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Palisades Nuclear Plant
Operated by Nuclear Management Company, LLC

April 13, 2004

Technical Specification 5.6.8

U. S. Nuclear Regulatory Commission
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Steam Generator Tube Integrity Assessment from the 2003 Refueling Outage

Nuclear Management Company, LLC is providing the Palisades Nuclear Plant Steam Generator Tube Integrity Assessment Report for the 2003 refueling outage. Palisades Technical Specification 5.6.8.b requires that this report be submitted to the Nuclear Regulatory Commission within 12 months following the completion of the inservice inspection. The inservice inspection was completed and the steam generators were declared operable on April 18, 2003.

Summary of Commitments

This letter contains no new commitments and no revisions to existing commitments.

Daniel J. Malone
Site Vice President, Palisades Nuclear Plant
Nuclear Management Company, LLC

Enclosure (1)

CC Administrator, Region III, USNRC
Project Manager, Palisades, USNRC
Resident Inspector, Palisades, USNRC

A001

27780 Blue Star Memorial Highway • Covert, Michigan 49043-9530
Telephone: 269.764.2000

ENCLOSURE 1

STEAM GENERATOR TUBE INTEGRITY ASSESSMENT
2003 REFUELING OUTAGE

46 Pages Follow

PALISADES NUCLEAR PLANT

STEAM GENERATOR

TUBE INTEGRITY ASSESSMENT

2003 REFUELING OUTAGE

John Hager / 4-1-2004
Assessment Sponsor Date

JM Zeger for MB Kirk / 04.01.04
Eddy Current Level III Review Date

[signature] 04/01/04
Supervisor Review Date

[signature] / 4/1/04
Manager Review Date

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1.0 PURPOSE

1.1 TECHNICAL SPECIFICATIONS

It is the intent of this Steam Generator Tube Integrity Assessment to provide all the information required to meet the reporting requirements of Palisades Technical Specification 5.6.8b. The specific information is identified below:

- Number and extent of tubes inspected is located in section 2.2 BOBBIN COIL INSPECTION, 2.3 PLUS POINT RPC TOP OF TUBESHEET INSPECTION HOT LEG, 2.4 ROW 1 AND 2 U-BEND PLUS POINT RPC INSPECTION and 2.7 DINGS.

- Location and percent wall-thickness penetration for each indication of an imperfection is located in Attachment 1, "Steam Generator E-50A Indications" and Attachment 2, "Steam Generator E-50B Indications". Please note the 1990 refueling outage is the refueling outage in which the steam generators were replaced.

- Identification of tubes plugged is located in section 3.0 STEAM GENERATOR EDDY CURRENT SUMMARY 2003 REFUELING OUTAGE.

The following additional information provides a summary of the tube integrity assessment performed during the 2003 refueling outage:

- Identification of active and potential tubing degradation mechanisms is located in section 4.0 ASSESSMENT OF ACTIVE AND POTENTIAL DEGRADATION MECHANISMS.

- A comparison of the as-found inspection results against the performance criteria for structural integrity and accident leakage is located in section 5.0 CONDITION MONITORING FOR 2003 REFUELING OUTAGE / OPERATIONAL ASSESSMENT CYCLE 17 and section 6.0 CONDITION MONITORING CONCLUSION FOR THE 2003 REFUELING OUTAGE.

- A prediction of the steam generator tube conditions used to ensure structural integrity and accident leakage performance criteria are not exceeded during the current operational cycle is located in section 7.0 OPERATIONAL ASSESSMENT EVALUATION FOR CYCLE 17.

Note: Acronyms not defined within the text can be found in section 9.2 "ACRONYMS".

2.0 STEAM GENERATOR INSPECTION FOR 2003 REFUELING OUTAGE

2.1 STEAM GENERATOR ISI REQUIREMENTS

Section 3.3.1, "Examination of Tubes", from EPRI PWR Steam Generator Examination Guidelines: Revision 5 states, "100% of the tubing shall be inspected with a 60 Effective Full Power Months (EFPM) time frame. If 60 EFPM occurs during an operating cycle, completion of that cycle is acceptable and is within the stated requirement".

The current 60 EFPM cycle started 06/07/98 and will end 10/19/04 or 59.1 EFPM.

During the 2003 refueling outage 40% of the tubes were inspected in Steam Generator E-50A and 50% in Steam Generator E-50B with the bobbin coil inspection. Currently 85% of bobbin program in Steam Generator E-50A and 90% of the bobbin program in Steam Generator E-50B have been completed for the current 60 EFPM cycle.

