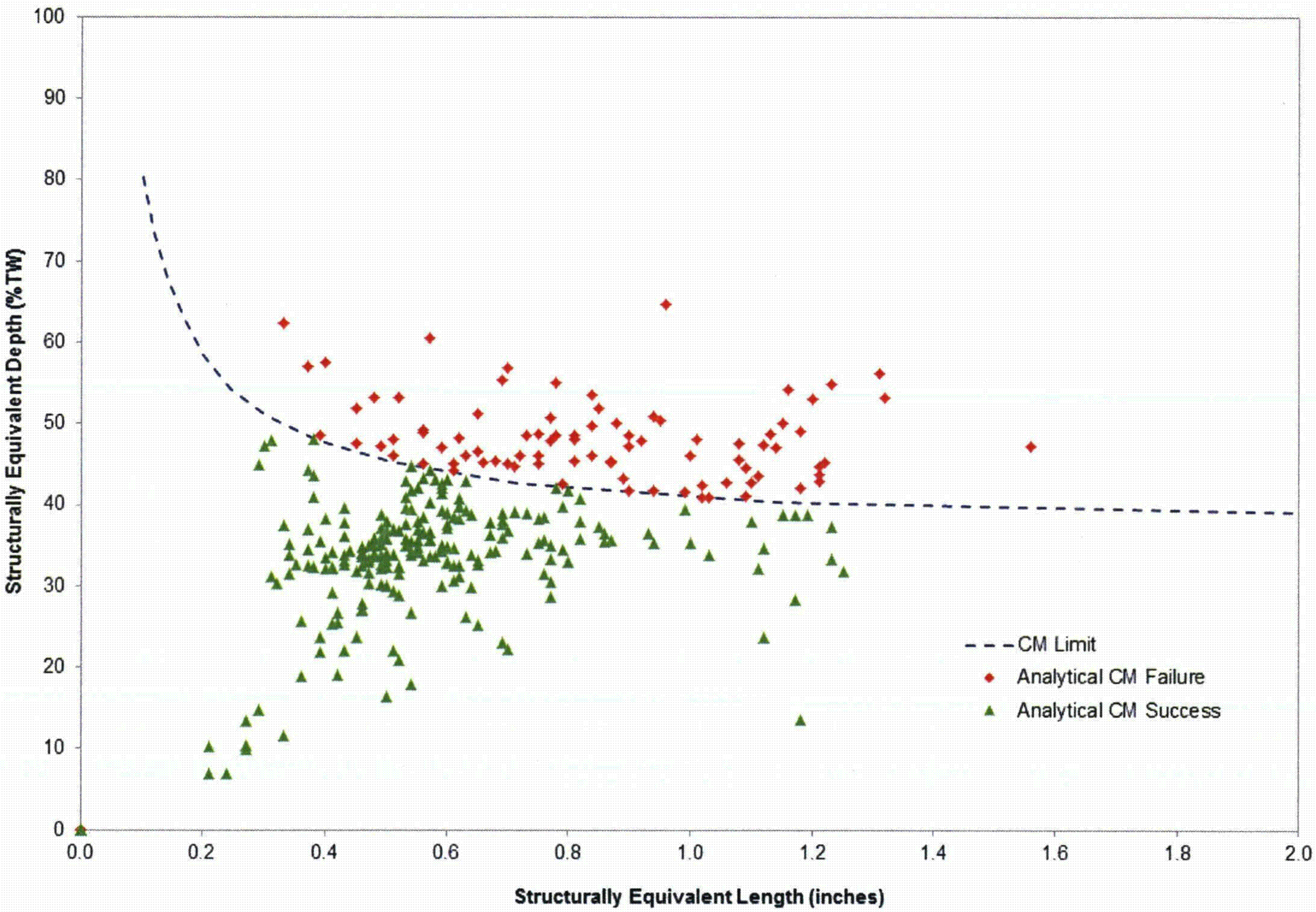


Figure 8-4: CM Limit for SG 3E-089 TSP Wear, ETSS 96910.1, Structural Dimensions

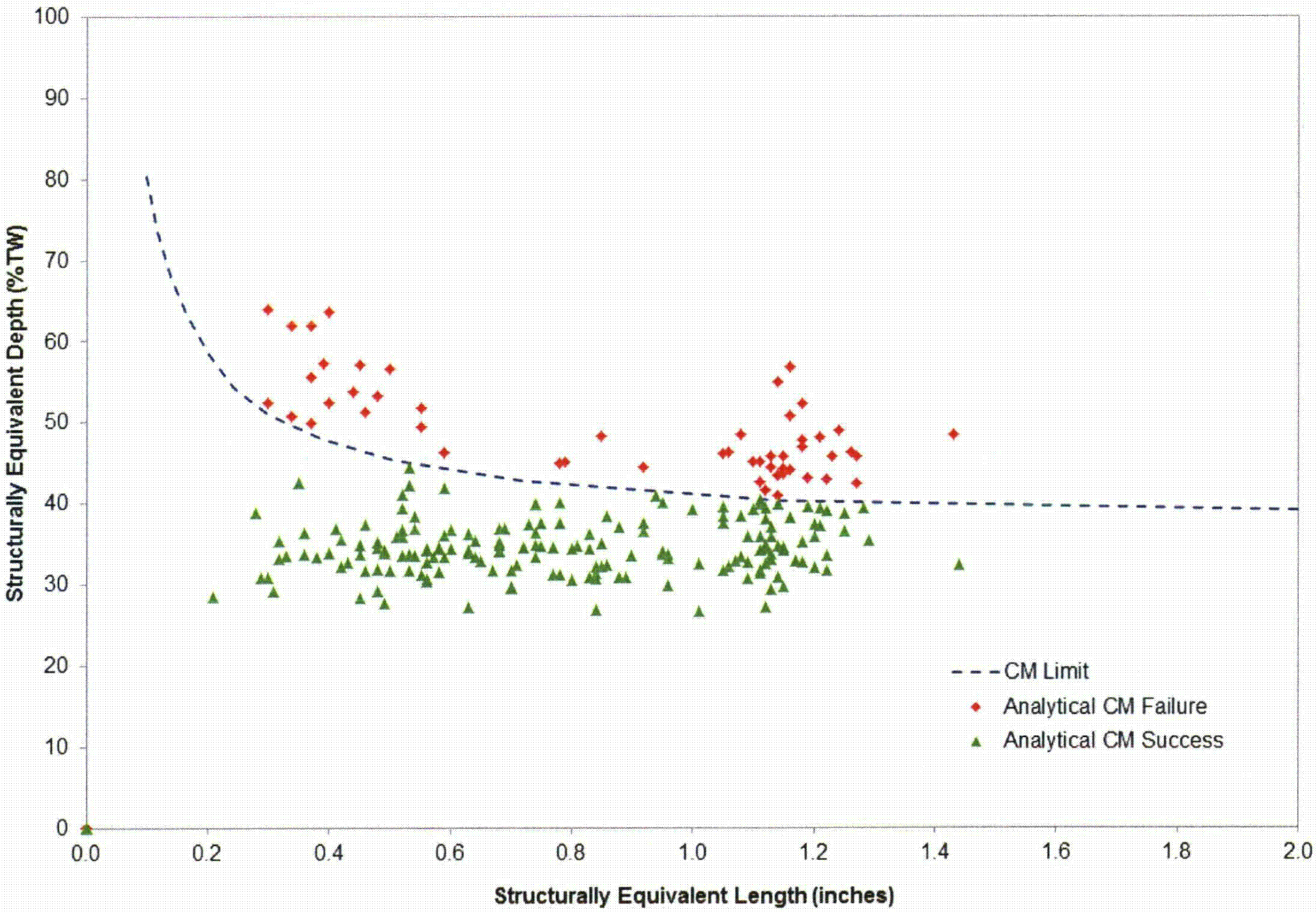


Figure 8-5: In-Situ Test Results for SG 3E-088 TSP Wear, ETSS 96910.1, Structural Dimensions

