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U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-0001

Subject: Beaver Valley Power Station, Unit No. 2
Docket No. 50-412, License No. NPF-73
Response to Request for Additional Information
Unit 2 SG Tube Inspection Surveillance Interval Extension,
License Amendment Request No. 142

This letter provides our response to a verbal NRC request for additional information concerning Unit 2 License Amendment Request (LAR) No. 142. LAR No. 142 was submitted to the NRC by letter L–99-141 dated November 29, 1999. This LAR proposed an extension of the steam generator tube inspection surveillance interval that would allow the surveillance to be performed during the Unit 2 eighth refueling outage. In order to support the review of LAR No. 142, the NRC has requested that the Condition Monitoring and Operational Assessment Report for the Unit 2 steam generators also be submitted for review. The most recent revision of the requested report is provided in the attachment to this letter.

If there are any questions concerning this matter, please contact Mr. Mark S. Ackerman, Manager, Licensing at 412-393-5203.

Sincerely,

Mark T. Reason for
Lew W. Myers

c: Mr. D. S. Collins, Project Manager
Mr. D. M. Kern, Sr. Resident Inspector
Mr. H. J. Miller, NRC Region I Administrator
Mr. W. P. Dornsife, Director BRP/DEP
Mr. M. P. Murphy (BRP/DEP)

A001

c: Mary E. O'Reilly
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Akron, OH 44308

I, Marc P. Pearson, being duly sworn, state that I am Director, Plant Services of FirstEnergy Nuclear Operating Company (FENOC), that I am authorized to sign and file this submittal with the Nuclear Regulatory Commission on behalf of FENOC, and that the statements made and the matters set forth herein pertaining to FENOC are true and correct to the best of my knowledge and belief.

FirstEnergy Nuclear Operating Company

Marc P. Pearson
Director Plant Services

STATE OF Pennsylvania

COUNTY OF Beaver

Subscribed and sworn to me, a Notary Public, in and for the County and State above named, this ~~17~~ 20th (Amd) th day of December, 1999.

Sheila M Fattore

My Commission Expires:

Notarial Seal
Sheila M. Fattore, Notary Public
Shippingport Boro, Beaver County
My Commission Expires Sept. 30, 2002
Member, Pennsylvania Association of Notaries

FRAMATOME TECHNOLOGIES

ENGINEERING INFORMATION RECORD

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Technical Manager Statement: Initials [initials]

Reviewer is Independent.

Remarks:

This document provides the condition monitoring and operational assessments of the steam generator tubing at the Beaver Valley Power Station – Unit 2. The condition monitoring portion of this document is based on the as-found conditions of the tubing during the 08/98 Forced Outage. The operational assessment projects the condition of the tubing at the time of the next scheduled inspection. Since the next inspection isn't scheduled until the eighth refueling outage, this assessment covers the remainder of Cycle 7 and all of Cycle 8.

Record of Revisions

Revision 00	Original Release
Revision 01	Incorporated DLCo Comments into Sections 3.4, 4.4, 7.5 and 8.5

FTI Non-Proprietary

1.0 INTRODUCTION

This report provides the tube integrity condition monitoring and operational assessments for the Beaver Valley Unit 2 steam generators. This report assesses the "as-found" conditions of the steam generator tubing during the 08/98 Forced Outage as well as the projected condition of the tubing at the end of Cycle 8. The condition of the tubing is evaluated against the structural guidelines of Regulatory Guide 1.121 and of the Draft Regulatory Guide DG-1074. According to DG-1074, the condition monitoring assessment should address the as-found conditions of the tubing with respect to the structural, operational leakage, and accident leakage criteria. Per DG-1074, an operational assessment should also be performed to demonstrate that the performance criteria would continue to be met until the next scheduled inspection.

During the 08/98 Forced Outage, tubesheet-related degradation accounted for the majority of the repairable indications. Circumferential ODSCC near the top of the hot leg tubesheet was the main damage mechanism affecting the BVPS-2 steam generator tubes. A total of thirteen tubes were repaired during the Forced Outage. Eight tubes were repaired due to tubesheet related indications. Five tubes were repaired due to non-tubesheet related indications.

Tubesheet Indications

- 5 tubes w/ circumferential ODSCC at the top of the hot leg tubesheet
- 1 tube w/ axial ODSCC just above the top of the hot leg tubesheet
- 1 tube w/ pit-like indication at the top of the hot leg tubesheet
- 1 tube w/ volumetric indication near the top of the cold leg tubesheet

Other Indications

- 1 tube w/ volumetric indication in a Row 1 u-bend
- 1 tube w/ volumetric indication at the 2H support plate
- 3 tubes w/ unusual freespan bobbin signals (SG B); preventatively plugged (see Section 7.5)

2.0 EVALUATION OF THE LIMITING INDICATIONS

The results of the eddy current inspection were reviewed to determine the structural significance of the indications detected relative to the requirements of plant Technical Specifications, RG 1.121, and DG-1074. For circumferential ODSCC at the top of the tubesheet, the structural limit is 1.72 inches in arc length (Ref. 9.1). For axial ODSCC in the sludge pile, the structural limit is 0.45 inches. These structural limits assume a 100% throughwall crack of the corresponding length. Additionally for axial ODSCC, the structural limit is 1.0 inch at 68% throughwall for lower tolerance limit tube material properties (Ref 9.3). Table 2-1 shows the estimated lengths and depths of all of the crack-like indications as well as the sizes of the largest volumetric-type indications.

Table 2-1
Summary of Indication Sizes

Degradation Mechanism	SG	Row	Col	+ PT Volts	Length (inches)	Structural Limit	Max Depth (%TW)
Circumferential ODSCC At Roll Transition	A	8	48	0.23	0.22	62.6 PDA 1.72" - 100%	89
	A	13	88	0.11	0.85		100
	A	33	31	0.14	0.16		97
	B	8	50	0.21	0.23		84
	C	8	46	0.50	0.74		82
Axial ODSCC In The Sludge Pile	B	6	46	0.38	0.27	1.00" - 68% 0.45" - 100%	46
U-Bend ID Vol	B	1	15	0.27	0.17	0.55" - 100%	99
OD Vol at TSP	C	6	62	0.67	NA	8.6 Volts	NA
Pitting Above Tubesheet	C	25	84	1.13	NA	NA*	60
	A	19	80	0.17	NA	NA*	27
AVB Wear	Several Tubes			0.55	NA	65% TW	33

* Pitting does not pose a threat to structural integrity; however, pit-like indications are considered for leak testing at 80%TW (Ref 9.7).