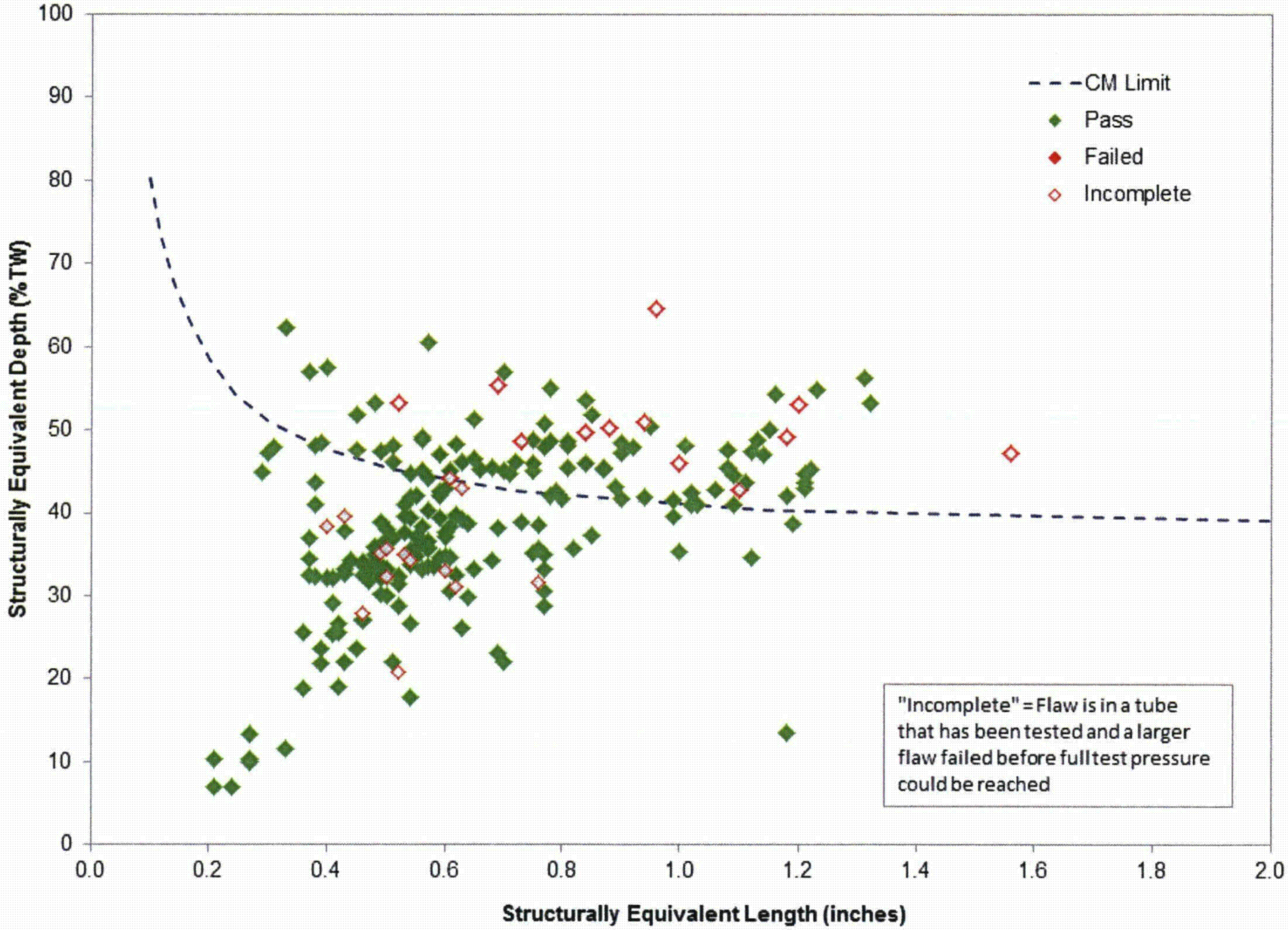


Figure 8-6: In-Situ Test Results for SG 3E-089 TSP Wear, ETSS 96910.1, Structural Dimensions

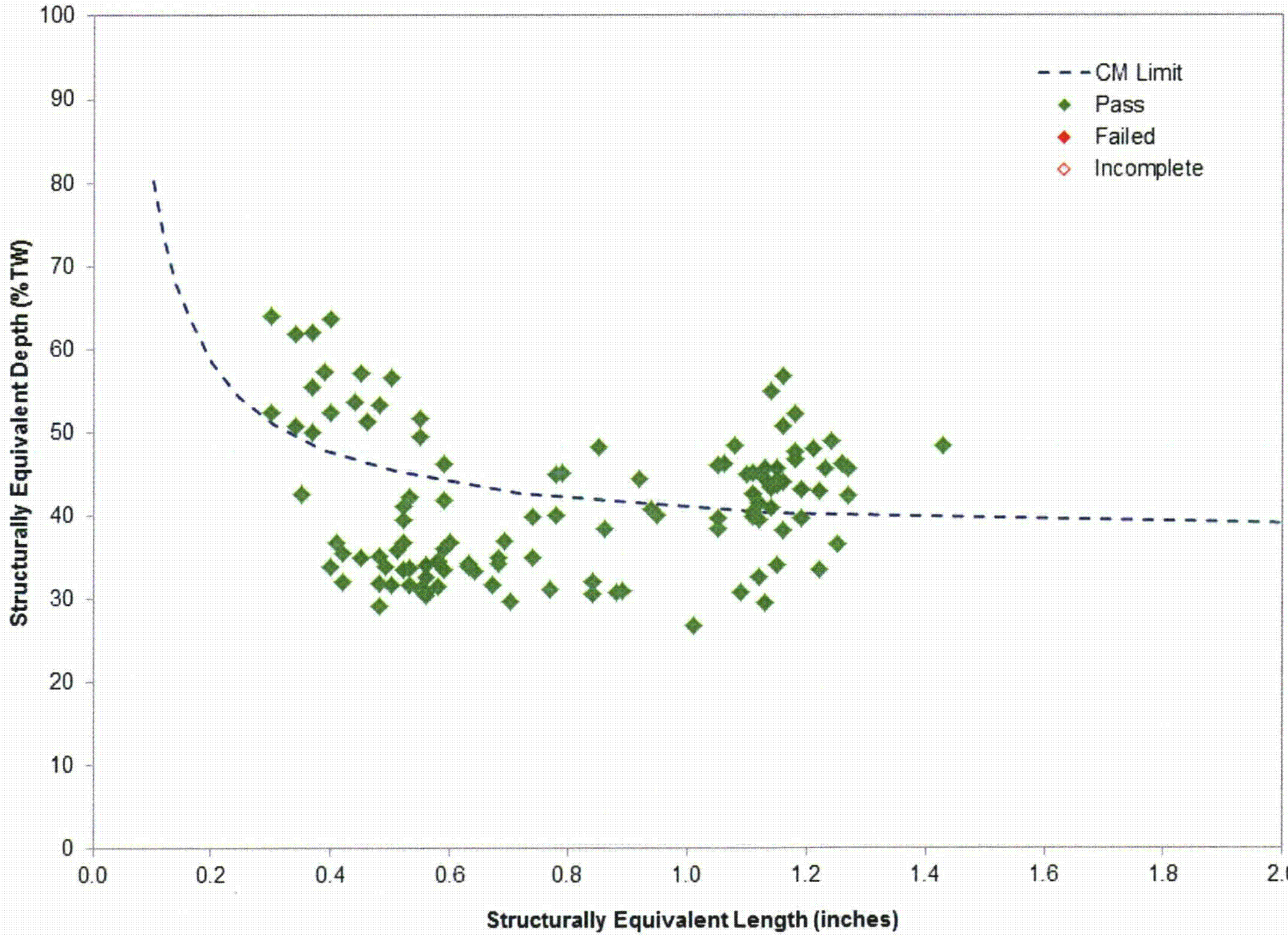


Figure 8-7: Axial Depth Profile – SG 3E-088 R106 C78 07H-1

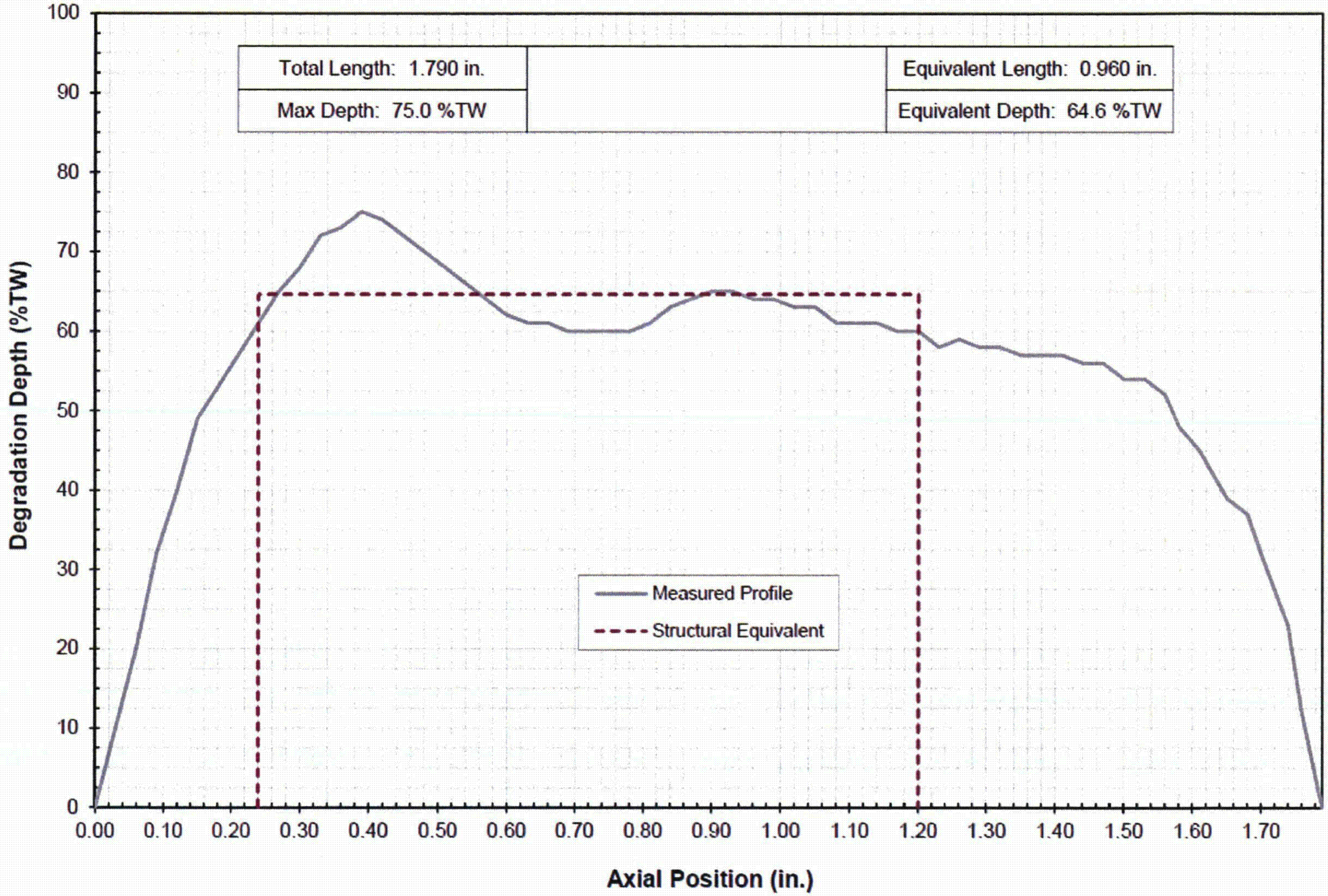
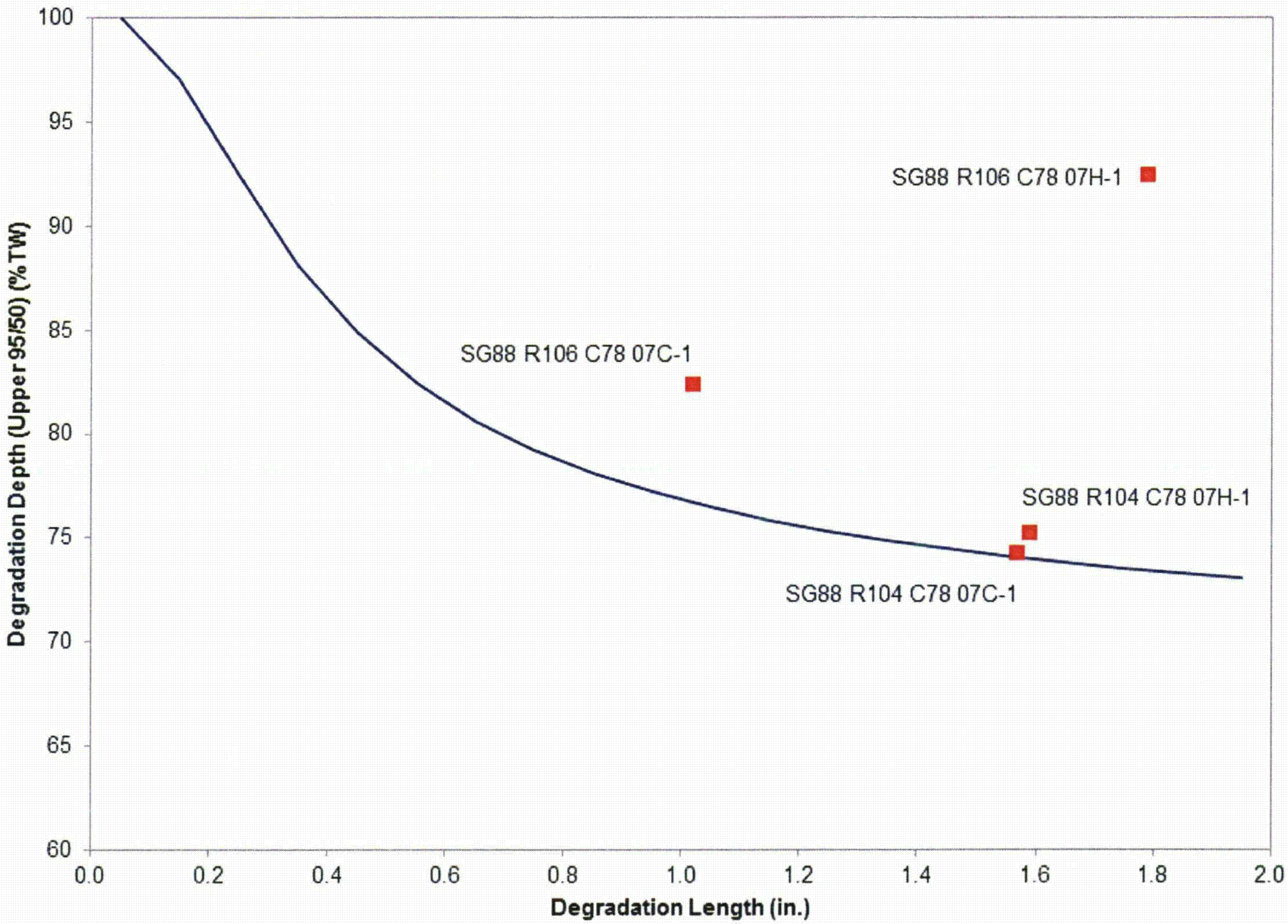


Figure 8-8: Axial Pop-Through Limit for TSP Wear



8.2.3 Retainer Bar Wear

Retainer bar wear was also evaluated with the "axial part-throughwall degradation < 135° in circumferential extent" degradation model as described in Reference 4. The maximum measured circumferential extent of RB wear was 0.36 inches (Table 7-6) which corresponds with an angular extent at the mid tube wall of 58°; well within the 135° requirement for this flaw model. Because of the rather short axial extent of the RB wear indications, it is prudent to also consider the potential for rupture in the circumferential direction. For the indication with the largest circumferential extent (0.36 inch, SG 3E-088 R117 C137 B10), and a limiting assumption that the wear is 100%TW over the entire circumferential extent, the percent degraded area (PDA) is found to be 16 PDA (i.e., (0.36)/(π(mid-wall diameter))). This limiting flaw was evaluated with the degradation model for circumferential cracking under pressure loading as described in Reference 2. Based on this model the lower bound burst pressure in the circumferential direction was determined to be 7000 psi; much less limiting than the results from the axial part-throughwall model (discussed below). This provides the basis for concluding that the axial part-throughwall degradation model is appropriate for the evaluation of RB wear.

External loads which are assumed to exist concurrently with the SLB accident do not significantly affect burst pressure in tubes with flaws located in the U-bend region on the tube flanks (±45°) [2]. On Unit 2, +Point™ probe examinations were performed with another eddy current probe placed in an adjacent tube in order to estimate the position of the limiting flaw (Unit 2 SG 2E-089 R119 C133 B02) relative to the tube flank. This testing showed that the indication lies approximately 40 to 50 degrees from the flank position; consequently, the RB wear may not lie entirely within the flank region. However, it is also known that external loads do not significantly affect burst pressure in tubes with flaws whose circumferential involvement is less than 25 PDA [2]. The upper bound circumferential involvement of the limiting Unit 3 RB wear indication is only 16 PDA. It is therefore concluded that the limiting condition monitoring structural criteria is 3x normal operating pressure differential, rather than 1.2x the combined loading of SLB pressure and external loads. In short, it is appropriate to consider pressure loading-only for the structural integrity evaluation of RB wear indications.

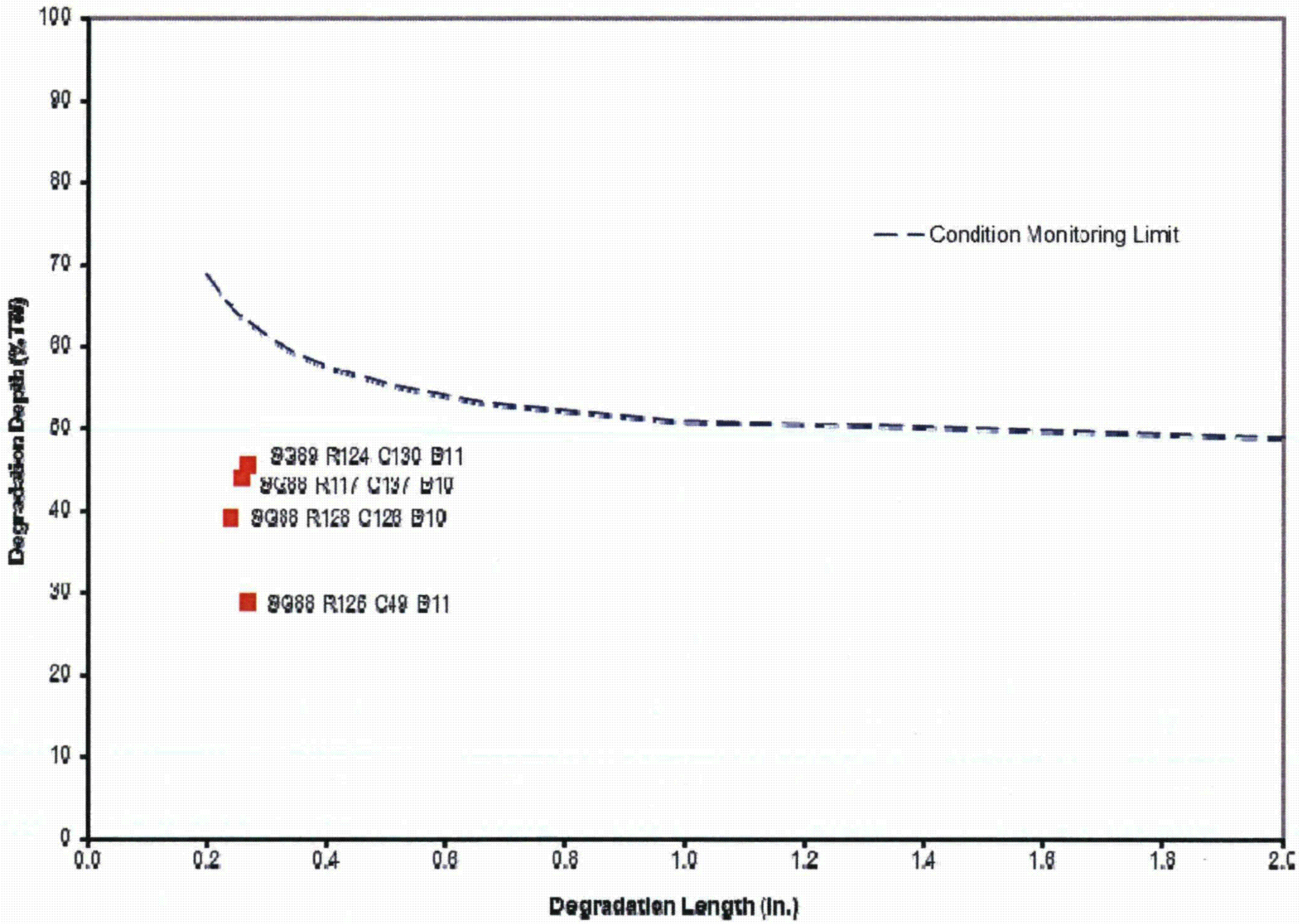
The axial depth profile of each RB wear indication was measured using ETSS 27903.1, and this data was used to determine the structurally significant dimensions of the indications using the methods described in Section 5.1.5 of Reference 4. The results are provided in Table 7-6 and are plotted on the CM curve provided in Figure 8-9. Since all four RB wear indications lie well below CM curve it is concluded that all Unit 3 RB wear satisfied the structural integrity performance criteria.

RB wear must also be evaluated against the AILPC. For the purpose of this evaluation it is assumed that RB wear resides on the tube intrados or extrados where in-plane motion produces consequential bending stress during analyzed events. For the SONGS SGs, bending moments anticipated in the vicinity of B10 and B11 during a DBE [12], would produce in-plane bending stress of approximately 8,800 psi.

The pressure at which circumferential pop-through and leakage will occur in the presence of pressure and external loads may be evaluated using the methods described in Section 9.6.1 of Reference 2. The maximum depth of identified RB wear was 51%TW. Adjusting upwards to conservatively account for ETSS 27903.1 sizing uncertainty yields an upper bound estimate of 56%TW. Assuming that this limiting RB wear flaw has a circumferential extent of 58° (see earlier discussion), and is subjected to a 20 ksi bending stress, circumferential pop-through would not occur at or below MSLB pressure. Consequently, it is concluded that external loads do not lead to failure to satisfy the AILPC in the circumferential orientation. The axial pop-through evaluation performed for TSP wear and summarized in Figure 8-8 is applicable for RB wear and provides the basis for concluding that the limiting RB wear satisfied the AILPC in the axial direction. Hence, all four of the RB wear indications satisfied the SONGS AILPC during the operating period prior to the leaker outage.