As shown in Table 2-1, only six crack-like indications were detected during the 08/98 Forced Outage. Five of these six indications were circumferentially oriented indications located near the top of the tubesheet in the roll transition. The other crack-like indication was axially oriented and was located in the sludge pile. None of these indications were close to their corresponding structural limit.

3.0 Assessment of Circumferential Indications

3.1 Plus Point Sizing of Circumferential Indications

Five circumferential indications were detected with the plus point probe during the 08/98 Forced Outage. Based on the ET phase angle, all of these indications initiated from the outside diameter of the tubing and were located in the roll transition near the top of the hot leg tubesheet. The sizing of the circumferential indications was performed using the plus point data. This is a non-qualified sizing technique per EPRI. No documented ET uncertainties exist for depth or length sizing (see Section 3.3). The estimated arc lengths of these indications ranged from 0.16" to 0.85", with a mean length of 0.44". The estimated maximum depths ranged from 82%TW to 100%TW, with an average maximum depth of 90%TW. Depth profiles were prepared for all of these indications and are shown in Figures 3-1 through 3-5. The percent-degraded area (PDA) was calculated for all of these indications. The PDA is a better characteristic for assessing the structural significance of circumferential indications. The PDA's ranged from 2.6% to 22.3%.

Figure 3-1

Depth Profile For SG C R8 C46
Beaver Valley-2 08/98 Forced Outage

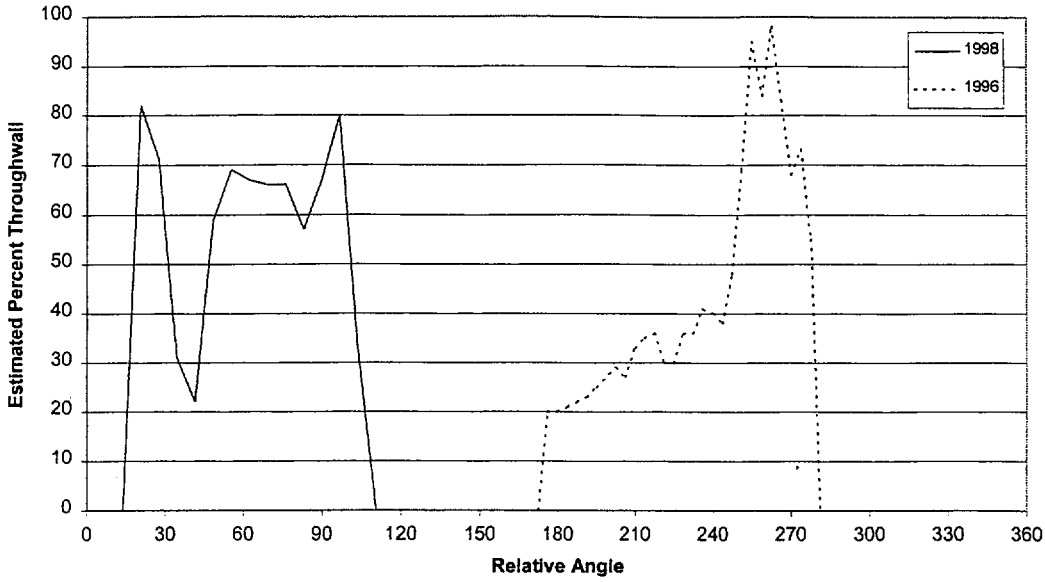


Figure 3-2

Depth Profile For SG B R8 C50
Beaver Valley-2 08/98 Forced Outage

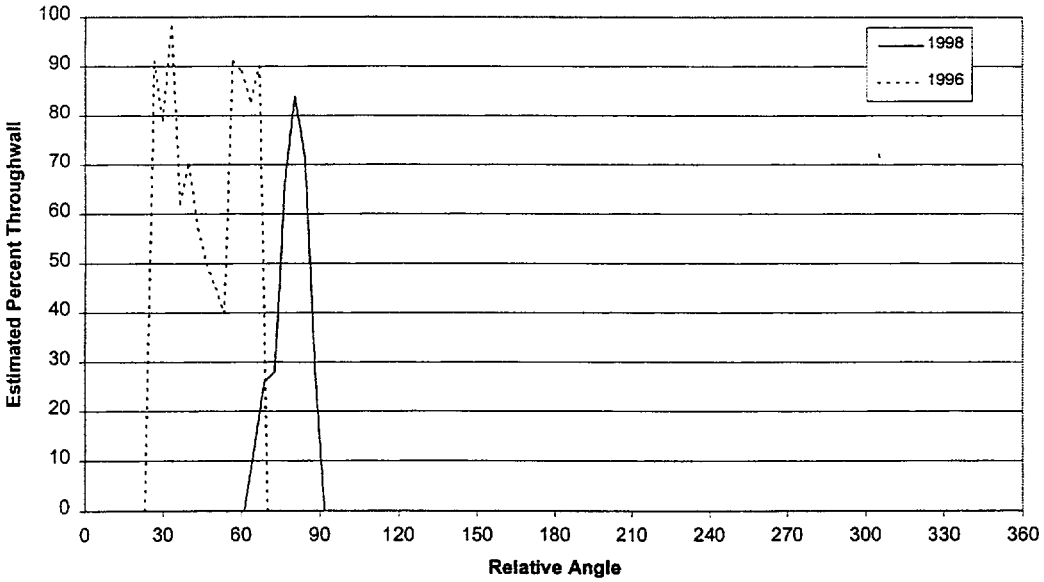


Figure 3-3

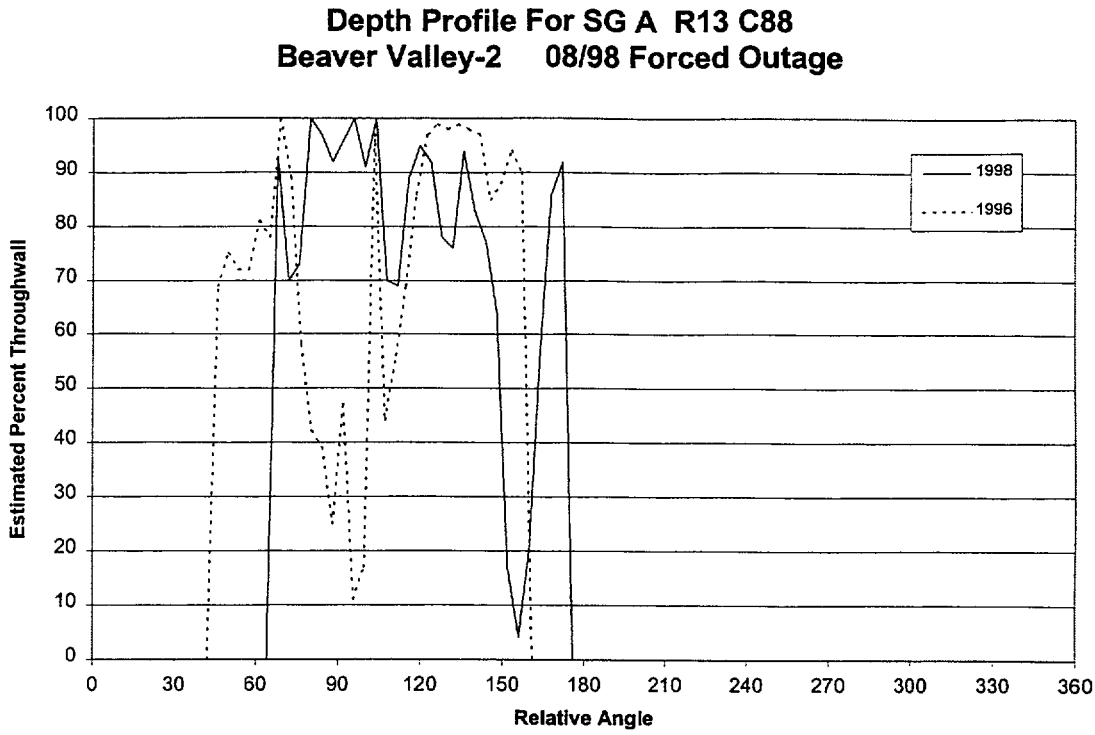


Figure 3-4

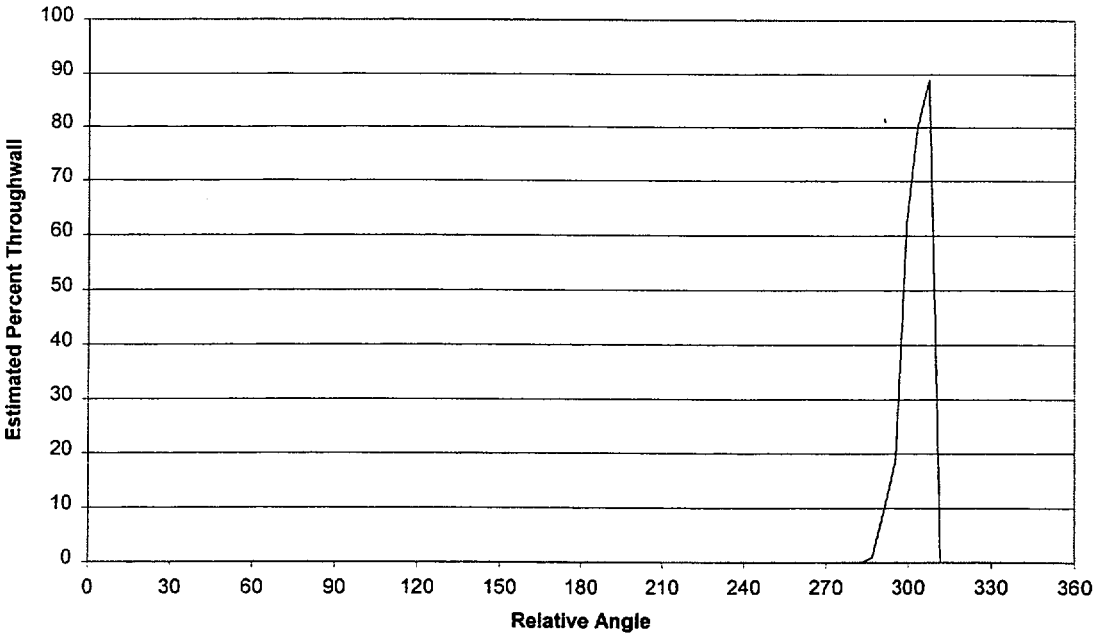
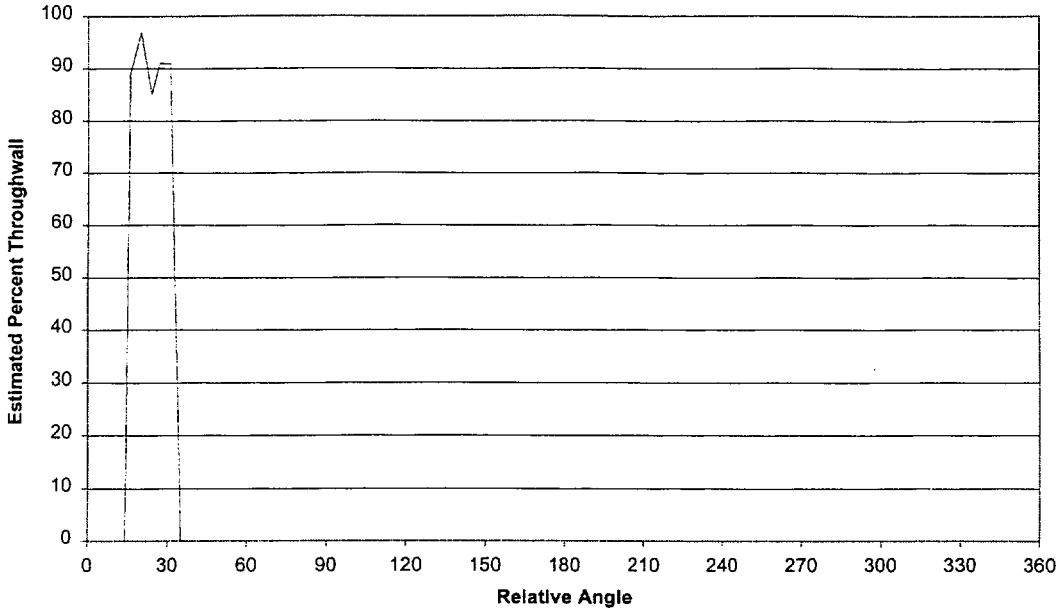


Figure 3-5

Depth Profile For SG A R33 C31
Beaver Valley-2 08/98 Forced Outage



3.2 Threshold of Detection for Circumferential Indications

In order to verify the detectability and sizing capabilities of the ET methods, destructive examinations are typically performed to develop correlations of real degradation to the ET signals. No tube sections have been removed from the Beaver Valley Unit 2 steam generators. Therefore, the values used for the threshold of detection and sizing uncertainties will be based on the data from other plants used in various industry studies and/or data from tube sections removed from the Beaver Valley Unit 1 steam generators. During the 08/98 Forced Outage, the PDAs calculated for the circumferential indications ranged from 2.6 to 22.3. Based on the EPRI ETSS for ODSCC in tubesheet region, the POD is 0.84 for indications with a depth greater than or equal to 50%. For this assessment, the detection threshold will conservatively be 50%TW and the longest length of the indications detected, 0.85 inches (15.5 PDA), since the results of the inspection suggest a lower threshold.