It should be noted that multiple eddy current examination techniques and multiple phases of eddy current analysis are applied when characterizing tube degradation to provide as much information and accuracy as practical. Certain indications, such as retainer bar wear, which are detected by the bobbin coil examination are subsequently tested by a rotating coil probe to provide a better and more detailed characterization of the degradation. An initial single-point evaluation of the depth of an indication is performed from the rotating +Point™ data by a resolution analyst. Subsequent analysis of any significant indications is performed to assign a depth evaluation to each scan line of the rotating coil data. This process is called line-by-line sizing and produces a detailed profile of the subject indication. It is not unusual to have some variation between the single-point analysis result and the subsequent line-by-line sizing evaluation. In the case of the SG 3E-089 retainer bar wear, the initial depth report was 46% TW based on EPRI ETSS sizing technique 27903.1 for the Single Volumetric Indication (SVI) report. The line-by-line sizing produced a maximum depth of 51% TW at one position within the indication. As a conservative approach, this maximum depth value of 51% TW was used in the CM analysis of the retainer bar wear degradation.

Figure 8-9: CM Limit for RB Wear, ETSS 27903.1



8.2.4 Tube-To-Tube Wear

Tube-to-Tube wear was evaluated with the flaw model described in Reference 4 as "axial part-throughwall degradation < 135° in circumferential extent." The circumferential extent of a TTW flaw is limited by the geometry of the interacting tubes such that it can be modeled as a single 100%TW wear scar formed by a flat bar positioned tangentially to the tube surface. In this configuration the maximum circumferential extent of the degradation will be 55.4°. For double-sided TTW, this model is bounding because the wear geometry provides sufficient circumferential separation between the wear scars to permit each indication to be treated separately. The separation between centerline contact points for double-side TTW is 180°, and results in negligible circumferential interaction between separate wear locations in the same axial plane of the tube. With respect to external loads, each wear indication at the same axial location may be treated individually. An individual TTW indication with a depth of 100%TW and a circumferential extent of 55.4° would be less than 16 PDA. Because the circumferential involvement of this limiting indication is less than 25 PDA, external loads need not be considered in the evaluation of burst integrity for TTW.

The +Point™ probe was used to measure the depth and the overall length of TTW through the application of ETSS 27902.2. The maximum measured length of any TTW indication was 41 inches. Using the flaw model discussed above it was determined that a rectangular flaw 41 inches long and 45%TW would meet the SIPC. Hence, it was concluded that all TTW sized less than 45%TW satisfied the SIPC. Although only TTW exceeding 45%TW required the more detailed flaw profiling analysis, all TTW indications with maximum depth ≥40%TW were profiled and analyzed to determine the structurally equivalent dimensions.

CM limit curves for TTW based upon ETSS 27902.2 are provided for SG 3E-088 and SG 3E-089 in Figure 8-10 and Figure 8-11, respectively. The figures also depict the structural dimensions of all indications for which axial depth profiling was performed. The use of structurally equivalent dimensions provides the highest likelihood of analytically demonstrating compliance with the CM structural performance criteria. However, as illustrated in Figure 8-10 and Figure 8-11, many TTW flaws exceeded the CM curve thus; satisfaction of the CM criteria could not be analytically demonstrated. Consequently, all of the TTW that exceeded the CM limit was subjected to in-situ pressure testing in an attempt to demonstrate CM criteria compliance.

8.2.4.1 In-Situ Test Results

Figure 8-12 and Figure 8-13 summarize the results of in-situ testing of TTW indications in each SG. All tested TTW wear in SG 3E-089 satisfied the structural integrity and accident leakage performance criteria. In SG 3E-088 three TTW indications failed both the AILPC and SIPC, and five flaws passed the AILPC but failed the SIPC. These results are summarized in Table 8-4.

In addition, four TTW indications predicted analytically to fail the SIPC, could not be tested to the required pressure levels because more limiting TTW in the same tube failed below the target pressure, terminating the test. These indications are depicted in Figure 8-12 as "Incomplete" (above the CM curve). In the absence of a successful in-situ pressure test, these must be considered to be SIPC failures (see Table 8-4).

For one TTW flaw a determination could not be made based upon in-situ test result as to whether the AILPC was satisfied. This flaw is labeled in Table 8-4 as "In Situ Test Indeterminate" due to the failure of a TTW flaw in the same tube at a pressure below the target AILPC pressure. The maximum measured throughwall depth of this flaw was 99%TW and the structural length exceeded 2 inches. From Figure 8-8 it must be concluded that this flaw does not satisfy the AILPC.

In summary, 12 TTW flaws in eight tubes failed to satisfy the structural integrity performance criteria, and four of the flaws (in three tubes) failed to satisfy the accident-induced leakage performance criteria.

8.2.4.2 Eddy Current Sizing

Following the detection of TTW, application of ETSS 27902.2 was site validated [13]. This was done by building a test specimen with flaws similar to the TTW flaws observed at SONGS. Many depth estimates were made with +Point™ using ETSS 27902.2. These results were compared with the actual depths of the wear flaws. This comparison showed that ETSS 27902.2 conservatively overestimated the depths across the entire range of depths tested (from 5%TW to 81%TW). The flaws in the test specimen that measured ≥70%TW were overestimated by an average of 17%TW.

The conservatism in the sizing technique as discussed above is supported by the in-situ test results. A cursory review of the best estimate burst pressures for the tubes that were in-situ pressure tested shows that approximately 45 failures would have been expected if the NDE sizing was accurate. Because there were only eight tubes that failed in-situ pressure testing, the measured depths are assumed to be overestimated using ETSS 27902.2. Again, this is consistent with the site validation work which showed that ETSS 27902.2 consistently overestimated the depths.

Table 8-4: In-Situ Test Result Summary for TTW Flaws

SG	Row	Col	Structural Depth (%TW)	Structural Length (in.)	Location	Test Pressure at Termination (psi)	SIPC Success During In-Situ Test?	AILPC Success During In-Situ Test?	Maximum Measured Depth (%TW)	AILPC Success Analytically?
SG 3E-088	98	80	74.4	3.28	B02	4886	No	Yes	NA	NA
SG 3E-088	99	81	71.8	4.17	B02	5026	No	Yes	NA	NA
SG 3E-088	100	80	79.7	2.8	B02-1	4732	No	Yes	NA	NA
			52.6	3.33	B02-2		No‡	Yes	NA	NA
SG 3E-088	101	81	74.3	3.86	B02-1	4889	No	Yes	NA	NA
			50.7	5.02	B02-2		No‡	Yes	NA	NA
SG 3E-088	102	78	98.7	2.63	B02	3268	No	No	NA	NA
SG 3E-088	104	78	91.7	1.06	B03	3180	No	No	NA	NA
			92.6	2.12	B02		No‡	In-Situ Test Indeterminateǂ	99	No
SG 3E-088	106	78	91.7	3.05	B03	2874	No	No	NA	NA
SG 3E-088	107	77	78.8	3.84	B02	5160	No	Yes	NA	NA
			47.5	3.22	B08		No‡	Yes	NA	NA

‡ Failure of SIPC predicted analytically, not proven otherwise by in-situ test. Failure assumed.

ǂ AILPC failed at the B03 TTW flaw. Test inconclusive for this flaw.

Figure 8-10: CM Limit for SG 3E-088 TTW, ETSS 27902.2, Structural Dimensions

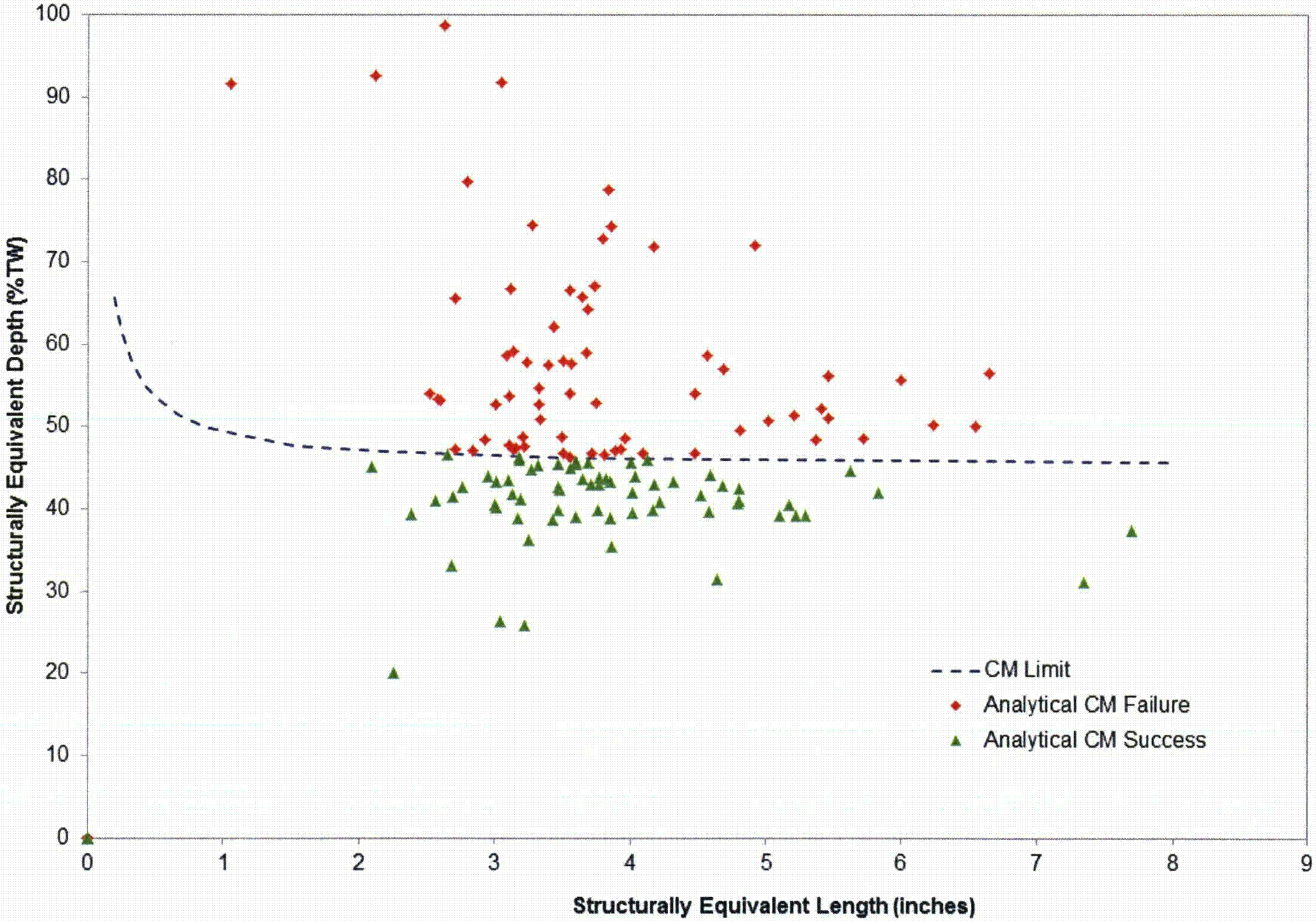


Figure 8-11: CM Limit for SG 3E-089 TTW, ETSS 27902.2, Structural Dimensions

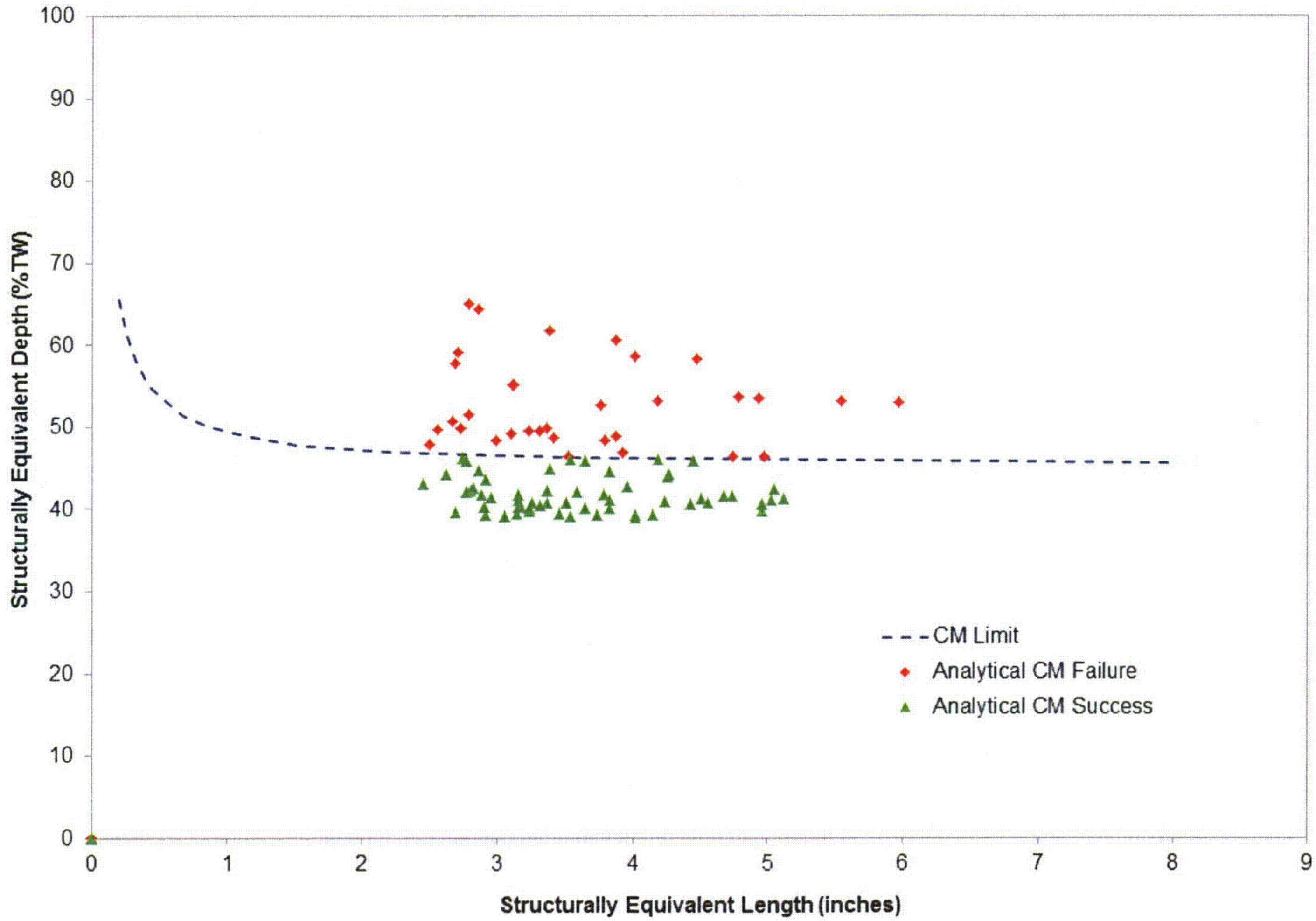


Figure 8-12: In-Situ Test Results for SG 3E-088 TTW, ETSS 27902.2, Structural Dimensions

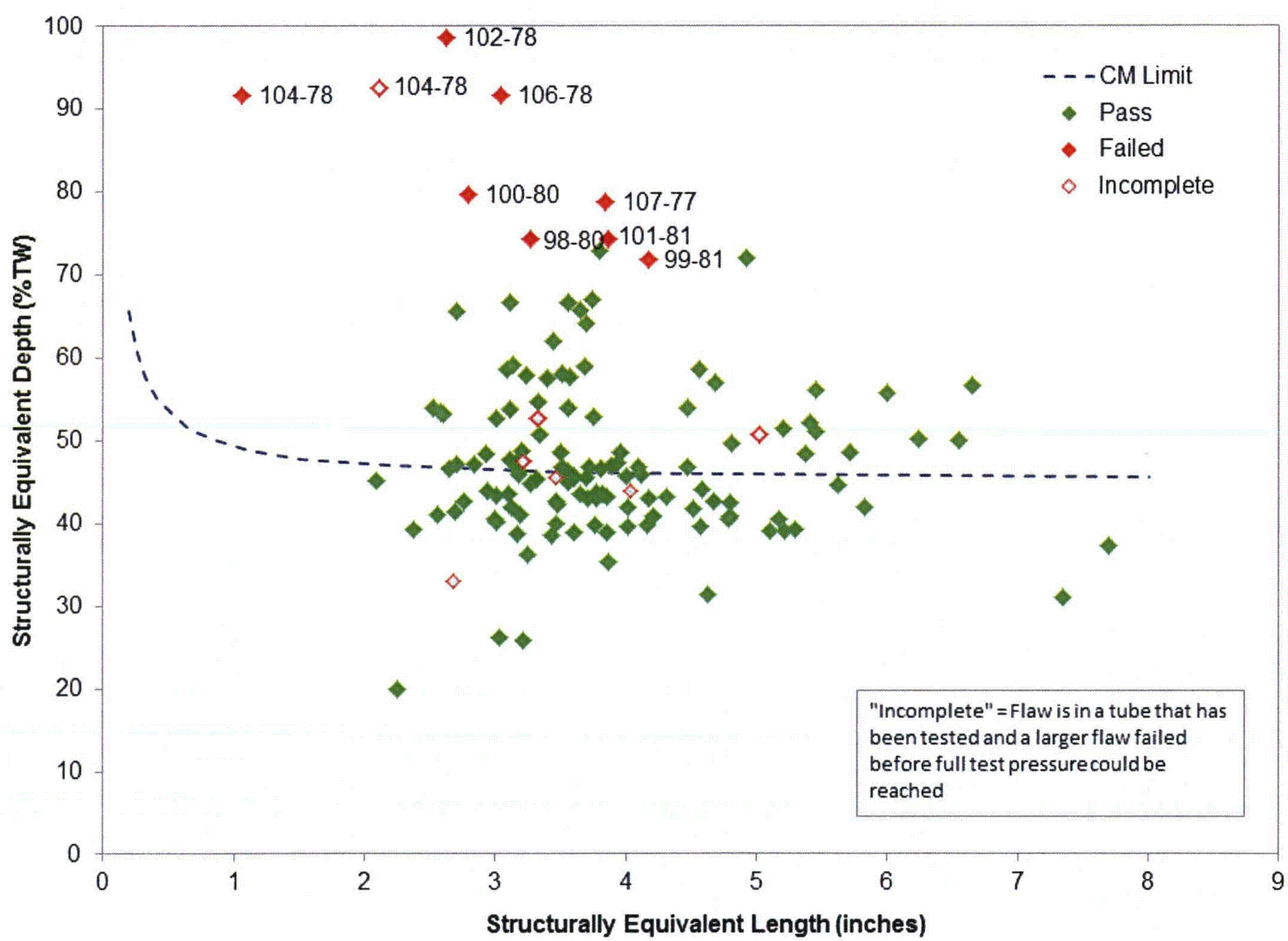
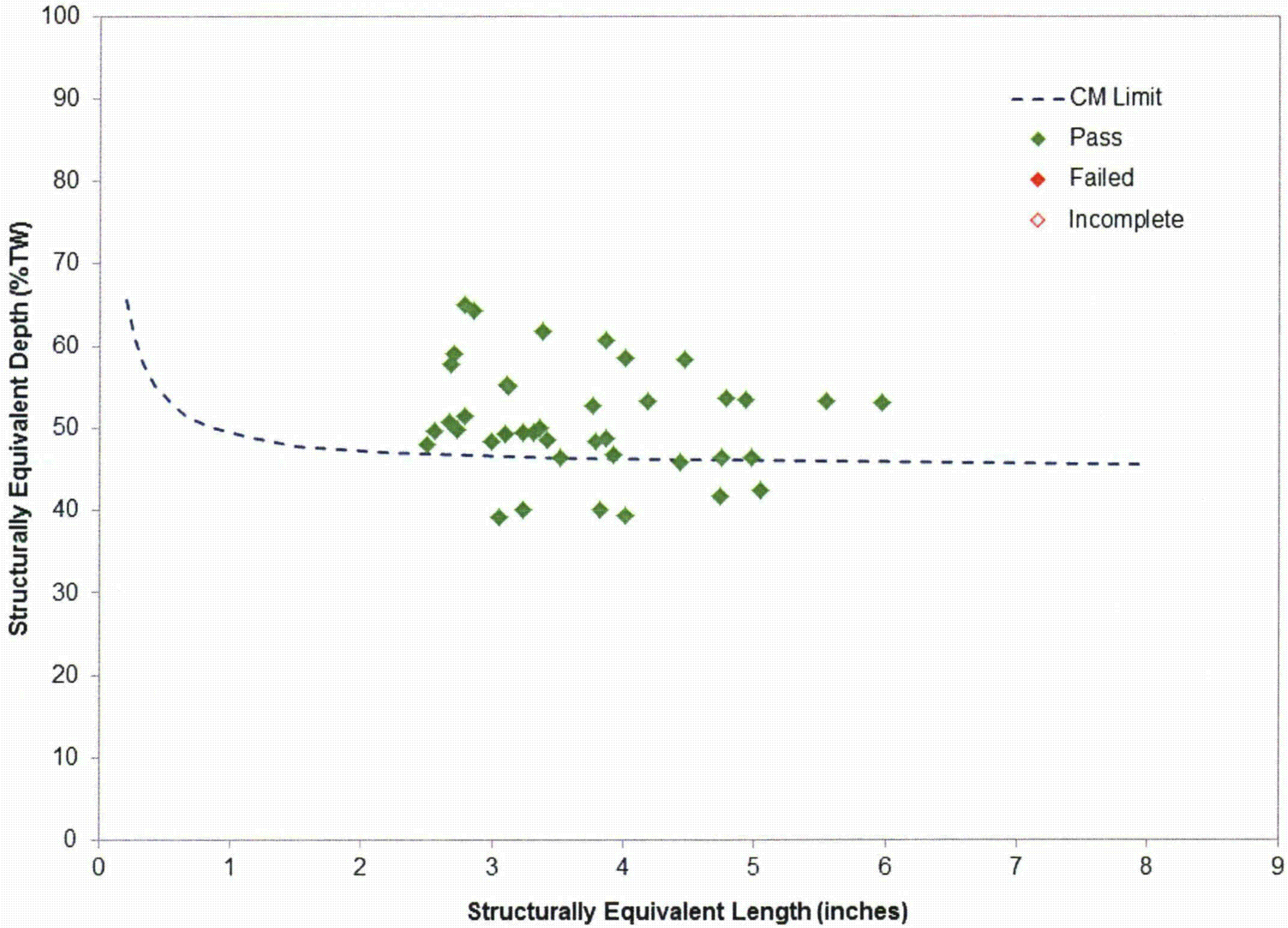