3.3 ET Uncertainties Associated with Sizing of Circumferential Indications

For the sizing of circumferential indications, no documented ET uncertainties exist. However, recent EPRI circumferential crack sizing studies have determined that, for hard roll transitions, the sizing capabilities for ODSCC circumferential indications is not very accurate. The uncertainties have a mean of 18.7 PDA, with a standard deviation of 21.8 PDA. This equates to 55 PDA at 95% upper confidence. These studies include data from pancake coil probes which have been shown to be less accurate than sizing data from the plus point coil. For the purposes of this report, a 20 PDA for uncertainties will be used.

3.4 Growth Rate of Circumferential Indications

The 1996 2R6 plus point data was reviewed for all of the circumferential indications called during the 08/98 Forced Outage. Table 3-1 shows the results of this review. The review identified signals that correspond to the three longest circumferential indications in the 2R6 inspection data. However, these signals were not classified as flaw-like during the 2R6 inspection by the resolution analysts. A comparison of the data from the two inspections indicated that there were no substantive changes in any of the characteristics presented. This lack of substantive change in indication parameters supports the non-flaw resolution call made in 1996, however, the indications were conservatively evaluated as flaw-like during the 1998 inspection and were repaired accordingly. The other two indications were either below the detection threshold during the 1996 inspection, or initiated during Cycle 7 operation; these indications were relatively small in the 08/98 inspection. The growth of the three indications, which were detectable during the 1996 inspection, was negligible. The largest growth measured by increasing PDA was in AR33C31, which was 3.8.

Based on the 8/98 results as shown in Table 3-2, the average growth of the circumferential indications as measured by PDA was 1.50 PDA with a standard deviation of 1.67 PDA. At a 95%/95% confidence level, the growth is 4.40 PDA/EFPY. Adjusting this value to account for the operating interval before the next scheduled inspection (2.055 EFPY) gives a growth of 9.0 PDA.

Table 3-1
Results of History Review for Circumferential Indications

			1998			1996		
SG	Row	Col	Volts	Length	PDA	Volts	Length	PDA
C	8	46	0.50	0.74"	13.8	0.14	0.83"	12.7
B	8	50	0.21	0.23"	3.0	0.15	0.36"	8.2
A	13	88	0.11	0.85"	22.3	0.12	0.91"	22.4
A	8	48	0.23	0.22"	2.6	NDD	NDD	NDD
A	33	31	0.14	0.16"	3.8	NDD	NDD	NDD

Table 3-2: Growth of Circumferential Indications

SG	Row	Col	Volts	Length	PDA
C	8	46	0.36	-0.09	1.1
B	8	50	0.06	-0.13	-5.2
A	13	88	-0.01	-0.06	-0.1
A	8	48	0.23	0.22	2.6
A	33	31	0.14	0.16	3.8
Average[1]			**0.16**	**0.08**	**1.50**
STD DEV[1]			**0.14**	**0.11**	**1.67**

[1] For the calculation of the average growth and standard deviation, the negative growth values were assumed to be zero.

4.0 Assessment of Axial Indications

4.1 Plus Point Sizing of Axial Indications

Only one axial indication was detected during the 08/98 Forced Outage, SGB R6C46 at TSH +0.10". This indication was sized by plus point to be 0.26" long and 46% through wall maximum depth.

4.2 Threshold of Detection for Axial Indications

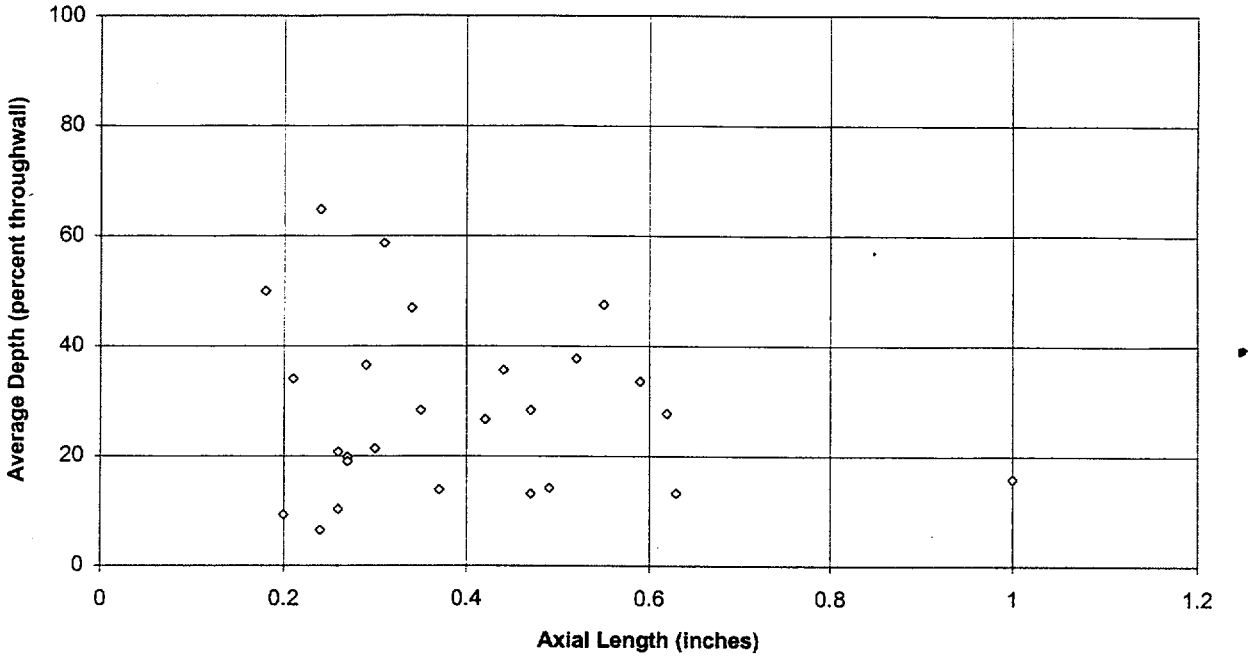
In order to verify the detectability and sizing capabilities of the ET methods, destructive examinations are typically performed to develop correlations of real degradation to ET signals. No tube sections have been removed from the BVPS-2 steam generators. Therefore, the data collected from the BVPS Unit 1 tube pulls performed during 1R11 will be utilized to determine the detection capabilities of the plus point probe for axial indications.