Figure 8-13: In-Situ Test Results for SG 3E-089 TTW, ETSS 27902.2, Structural Dimensions



9.0 CONDITION MONITORING CONCLUSION

This condition monitoring assessment has evaluated all SG tube degradation detected during the Unit 3 2012 leaker outage against the three SONGS Technical Specification performance criteria. Through a combination of eddy current inspection, analytical evaluation, in-situ pressure testing, and operational leakage monitoring, the following conclusions are drawn:

1) Despite the fact that operational SG tube leakage resulted in a forced outage, the leak rate remained below the Technical Specification limit (150 GPD); therefore the operational leakage integrity performance criterion was met.

2) A total of eight tubes failed to meet the structural integrity performance criterion due to tube-to-tube wear and tube support plate wear.

3) A total of three tubes failed to meet the accident-induced leakage performance criterion due to tube-to-tube wear and tube support plate wear.

10.0 REFERENCES

1. NEI 97-06, "SG Program Guidelines," Rev. 3, January 2011.
2. EPRI Report 1019038, "SG Integrity Assessment Guidelines: Revision 3", November 2009.
3. EPRI Report 1014983, "Steam Generator In Situ Pressure Test Guidelines, Revision 3", August 2007.
4. EPRI Report 1019037 "Steam Generator Degradation Specific Management Flaw Handbook", Revision 1, with error correction in J. Benson email dated 3/30/2012, December 2009.
5. EPRI, SG Management Project, "sgmp.epriq.com."
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7. AREVA Document 51-9104383-002, "SONGS Units 2 & 3 Replacement Steam Generator Eddy Current Technique Validation."
8. AREVA Document 32-5033045-002, "Mathcad Implementation of SG Flaw Handbook Equations for Integrity Assessment".
9. *Matheny, Southern California Edison, "Numerical Values for the SG OAs, SONGS Units 2 and 3", February 8, 2012
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11. AREVA Document 51-9179808-000, "In-Situ Pressure Test Results for SONGS U3F16B Outage."
12. *MHI, "SONGS Unit 2 & 3 RSGs, Regulatory Guide 1.121 Analysis," SO23-617-1-C1262, Rev. 4
13. AREVA Document 51-9177744-000 "Site Validation of EPRI Sizing ETSS for Tube-Tube Wear in SONGS Steam Generators".
14. AREVA Document 51-9179946-001, "Comparison of Bobbin and +Point POD for Tube-Tube Wear in SONGS Steam Generators".
15. SCE Licensee Event Report 2012-001-00, "Unit 3 Manual Reactor Trip due to Steam Generator Tube Leak", March 29 2012.
16. SONGS Technical Specifications Section 5.5.2.11, "Steam Generator (SG) Program".
17. SONGS Technical Specifications Section 3.4.13, "RCS Operational Leakage".

18. INPO Operating Experience Report OE 34946, "Tube –to-Tube Contact Wear Identified in TMI-1 Steam Generators (TMI-1)".

19. NRC Information Notice 2012-7, "Tube-to-Tube Contact Resulting in Wear in Once Through Steam Generators".

20. INPO Operating Experience Report OE 35359, "Large Number of Anti-Vibration Bar Wear Indications Reported in the Unit 2 Replacement Steam Generators (St. Lucie)."

21. *MHI Document L5-04GA111, "San Onofre Generating Station, Units 2 & 3 Replacement Steam Generators Vendor Manual", Rev 6 (SONGS Document SO23-617-1-M1273, Rev 6).

22. AREVA Document 03-9180130-000, "SONGS 3F16B SSI Final Report".

* These references are not available from the AREVA NP records center. However, they are available from the SCE document control system. Therefore, this is an acceptable reference for use on this contract per AREVA NP Procedure 0402-01, Attachment 8 as authorized by the PM signature on page 2

Appendix A

SG 3E-088 Plugging List

S/G	Row	Col	Hot Leg	Cold Leg	Reason for Tube Repair	Rev
3E088	117	81	ROLLSTAB (750")	ROLLED	AVB Wear >=35%	Rev3
3E088	108	34	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	110	34	ROLLSTAB (668")	ROLLED	Preventative - Retainer Bar	Rev1
3E088	109	35	ROLLSTAB (668")	ROLLED	Preventative - Retainer Bar	Rev1
3E088	111	35	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	110	36	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	112	36	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	111	37	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	113	37	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	112	38	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	114	38	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	113	39	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	115	39	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	114	40	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	116	40	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	115	41	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	117	41	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	116	42	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	118	42	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	117	43	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	119	43	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	118	44	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	120	44	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	119	45	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	121	45	ROLLSTAB (668")	ROLLED	Preventative - Retainer Bar	Rev1
3E088	120	46	ROLLSTAB (668")	ROLLED	Preventative - Retainer Bar	Rev1
3E088	122	46	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	121	47	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	123	47	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	122	48	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	124	48	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	123	49	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	124	50	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	126	50	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	125	51	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	127	51	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	126	52	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	128	52	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	127	53	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	129	53	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	128	54	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	130	54	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	129	55	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	131	55	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1

S/G	Row	Col	Hot Leg	Cold Leg	Reason for Tube Repair	Rev
3E088	130	56	ROLLSTAB (668")	ROLLED	Preventative - Retainer Bar	Rev1
3E088	132	56	ROLLSTAB (668")	ROLLED	Preventative - Retainer Bar	Rev1
3E088	131	57	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	131	121	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	130	122	ROLLSTAB (668")	ROLLED	Preventative - Retainer Bar	Rev1
3E088	132	122	ROLLSTAB (668")	ROLLED	Preventative - Retainer Bar	Rev1
3E088	129	123	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	131	123	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	128	124	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	130	124	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	127	125	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	129	125	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	126	126	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	125	127	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	127	127	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	124	128	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	126	128	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	123	129	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	125	129	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	122	130	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	124	130	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	121	131	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	123	131	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	120	132	ROLLSTAB (668")	ROLLED	Preventative - Retainer Bar	Rev1
3E088	122	132	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	119	133	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	121	133	ROLLSTAB (668")	ROLLED	Preventative - Retainer Bar	Rev1
3E088	118	134	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	120	134	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	117	135	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	119	135	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	116	136	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	118	136	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	115	137	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	114	138	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	116	138	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	113	139	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	115	139	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	112	140	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	114	140	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	111	141	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	113	141	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	110	142	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	112	142	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	109	143	ROLLSTAB (668")	ROLLED	Preventative - Retainer Bar	Rev1

S/G	Row	Col	Hot Leg	Cold Leg	Reason for Tube Repair	Rev
3E088	111	143	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	108	144	ROLLED	ROLLED	Preventative - Retainer Bar	Rev1
3E088	110	144	ROLLSTAB (668")	ROLLED	Preventative - Retainer Bar	Rev1
3E088	92	74	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	94	74	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	102	74	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	106	74	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	108	74	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	93	75	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	95	75	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	121	75	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	92	76	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	94	76	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	96	76	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	116	76	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	122	76	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	124	76	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	81	77	ROLLSTAB (668")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	87	77	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	89	77	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	93	77	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	95	77	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	97	77	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	123	77	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	125	77	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	80	78	ROLLSTAB (668")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	82	78	ROLLSTAB (668")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	84	78	ROLLSTAB (668")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	86	78	ROLLSTAB (668")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	88	78	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	90	78	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	92	78	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	94	78	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	124	78	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	130	78	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	81	79	ROLLSTAB (668")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	83	79	ROLLSTAB (668")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	85	79	ROLLSTAB (668")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	87	79	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	89	79	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	91	79	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	93	79	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	123	79	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	80	80	ROLLSTAB (668")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	82	80	ROLLSTAB (668")	ROLLED	Preventative (MHI for TTW)	Rev4