Four tubes were removed in 1R11 to support tube integrity evaluations for axial sludge pile indications. Based on the results from the destructive examination from the Unit 1 pulled tubes, the threshold of detection was conservatively established at 35% throughwall in average depth for shorter indications (<0.50") and 28% throughwall in average depth for longer indications (Ref 9.6). These values were obtained by considering the smallest indications, which were detected and have destructive examination data as the detection threshold. Since the tubes that are selected for tube pull typically have the largest indications, this is an overly conservative threshold. Figure 4-1 shows the estimated lengths plotted against the estimated average depths for the BVPS-2 data from the 2R6 outage and the 08/98 Forced Outage. This chart shows that over half of the indications, which were called were below this conservative detection threshold. Therefore, it is reasonable to assume that the actual detection threshold is lower than these values.

For the purposes of this report, the detection threshold will be 0.45" and 25%TW average depth. Figure 4-1 shows that for the last two inspections at BVPS-2, 7 out of the 25 indications which had depth profiles done were below this threshold. This gives assurance that indications below this threshold are detectable.

Figure 4-1

Average Depths vs. Axial Lengths for TSH Indications
Beaver Valley-2 1996 2R6 and 08/98 Forced Outage



4.3 ET Uncertainty Associated with Sizing of Axial Indications

Since no tubes have been removed from Unit 2, the estimation of the ET uncertainties associated with the plus point sizing of indications is based upon the data obtained from the Unit 1 pulled tube destructive examinations (Ref. 9.3). For axial indications, the plus point coil average depth analyses have a mean bias of 4.0%TW with a standard deviation of 11%TW, and the length analyses have a mean bias of -0.04" with a standard deviation of 0.10". At 95% confidence levels, the ET uncertainties are 22%TW and 0.13".

4.4 Growth of Axial Indications

The 1996 data for the tube with the axial indication in the 08/98 outage was reviewed to determine if the indication was present during the previous inspection. During this review the presence of a signal could be inferred at the same location in 1996 inspection data. However its size in length is near the threshold of detection measuring only 0.20" in 1996. Its average depth was determined to be 99%TW from the 1996 data, however, it is likely that the depth measurement of this indication has a large error due to its limited axial extent. The length of this indication was again relatively small during the most recent inspection (0.27") while its maximum depth was only 46% TW, indicating only minor change in the signal and again casting question on the accuracy of the depth measurement from the 1996 data.

The axial indication grew 0.07" in 371 EFPD. Adjusting this length growth for a 750 EFPD cycle, an axial indication is expected to grow approximately 0.14 inches. Since the depth measurement of this indication between the 1996 and 1998 outages produces a negative growth rate, the depth growth rate for axial indications from the 1997 Unit 2 outage will be used. The growth in maximum depth had an average of -4.5%TW with a standard deviation of 8.7%TW (Ref 9.3). For this assessment, the average growth is set at 0%TW. Adjusting the depth growth for a 750 EFPD cycle and 95% upper confidence bound, an axial indication is expected to grow approximately 30%TW deeper.

5.0 Assessment of AVB Wear Indications

5.1 Sizing of AVB Wear Indications

Sizing of the AVB wear indications was performed utilizing the bobbin coil inspection. No indications greater than the repair limit of 40%TW were detected. The largest indication detected was a 33 percent throughwall indication in Steam Generator B. The average size detected was 17.7 %TW. The data suggests a detection threshold of 13-16%TW, based upon a review of all inspections.

5.2 ET Uncertainties

AVB wear indications are sizable by a standard bobbin coil inspection, based on the EPRI ETSS #96004 (Ref 9.4). The sizing was performed using the 400/100 differential mix. The RMSE relates the ET depth to the real depth of wall penetration. For sizing of AVB wear indications, the RMSE was about 5% which indicates relatively accurate sizing for these indications.

The EPRI data set used in the qualification of this technique was reviewed to determine the uncertainties associated with the sizing of these indications. The data set contained a total of 64 indications. The bobbin coil technique using the 400/100 differential mix channel undercalled the actual depth by an average of 2.1% throughwall and had a

standard deviation of 4.5% throughwall. At a 95% confidence level, this yields an NDE uncertainty of 9.5% throughwall.

5.3 Growth of AVB Wear Indications

A review of the eddy current results from the previous inspection was performed to determine the growth rates of AVB wear indications. The average growth is -1.6 percent throughwall and the standard deviation of the growth is 4.0 percent throughwall. For the purposes of this report, however, the negative growth rates were assumed to be zero. Therefore, the average growth became 0.8% throughwall. Adjusting these values for the actual operating interval of 1.016 EFPY gives a growth of 0.79% throughwall per EFPY and a standard deviation of 3.94% throughwall. The 95% upper confidence limit (1.65 standard deviations) for growth over the next operating interval (2.055 EFPY) is 15.0% throughwall.

6.0 Assessment of Volumetric Indications

6.1 Sizing of Volumetric Indications

During the 08/98 Forced Outage, four volumetric indications were detected and one was classified as pit-like. The indications were located at the top of the hot leg tubesheet, top of the cold leg tubesheet, low row u-bend and hot leg tube support plate. The indication found above the cold leg tubesheet was examined with plus point and 3 coil during the 08/98 outage. The historical data for this location was reviewed and this indication was present and has not significantly changed; therefore, this indication is considered an MBM and was preventatively plugged based on its location above the tubesheet. The volumetric indications were depth sized using plus point; the sizing information is provided in Table 6-1.

Table 6-1: Volumetric Indications

SG	Row	Col	Location	Plus Pt Volts	Axial Length	Max Depth (%TW)
A	19	80	TSH +0.04	0.17	NA	27
B	1	15	8H +11.32	0.27	0.17"	99
C	6	62	2H +0.36	0.67	NA	See Below
C	25	84	TSC +0.08	1.13	NA	60

The indication in R6C62 is located within the tube support plate and was detected by bobbin with a voltage of 0.45 volts. Even though this indication is reported as volumetric, this assessment will treat the indication as an axial crack-like indication because ODSCC is a potential degradation mechanism at hot leg support plates. Treating the indication as a crack-like indication is conservative.

The indication in R1C15 is located in low row U-bend region and was detected by plus point measuring 0.17" and 99%TW. Even though this indication is reported as volumetric, this assessment will treat the indication as an axial crack-like indication because PWSCC is a potential degradation mechanism in the low row u-bend tubes. Treating the indication as a crack-like indication is conservative.

6.2 Threshold of Detection and ET Uncertainties

Indications in the vicinity of the hot leg tubesheet and low row u-bend were not detectable by the bobbin coil examination. The threshold of detection for the top of tubesheet indications is based on the plus point examination and is conservatively assumed to be 20-30% TW (Ref 9.6), based on the relatively small sizes and applying an NDE uncertainty.

6.3 Growth of Volumetric Indications

The top of tubesheet pit-like indications do not significantly impact the burst strength of steam generator tubes. Due to the insignificance of these indications, industry growth rates are not available for a rotating coil inspection. These indications can be assumed to be progressing at a slower rate than the true crack-like indications, because of the location of the indications (sufficient distance from the stresses of the roll transition). If the damage mechanism is attributable to intergranular attack (IGA), expected growth rates are on the order of 1-2%TW per EFPY, based upon Framatome bobbin coil sizing studies (Ref 9.6).

7.0 Condition Monitoring

The condition monitoring assessment documents the "as found" condition of the steam generator tubing prior to plugging or repair of the tubes. The "as found" condition is compared to the performance criteria for the tubing to ensure that adequate steam generator integrity has been maintained over the last cycle. For Beaver Valley Unit 2, the 08/98 Forced Outage marked the end of a 371 EFPD cycle. As documented earlier, a total of thirteen tubes were repaired during the Forced Outage. Eight tubes were repaired due to tubesheet related indications. Five tubes were repaired due to non-tubesheet related indications.

Tubesheet Indications

- 5 tubes circumferential ODSCC at the top of the tubesheet
- 1 tube axial ODSCC just above the top of the hot leg tubesheet
- 1 tube pit-like indication at the top of the hot leg tubesheet
- 1 tube volumetric indication near the top of the cold leg tubesheet

Other Indications

- 1 tube volumetric indication in a Row 1 u-bend
- 1 tube volumetric indication at the 2H support plate
- 3 tubes preventatively plugged unusual freespan bobbin signals (SG B)

Each indication category will be reviewed below to determine the structural significance of the indications detected relative to the requirements of plant Technical Specifications, RG 1.121, and DG-1074.

7.1 Circumferential Indications

All of the circumferential indications detected during the 08/98 Forced Outage were found in hot leg top of tubesheet region. The structural limit for circumferential ODSCC is 1.72" arc length at 100% through wall, or 62.6 PDA (Ref 9.3). The length, depth, and PDA measurements for the circumferential indications ranged from 0.16" to 0.74" and 2.6 to 22.3, respectively.

The circumferential indications detected during the 08/98 Forced Outage did not threaten the structural integrity of the steam generator tubing with respect to burst or leakage, as none of these were near the structural limit.

7.2 Axial Indications

During the 08/98 Forced Outage, one axial indication was detected just above the hot leg tubesheet. The structural limit for axial ODSCC above the tubesheet in the sludge pile is 1.00" at 68% through wall or 0.45" at 100% through wall (Ref 9.3). This indication was 0.27" long and 46% through wall. This indication is well below the structural limits for axial ODSCC.

7.3 AVB Wear

Wear located at the anti-vibration bars was detected at 22 locations. The largest wear indication was 33% through wall. The structural limit for wear at the AVBs is 65% through wall (Ref 9.3). All of the wear indications were well below the structural limit for this damage mechanism.

7.4 Volumetric Indications

During the 08/98 Forced Outage, four volumetric indications were detected and one was classified as pit-like. The indications were located at the top of the hot leg tubesheet, top of the cold leg tubesheet, low row u-bend and hot leg tube support plate.

The indication located at the top of the hot leg tubesheet was classified as a pit-like indication. Pitting does not pose a threat to structural integrity; however, pit-like indications are considered for leak testing at 80%TW (Ref 9.7). This indication is not a structural integrity concern or a candidate for leak testing.

The indication found above the cold leg tubesheet was examined with plus point and 3 coil during the 08/98 outage. The historical data for this location was reviewed and this indication was present and has not significantly changed; therefore, this indication is considered a manufacturing artifact and was preventatively plugged based on its location above the tubesheet.

The indication in R1C15 is located in low row U-bend region and was detected by plus point measuring 0.17" and 99%TW. Evaluating this indication against the structural limits for axial PWSCC in low row u-bends, it is below the structural limit (0.55" and 100%TW) for this type of degradation (Ref 9.3).

The indication located within the tube support plate will be evaluated conservatively as axial ODSCC, discussed in Section 6.1. Based on the bobbin voltage (0.45), this indication is well below the structural limit (8.6 volts) for this type of degradation (Ref 9.3).

7.5 Non-confirmed Freespan Bobbin Coil Indications

During the bobbin coil inspection of SG B, three indications were identified in three tubes (R3824, R38C27, R38C28) at the same elevation, 4.2 to 4.8 inches above the 6th TSP in the hot leg. The indications were identified as FSI, (freespan indication) since they met the appropriate criteria outlined in the ET analysis guidelines. All three indications were further interrogated with a Plus point probe. The Plus point exams did not confirm the presence of degradation, however, as a conservative measure, these tubes were removed from service by DLCo. Since the Plus point coil did not confirm these indications as truly flaw-like and they were the only tubes affected, an assessment of these indications is not warranted for condition monitoring or operational assessment.

7.6 Condition Monitoring Conclusions

None of the indications detected during the 08/98 Forced Outage exceed or threaten structural limits of the tubing for any damage mechanism. Therefore, the "as found" condition of the Beaver Valley Unit 2 steam generators satisfy the performance criteria for condition monitoring.