S/G	Row	Col	Hot Leg	Cold Leg	Reason for Tube Repair	Rev
3E088	84	80	ROLLSTAB (668")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	88	80	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	90	80	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	92	80	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	120	80	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	122	80	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	124	80	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	79	81	ROLLSTAB (668")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	81	81	ROLLSTAB (668")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	83	81	ROLLSTAB (668")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	85	81	ROLLSTAB (668")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	87	81	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	89	81	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	91	81	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	119	81	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	121	81	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	80	82	ROLLSTAB (668")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	82	82	ROLLSTAB (668")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	84	82	ROLLSTAB (668")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	86	82	ROLLSTAB (668")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	88	82	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	90	82	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	92	82	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	116	82	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	118	82	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	124	82	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	85	83	ROLLSTAB (668")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	87	83	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	89	83	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	115	83	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	117	83	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	125	83	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	84	84	ROLLSTAB (668")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	88	84	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	114	84	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	118	84	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	83	85	ROLLSTAB (668")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	85	85	ROLLSTAB (668")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	87	85	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	89	85	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	113	85	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	117	85	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	119	85	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	121	85	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	84	86	ROLLSTAB (668")	ROLLED	Preventative (MHI for TTW)	Rev4

S/G	Row	Col	Hot Leg	Cold Leg	Reason for Tube Repair	Rev
3E088	86	86	ROLLSTAB (668")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	88	86	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	90	86	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	92	86	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	108	86	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	110	86	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	112	86	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	85	87	ROLLSTAB (668")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	89	87	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	91	87	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	93	87	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	109	87	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	111	87	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	113	87	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	92	88	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	108	88	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	110	88	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	112	88	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	116	88	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	118	88	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	93	89	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	95	89	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	97	89	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	109	89	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	111	89	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	94	90	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	96	90	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	98	90	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	100	90	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	102	90	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	108	90	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	112	90	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	89	91	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	95	91	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	97	91	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	99	91	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	101	91	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	103	91	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	105	91	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	107	91	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	94	92	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	96	92	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	98	92	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	100	92	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	102	92	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4

S/G	Row	Col	Hot Leg	Cold Leg	Reason for Tube Repair	Rev
3E088	104	92	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	106	92	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	108	92	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	89	93	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	93	93	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	95	93	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	97	93	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	99	93	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	101	93	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	105	93	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	107	93	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	88	94	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	94	94	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	89	95	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	88	96	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	90	96	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	92	96	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	89	97	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	91	97	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev4
3E088	87	75	ROLLSTAB (750")	ROLLED	Preventative (Six Consecutive AVB Wear)	Rev5
3E088	78	80	ROLLSTAB (750")	ROLLED	Preventative (Six Consecutive AVB Wear)	Rev5
3E088	109	73	ROLLSTAB (780")	ROLLED	Preventative (TTW Fence)	Rev4
3E088	111	73	ROLLSTAB (780")	ROLLED	Preventative (TTW Fence)	Rev4
3E088	113	73	ROLLSTAB (780")	ROLLED	Preventative (TTW Fence)	Rev4
3E088	115	73	ROLLSTAB (780")	ROLLED	Preventative (TTW Fence)	Rev4
3E088	100	74	ROLLSTAB (750")	ROLLED	Preventative (TTW Fence)	Rev4
3E088	104	74	ROLLSTAB (750")	ROLLED	Preventative (TTW Fence)	Rev4
3E088	116	74	ROLLSTAB (780")	ROLLED	Preventative (TTW Fence)	Rev4
3E088	97	75	ROLLSTAB (750")	ROLLED	Preventative (TTW Fence)	Rev4
3E088	99	75	ROLLSTAB (750")	ROLLED	Preventative (TTW Fence)	Rev4
3E088	117	75	ROLLSTAB (780")	ROLLED	Preventative (TTW Fence)	Rev4
3E088	119	75	ROLLSTAB (780")	ROLLED	Preventative (TTW Fence)	Rev4
3E088	125	49	ROLLSTAB (668")	ROLLED	Retainer Bar Wear	Rev1
3E088	128	126	ROLLSTAB (668")	ROLLED	Retainer Bar Wear	Rev1
3E088	117	137	ROLLSTAB (668")	ROLLED	Retainer Bar Wear	Rev1
3E088	110	74	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	112	74	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	114	74	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	101	75	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	103	75	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	105	75	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	107	75	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	109	75	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	111	75	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	113	75	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3

S/G	Row	Col	Hot Leg	Cold Leg	Reason for Tube Repair	Rev
3E088	115	75	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	98	76	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	100	76	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	102	76	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	104	76	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	106	76	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	108	76	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	110	76	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	112	76	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	114	76	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	118	76	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	120	76	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	99	77	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	101	77	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	103	77	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	105	77	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	107	77	ROLLSTAB (780")	ROLLED	U-bend TTW	Rev0
3E088	109	77	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	111	77	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	113	77	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	115	77	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	117	77	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	119	77	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	121	77	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	96	78	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	98	78	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	100	78	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	102	78	ROLLSTAB (780")	ROLLED	U-bend TTW	Rev0
3E088	104	78	ROLLSTAB (780")	ROLLED	U-bend TTW	Rev0
3E088	106	78	ROLLSTAB (780")	ROLLED	U-bend TTW	Rev0
3E088	108	78	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	110	78	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	112	78	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	114	78	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	116	78	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	118	78	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	120	78	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	122	78	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	95	79	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	97	79	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	99	79	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	101	79	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	103	79	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	105	79	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	107	79	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2

S/G	Row	Col	Hot Leg	Cold Leg	Reason for Tube Repair	Rev
3E088	109	79	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	111	79	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	113	79	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	115	79	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	117	79	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	119	79	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	121	79	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	94	80	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	96	80	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	98	80	ROLLSTAB (780")	ROLLED	U-bend TTW	Rev0
3E088	100	80	ROLLSTAB (780")	ROLLED	U-bend TTW	Rev0
3E088	102	80	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	104	80	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	106	80	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	108	80	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	110	80	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	112	80	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	114	80	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	116	80	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	118	80	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	93	81	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	95	81	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	97	81	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	99	81	ROLLSTAB (780")	ROLLED	U-bend TTW	Rev0
3E088	101	81	ROLLSTAB (780")	ROLLED	U-bend TTW	Rev0
3E088	103	81	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	105	81	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	107	81	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	109	81	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	111	81	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	113	81	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	115	81	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	94	82	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	96	82	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	98	82	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	100	82	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	102	82	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	104	82	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	106	82	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	108	82	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	110	82	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	112	82	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	114	82	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	91	83	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	93	83	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2

S/G	Row	Col	Hot Leg	Cold Leg	Reason for Tube Repair	Rev
3E088	95	83	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	97	83	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	99	83	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	101	83	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	103	83	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	105	83	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	107	83	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	109	83	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	111	83	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	113	83	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	90	84	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	92	84	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	94	84	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	96	84	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	98	84	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	100	84	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	102	84	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	104	84	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	106	84	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	108	84	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	110	84	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	112	84	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	91	85	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	93	85	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	95	85	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	97	85	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	99	85	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	101	85	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	103	85	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	105	85	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	107	85	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	109	85	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	111	85	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	94	86	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	96	86	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	98	86	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	100	86	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	102	86	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	104	86	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	106	86	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	95	87	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	97	87	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	99	87	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	101	87	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	103	87	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2

S/G	Row	Col	Hot Leg	Cold Leg	Reason for Tube Repair	Rev
3E088	105	87	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	107	87	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	94	88	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	96	88	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	98	88	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	100	88	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	102	88	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	104	88	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E088	106	88	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	99	89	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	101	89	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	103	89	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	105	89	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	107	89	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	104	90	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3
3E088	106	90	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev3

Appendix B

SG 3E-089 Plugging List

S/G	Row	Col	Hot Leg	Cold Leg	Reason for Tube Repair	Rev
3E089	108	34	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	110	34	ROLLSTAB (668")	ROLLED	Preventative - Retainer Bar	Rev0
3E089	109	35	ROLLSTAB (668")	ROLLED	Preventative - Retainer Bar	Rev0
3E089	111	35	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	110	36	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	112	36	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	111	37	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	113	37	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	112	38	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	114	38	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	113	39	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	115	39	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	114	40	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	116	40	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	115	41	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	117	41	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	116	42	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	118	42	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	117	43	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	119	43	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	118	44	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	120	44	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	119	45	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	121	45	ROLLSTAB (668")	ROLLED	Preventative - Retainer Bar	Rev0
3E089	120	46	ROLLSTAB (668")	ROLLED	Preventative - Retainer Bar	Rev0
3E089	122	46	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	121	47	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	123	47	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	122	48	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	124	48	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	123	49	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	125	49	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	124	50	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	126	50	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	125	51	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	127	51	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	126	52	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	128	52	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	127	53	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	129	53	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	128	54	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	130	54	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	129	55	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	131	55	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0

S/G	Row	Col	Hot Leg	Cold Leg	Reason for Tube Repair	Rev
3E089	130	56	ROLLSTAB (668")	ROLLED	Preventative - Retainer Bar	Rev0
3E089	132	56	ROLLSTAB (668")	ROLLED	Preventative - Retainer Bar	Rev0
3E089	131	57	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	131	121	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	130	122	ROLLSTAB (668")	ROLLED	Preventative - Retainer Bar	Rev0
3E089	132	122	ROLLSTAB (668")	ROLLED	Preventative - Retainer Bar	Rev0
3E089	129	123	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	131	123	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	128	124	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	130	124	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	127	125	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	129	125	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	126	126	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	128	126	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	125	127	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	127	127	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	124	128	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	126	128	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	123	129	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	125	129	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	122	130	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	121	131	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	123	131	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	120	132	ROLLSTAB (668")	ROLLED	Preventative - Retainer Bar	Rev0
3E089	122	132	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	119	133	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	121	133	ROLLSTAB (668")	ROLLED	Preventative - Retainer Bar	Rev0
3E089	118	134	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	120	134	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	117	135	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	119	135	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	116	136	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	118	136	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	115	137	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	117	137	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	114	138	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	116	138	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	113	139	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	115	139	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	112	140	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	114	140	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	111	141	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	113	141	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	110	142	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	112	142	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0