8.0 Operational Assessment

This operational assessment was completed using a bounding methodology. For the plug-on-detection mechanisms, this assessment assumes that the largest flaw left in service for each degradation mechanism is a flaw equivalent to the detection threshold.

8.1 Circumferential Indications

Based on the EPRI ETSS for ODSCC in tubesheet region, the POD is 0.84 for indications with a depth greater than or equal to 50% TW will be detected with the plus point coil. Based on this POD and the 8/98 results, approximately one indication could be left in service at 50%TW. Reviewing the 8/98 results, all indications were over 50%TW at the maximum depth. For this assessment, the detection threshold will be 50%TW and the longest length of the indications detected, 0.85 inches (15.5 PDA). At a 95% upper confidence limit, this indication would be expected to grow approximately 9 PDA over the next operating cycle. Applying the ET uncertainties of 20 PDA, the indication would be 44.5 PDA at the EOC 8.

The postulated indication would not be a structural integrity or leakage concern at the EOC 8.

8.2 Axial Indications

Based on the EPRI ETSS for ODSCC in tubesheet region, the POD is 0.84 for axial indications detected with the plus point coil. Based on this POD and the 8/98 results, no significant axial indications would be expected to be left in service; however, this assessment will conservatively leave one indication in service at the detection threshold, 0.45" and 25%TW. At a 95% upper confidence limit, this indication would be expected to grow approximately 0.14" and 30%TW over the next operating cycle. Reference Section 4.3 for discussion about ET uncertainties. Using this bounding methodology, this indication would be 0.72" and 77%TW at the EOC 8.

The postulated indication would not be a structural integrity or leakage concern at EOC 8.

8.3 AVB Wear

The largest indication left in service had a maximum depth of 33%TW. At a 95% upper confidence limit, this indication would be expected to grow approximately 15%TW over the next operating cycle. The ET uncertainty associated with this degradation is 9.5%TW. This indication would be 58%TW at the EOC 8. The structural limit for AVB Wear, as noted earlier, is 65%TW.

This indication would not be a threat to structural integrity and is not a leakage concern.

8.4 Volumetric Indications

During the 08/98 Forced Outage, four volumetric indications were detected and one was classified as pit-like. The indications were located at the top of the hot leg tubesheet, top of the cold leg tubesheet, low row u-bend and hot leg tube support plate. All of these indications were plugged.

The indication located at the top of the hot leg tubesheet was classified as a pit-like indication with a maximum depth of 27%TW. Pitting does not pose a threat to structural integrity; however, pit-like indications are considered for leak testing at 80%TW (Ref 9.7). This indication could be as much as 57%TW with ET uncertainty and would be expected to grow approximately 2%TW. The indication would be 59%TW at EOC 8. This indication is not a structural integrity concern or leakage concern.

The volumetric indication in R1C15 is located in low row U-bend region and was detected by plus point measuring 0.17" in axial extent and 99%TW. This indication will be conservatively analyzed as axial PWSCC for the operational assessment. Projecting the growth or ET uncertainty for this mechanism is

difficult due to lack of data; therefore, this assessment will assume the indication will double in length and progress to 100%TW. This indication would be 0.34" and 100%TW at EOC 8. Evaluating this indication against the structural limits for axial PWSCC in low row u-bends, it is below the structural limit (0.55" and 100%TW) for this type of degradation (Ref 9.3). However, this indication would be a leakage concern.

During the BVPS-1 R12 outage, four low row u-bend PWSCC indications were in-situ pressure tested. One of these indications showed slight leakage during the testing. The indication that leaked was axially oriented and was measured as 0.27" in axial length, 2.09 volts, and 76% maximum depth. Due to the fact that the voltage on this Unit 1 indication is much higher than the voltage on the Unit 2 volumetric indication, applying the leak rate from the Unit 1 in-situ testing to the Unit 2 indication is conservative. The Unit 1 in-situ test showed a leak rate of 0.015 gpm (21.6 gpd) at NOPD (normal operating pressure differential) and 0.012 gpm (17.3 gpd) at MSLB pressure. These values are well below the operational leakage limit of 150 gpd (Ref. 9.8) and the site-specific leakage limit of 6.0 gpm for a postulated steam line break event.

8.5 Operational Assessment Conclusions

Based on the above results, Beaver Valley Unit 2 with the worst case projected degradation would meet both the structural and operational leakage criteria for steam generator tube integrity after operating for 750 EFPD at the EOC 8.

9.0 References

9.1 FTI Document 51-1257268-00, "Regulatory Guide Assessment of the As-Found Conditions of Beaver Valley Unit 2 Steam Generators from 2R6 Eddy Current Inspection", December 1996.

9.2 FTI Document 51-5002382-00, "Crack Sizing and In-Situ Candidate Screening for 08/98 Inspection at Beaver Valley Unit 2", December 1998.

9.3 Westinghouse Document 96-07-007, "Tube Integrity Assessment BVPS-1, 1996 EOC-11 SG Indications", August 1996.

9.4 FTI Document 51-5002100-00, "Beaver Valley Unit 2 – EPRI Appendix H Eddy Current Technique Qualification Review", August 1998.

9.5 Aptech Document AES97053068-1-2 Rev 0, "An Operation Assessment of Steam Generator Tubing at Beaver Valley Unit 1, Cycle 13", November 1997.