S/G	Row	Col	Hot Leg	Cold Leg	Reason for Tube Repair	Rev
3E089	109	143	ROLLSTAB (668")	ROLLED	Preventative - Retainer Bar	Rev0
3E089	111	143	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	108	144	ROLLED	ROLLED	Preventative - Retainer Bar	Rev0
3E089	110	144	ROLLSTAB (668")	ROLLED	Preventative - Retainer Bar	Rev0
3E089	85	75	ROLLSTAB (668")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	97	75	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	86	76	ROLLSTAB (668")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	94	76	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	96	76	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	98	76	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	100	76	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	83	77	ROLLSTAB (668")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	87	77	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	93	77	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	107	77	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	86	78	ROLLSTAB (668")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	88	78	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	92	78	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	94	78	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	83	79	ROLLSTAB (668")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	85	79	ROLLSTAB (668")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	87	79	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	89	79	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	91	79	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	115	79	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	86	80	ROLLSTAB (668")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	88	80	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	90	80	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	110	80	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	114	80	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	87	81	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	109	81	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	84	82	ROLLSTAB (668")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	86	82	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	88	82	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	108	82	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	112	82	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	118	82	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	120	82	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	83	83	ROLLSTAB (668")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	85	83	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	109	83	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	111	83	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	113	83	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	117	83	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev3

S/G	Row	Col	Hot Leg	Cold Leg	Reason for Tube Repair	Rev
3E089	119	83	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	82	84	ROLLSTAB (668")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	84	84	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	108	84	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	110	84	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	112	84	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	114	84	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	81	85	ROLLSTAB (668")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	83	85	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	109	85	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	111	85	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	113	85	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	115	85	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	117	85	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	84	86	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	86	86	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	110	86	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	112	86	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	114	86	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	116	86	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	109	87	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	111	87	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	113	87	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	115	87	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	108	88	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	110	88	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	112	88	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	114	88	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	116	88	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	83	89	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	109	89	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	111	89	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	113	89	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	115	89	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	108	90	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	110	90	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	114	90	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	85	91	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	105	91	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	107	91	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	109	91	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	111	91	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	113	91	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	102	92	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	104	92	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3

S/G	Row	Col	Hot Leg	Cold Leg	Reason for Tube Repair	Rev
3E089	106	92	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	108	92	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	110	92	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	112	92	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	97	93	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	99	93	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	101	93	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	105	93	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	107	93	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	109	93	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	111	93	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	88	94	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	92	94	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	94	94	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	96	94	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	98	94	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	100	94	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	102	94	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	106	94	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	108	94	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	110	94	ROLLSTAB (780")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	91	95	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	93	95	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	99	95	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	101	95	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	107	95	ROLLSTAB (750")	ROLLED	Preventative (MHI for TTW)	Rev3
3E089	85	81	ROLLSTAB (750")	ROLLED	Preventative (Six Consecutive AVB Wear)	Rev4
3E089	122	88	ROLLSTAB (750")	ROLLED	Preventative (Six Consecutive AVB Wear)	Rev4
3E089	101	75	ROLLSTAB (750")	ROLLED	Preventative (TTW Fence)	Rev3
3E089	103	75	ROLLSTAB (750")	ROLLED	Preventative (TTW Fence)	Rev3
3E089	105	75	ROLLSTAB (750")	ROLLED	Preventative (TTW Fence)	Rev3
3E089	106	76	ROLLSTAB (750")	ROLLED	Preventative (TTW Fence)	Rev3
3E089	109	77	ROLLSTAB (750")	ROLLED	Preventative (TTW Fence)	Rev3
3E089	110	78	ROLLSTAB (780")	ROLLED	Preventative (TTW Fence)	Rev3
3E089	111	79	ROLLSTAB (780")	ROLLED	Preventative (TTW Fence)	Rev3
3E089	83	87	ROLLSTAB (750")	ROLLED	Preventative (TTW Fence)	Rev3
3E089	82	88	ROLLSTAB (750")	ROLLED	Preventative (TTW Fence)	Rev3
3E089	84	90	ROLLSTAB (750")	ROLLED	Preventative (TTW Fence)	Rev3
3E089	86	92	ROLLSTAB (750")	ROLLED	Preventative (TTW Fence)	Rev3
3E089	85	93	ROLLSTAB (750")	ROLLED	Preventative (TTW Fence)	Rev3
3E089	86	94	ROLLSTAB (750")	ROLLED	Preventative (TTW Fence)	Rev3
3E089	90	94	ROLLSTAB (750")	ROLLED	Preventative (TTW Fence)	Rev3
3E089	124	130	ROLLSTAB (668")	ROLLED	Retainer Bar Wear	Rev0
3E089	102	76	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	104	76	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2

S/G	Row	Col	Hot Leg	Cold Leg	Reason for Tube Repair	Rev
3E089	95	77	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	97	77	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	99	77	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	101	77	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	103	77	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	105	77	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	96	78	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	98	78	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	100	78	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	102	78	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	104	78	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	106	78	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	108	78	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	93	79	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	95	79	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	97	79	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	99	79	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	101	79	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	103	79	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	105	79	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	107	79	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	109	79	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	92	80	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	94	80	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	96	80	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	98	80	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	100	80	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	102	80	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	104	80	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	106	80	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	108	80	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	89	81	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	91	81	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	93	81	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	95	81	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	97	81	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	99	81	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	101	81	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	103	81	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	105	81	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	107	81	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	90	82	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	92	82	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	94	82	ROLLSTAB (780")	ROLLED	U-bend TTW	Rev2
3E089	96	82	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2

S/G	Row	Col	Hot Leg	Cold Leg	Reason for Tube Repair	Rev
3E089	98	82	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	100	82	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	102	82	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	104	82	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	106	82	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	87	83	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	89	83	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	91	83	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	93	83	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	95	83	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	97	83	ROLLSTAB (780")	ROLLED	U-bend TTW	Rev2
3E089	99	83	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	101	83	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	103	83	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	105	83	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	107	83	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	86	84	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	88	84	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	90	84	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	92	84	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	94	84	ROLLSTAB (780")	ROLLED	U-bend TTW	Rev2
3E089	96	84	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	98	84	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	100	84	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	102	84	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	104	84	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	106	84	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	85	85	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	87	85	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	89	85	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	91	85	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	93	85	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	95	85	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	97	85	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	99	85	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	101	85	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	103	85	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	105	85	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	107	85	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	88	86	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	90	86	ROLLSTAB (780")	ROLLED	U-bend TTW	Rev2
3E089	92	86	ROLLSTAB (780")	ROLLED	U-bend TTW	Rev2
3E089	94	86	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	96	86	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	98	86	ROLLSTAB (780")	ROLLED	U-bend TTW	Rev2

S/G	Row	Col	Hot Leg	Cold Leg	Reason for Tube Repair	Rev
3E089	100	86	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	102	86	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	104	86	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	106	86	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	108	86	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	85	87	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	87	87	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	89	87	ROLLSTAB (780")	ROLLED	U-bend TTW	Rev2
3E089	91	87	ROLLSTAB (780")	ROLLED	U-bend TTW	Rev2
3E089	93	87	ROLLSTAB (780")	ROLLED	U-bend TTW	Rev2
3E089	95	87	ROLLSTAB (780")	ROLLED	U-bend TTW	Rev2
3E089	97	87	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	99	87	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	101	87	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	103	87	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	105	87	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	107	87	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	84	88	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	86	88	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	88	88	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	90	88	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	92	88	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	94	88	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	96	88	ROLLSTAB (780")	ROLLED	U-bend TTW	Rev2
3E089	98	88	ROLLSTAB (780")	ROLLED	U-bend TTW	Rev2
3E089	100	88	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	102	88	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	104	88	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	106	88	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	85	89	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	87	89	ROLLSTAB (780")	ROLLED	U-bend TTW	Rev2
3E089	89	89	ROLLSTAB (780")	ROLLED	U-bend TTW	Rev2
3E089	91	89	ROLLSTAB (780")	ROLLED	U-bend TTW	Rev2
3E089	93	89	ROLLSTAB (780")	ROLLED	U-bend TTW	Rev2
3E089	95	89	ROLLSTAB (780")	ROLLED	U-bend TTW	Rev2
3E089	97	89	ROLLSTAB (780")	ROLLED	U-bend TTW	Rev2
3E089	99	89	ROLLSTAB (780")	ROLLED	U-bend TTW	Rev2
3E089	101	89	ROLLSTAB (780")	ROLLED	U-bend TTW	Rev2
3E089	103	89	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	105	89	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	107	89	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	86	90	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	88	90	ROLLSTAB (780")	ROLLED	U-bend TTW	Rev2
3E089	90	90	ROLLSTAB (780")	ROLLED	U-bend TTW	Rev2
3E089	92	90	ROLLSTAB (780")	ROLLED	U-bend TTW	Rev2

S/G	Row	Col	Hot Leg	Cold Leg	Reason for Tube Repair	Rev
3E089	94	90	ROLLSTAB (780")	ROLLED	U-bend TTW	Rev2
3E089	96	90	ROLLSTAB (780")	ROLLED	U-bend TTW	Rev2
3E089	98	90	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	100	90	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	102	90	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	104	90	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	106	90	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	87	91	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	89	91	ROLLSTAB (780")	ROLLED	U-bend TTW	Rev2
3E089	91	91	ROLLSTAB (780")	ROLLED	U-bend TTW	Rev2
3E089	93	91	ROLLSTAB (780")	ROLLED	U-bend TTW	Rev2
3E089	95	91	ROLLSTAB (780")	ROLLED	U-bend TTW	Rev2
3E089	97	91	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	99	91	ROLLSTAB (780")	ROLLED	U-bend TTW	Rev2
3E089	101	91	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	103	91	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	88	92	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	90	92	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	92	92	ROLLSTAB (780")	ROLLED	U-bend TTW	Rev2
3E089	94	92	ROLLSTAB (780")	ROLLED	U-bend TTW	Rev2
3E089	96	92	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	98	92	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	100	92	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	87	93	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	89	93	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	91	93	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2
3E089	93	93	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev1
3E089	95	93	ROLLSTAB (750")	ROLLED	U-bend TTW	Rev2