9.6 FTI Document 51-1257279-00, " Tube Integrity Assessment for Beaver Valley Unit 2 SGs for Cycle 07", March 1997.

9.7 EPRI Draft Report TR-107620, "Steam Generator In Situ Pressure Test Guidelines", October 1998.

9.8 EPRI Draft Report GC-107621 Rev A2, "Steam Generator Integrity Assessment Guidelines", October 1998.

Appendix A
Summary of All Indications

SG	Row	Col	DegMech	Ind	%TW	Volts	Chn	Deg	Elev	Inch1	Inch2
SG A	8	48	ODSCC	SCI		0.23	P 1	99	TSH	0	
SG A	13	88	ODSCC	SCI		0.11	P 1	64	TSH	-0.04	
SG A	19	80	Pitting	PIT		0.17	3	62	TSH	0.04	
SG A	20	64	AVB Wear	ODI	10	0.48	P 2	0	AV3	0	
SG A	20	64	AVB Wear	ODI	14	0.7	P 2	0	AV1	0	
SG A	20	64	AVB Wear	ODI	14	0.73	P 2	0	AV2	0	
SG A	27	71	AVB Wear	ODI	11	0.5	P 2	0	AV3	0	
SG A	27	71	AVB Wear	ODI	13	0.58	P 2	0	AV2	0	
SG A	27	72	AVB Wear	ODI	23	1.36	P 2	0	AV1	0	
SG A	31	68	AVB Wear	ODI	13	0.61	P 2	0	AV3	0	
SG A	33	31	ODSCC	SCI		0.14	P 1	120	TSH	0.05	
SG A	33	70	AVB Wear	ODI	17	0.95	P 2	0	AV1	0	
SG A	34	48	AVB Wear	ODI	21	1.18	P 2	0	AV3	0	
SG A	34	70	AVB Wear	ODI	17	0.84	P 2	0	AV3	0	
SG A	35	70	AVB Wear	ODI	12	0.62	P 2	0	AV3	0	
SG A	35	72	AVB Wear	ODI	10	0.52	P 2	0	AV1	0	
SG A	35	72	AVB Wear	ODI	12	0.65	P 2	0	AV3	0	
SG A	40	68	AVB Wear	ODI	15	0.71	P 2	0	AV3	0	
SG A	40	68	AVB Wear	ODI	19	1.04	P 2	0	AV4	0	
SG A	40	68	AVB Wear	ODI	20	1.07	P 2	0	AV1	0	
SG A	40	68	AVB Wear	ODI	24	1.49	P 2	0	AV2	0	
SG A	44	48	AVB Wear	ODI	9	0.42	P 2	0	AV2	0	
SG A	44	48	AVB Wear	ODI	10	0.48	P 2	0	AV1	0	
SG A	44	55	AVB Wear	ODI	19	1.07	P 2	0	AV4	0	
SG B	1	15	ID Vol	SVI		0.27	2	43	8H	11.32	
SG B	6	46	ODSCC	SAI		0.38	4	111	TSH	0.1	0.22
SG B	8	50	ODSCC	SCI		0.21	P 1	142	TSH	-0.12	
SG B	23	86	AVB Wear	ODI	12	0.45	P 2	0	AV3	0	
SG B	31	41	AVB Wear	ODI	16	0.61	P 2	0	AV3	0	
SG B	31	59	AVB Wear	ODI	20	0.83	P 2	0	AV3	0	
SG B	32	50	AVB Wear	ODI	16	0.68	P 2	0	AV2	0	
SG B	32	55	AVB Wear	ODI	19	0.8	P 2	0	AV4	0	
SG B	32	55	AVB Wear	ODI	23	1.13	P 2	0	AV3	0	
SG B	32	59	AVB Wear	ODI	17	0.66	P 2	0	AV3	0	
SG B	33	41	AVB Wear	ODI	20	0.83	P 2	0	AV3	0	
SG B	33	41	AVB Wear	ODI	23	1.07	P 2	0	AV2	0	
SG B	33	57	AVB Wear	ODI	12	0.51	P 2	63	AV2	0	
SG B	33	63	AVB Wear	ODI	32	2.08	P 2	0	AV2	0	
SG B	34	50	AVB Wear	ODI	21	1.02	P 2	0	AV1	0	
SG B	34	55	AVB Wear	ODI	12	0.45	P 2	0	AV1	0	
SG B	34	55	AVB Wear	ODI	27	1.44	P 2	0	AV3	0	
SG B	34	57	AVB Wear	ODI	21	0.94	P 2	0	AV2	0	
SG B	35	25	AVB Wear	ODI	19	0.65	P 2	0	AV2	0	
SG B	35	25	AVB Wear	ODI	20	0.68	P 2	0	AV3	0	

Appendix A (Cont'd)
Summary of All Indications

SG	Row	Col	DegMech	Ind	%TW	Volts	Chn	Deg	Elev	Inch1	Inch2
SG B	35	41	AVB Wear	ODI	12	0.42	P 2	0	AV1	0	
SG B	35	41	AVB Wear	ODI	26	1.38	P 2	0	AV2	0	
SG B	35	41	AVB Wear	ODI	30	1.78	P 2	0	AV4	0	
SG B	35	50	AVB Wear	ODI	14	0.51	P 2	0	AV1	0	
SG B	35	50	AVB Wear	ODI	15	0.54	P 2	0	AV3	0	
SG B	35	50	AVB Wear	ODI	19	0.8	P 2	0	AV2	0	
SG B	35	54	AVB Wear	ODI	10	0.42	P 2	0	AV1	0	
SG B	35	63	AVB Wear	ODI	17	0.66	P 2	0	AV2	0	
SG B	35	63	AVB Wear	ODI	19	0.77	P 2	0	AV3	0	
SG B	35	71	AVB Wear	ODI	14	0.55	P 2	0	AV4	0	
SG B	36	41	AVB Wear	ODI	16	0.64	P 2	0	AV2	0	
SG B	36	41	AVB Wear	ODI	27	1.53	P 2	0	AV1	0	
SG B	36	41	AVB Wear	ODI	33	2.36	P 2	0	AV3	0	
SG B	36	55	AVB Wear	ODI	9	0.32	P 2	0	AV2	0	
SG B	36	63	AVB Wear	ODI	18	0.76	P 2	0	AV3	0	
SG B	36	63	AVB Wear	ODI	19	0.81	P 2	0	AV2	0	
SG B	37	29	AVB Wear	ODI	23	0.83	P 2	0	AV2	0	
SG B	37	41	AVB Wear	ODI	14	0.49	P 2	0	AV2	0	
SG B	37	57	AVB Wear	ODI	12	0.54	P 2	0	AV4	0	
SG B	37	57	AVB Wear	ODI	15	0.73	P 2	0	AV2	0	
SG B	39	70	AVB Wear	ODI	26	1.51	P 2	0	AV3	0	
SG B	42	47	AVB Wear	ODI	19	0.77	P 2	0	AV1	0	
SG C	6	62	OD Vol	SVI		0.67	4	73	2H	0.36	
SG C	8	46	ODSCC	SCI		0.5	P 1	102	TSH	-0.15	
SG C	25	84	NA	SVI		1.13	4	76	TSC	0.08	
SG C	37	67	AVB Wear	ODI	18	0.81	P 2	0	AV2	0	
SG C	37	67	AVB Wear	ODI	20	0.9	P 2	0	AV3	0	