During the 2003 refueling outage 100% of the Rotating Pancake Coil (RPC) Top of Hot Leg Tubesheet were inspected and this meets the 100% sampling requirement for the 60 EFPM.

During the 2003 refueling outage 100% of Rows 1, 2 and 3 U-bends were inspected during the 2003 refueling outage in Steam Generator E-50A. This meets the 100% sampling requirement for the 60 EFPM.

During the 2003 refueling outage 25% of Rows 1 and 2 were inspected during the 2003 refueling outage in Steam Generator E-50B. This starts the first 25% sample frequency for 100% completion in 60 EFPM.

During the 2003 refueling outage 64% of the dings in Steam Generator E-50A and 56% of the dings in Steam Generator E-50B were inspected. There is one more inspection cycle to complete 60 EFPM.

2.2 BOBBIN COIL INSPECTION

2.2.1 Bobbin Coil Original Scope

In Steam Generator E-50A, a 25% random full length bobbin coil tube inspection was scheduled. To reduce inspection time the bobbin examination was completed utilizing duel bobbin probing.

In Steam Generator E-50B, a 50% random full length bobbin coil tube inspection of tubes was performed. To reduce inspection time the bobbin examination was completed utilizing duel bobbin probing.

2.2.2 Bobbin Coil Expanded Scope Inspection

In both Steam Generator E-50A and E-50B, the bobbin program was considered to be in the C-2 inspection category due to at least one 40% or greater reported wear indication in each steam generator which had grown by 10% or more in a cycle. The Steam Generator E-50A bobbin scope was increased by 20% to 45% total. No expansion for Steam Generator E-50B bobbin scope was required. The additional tubes needed for the C-2 expansion were included in the initial 50% scope for Steam Generator E-50B.

Inspection totals are as follows:

Table 1: Bobbin Coil Full Length Inspection 2003
Tubes inspected from tube end hot to tube end cold

Steam Generator	Tubes In Original Scope	Tubes C2 Expansion	Tubes Added to Encompass Possible Loose Parts	Total Tubes Tested
E-50A	2022	1576	0	3598
E-50B	3988	1576 (in original scope)	4	3992

2.2.3 Obstructed/Restricted Tube Condition Monitoring In 2003 Refueling Outage

One tube in E-50B, R135 C100, was found to be restricted to plus point RPC testing but was full-length bobbin coil tested. As a complete inspection of this tube could not performed, the tube was administratively removed from service by tube plugging. No additional restrictions were found in the 2003 refueling outage.

2.3 PLUS POINT RPC TOP OF TUBE SHEET INSPECTION HOT LEG

2.3.1 Plus Point RPC Top Of Tubesheet Hot Leg Original Scope

In Steam Generator E-50A, a 25% Plus Point RPC inspection of the hot leg top of tubesheet transition was performed. In addition to the 25% sample, 179 tubes were added to encompass stay rod locations (this area was identified as a high residual stress area and more susceptible to stress corrosion cracking).

In Steam Generator E-50B, a 50% plus point RPC inspection of the hot leg top of tubesheet transition was performed. In addition to the 50% sample, 180 tubes

were added to encompass stay rod locations (this area was identified as a high residual stress area and more susceptible to stress corrosion cracking).

2.3.2 Plus Point RPC Top of Tubesheet Hot Leg Expansion Scope

The Steam Generator E-5A plus point RPC hot leg top of tubesheet program was expanded from 25% to 100% by a C-2 expansion for outside diameter stress corrosion cracking (ODSCC) circumferential indication. In Steam Generator E-50B plus point RPC hot leg top of tubesheet program was expanded from 50% to 100% by a C-2 expansion for ODSCC Circumferential indication.

2.3.3 Axial Indication in 2003 Refueling Outage

There are 10 non-explosively expanded tubes in the steam generators that were plus point RPC examined the full length of the tubesheet in the 2003 refueling outage. The non-expanded tube population is 8 tubes in Steam Generator E-50A, and 2 non-expanded tubes in Steam Generator E-50B. One axial indication was identified in each steam generator at the tack roll just inside the tubesheet at the bottom of the hot leg tubesheet. There are now 7 tubes non-expanded in Steam Generator E-50A and 1 in Steam Generator E-50B after tube plugging.

2.3.4 Plus Point RPC Top of Tubesheet Inspection

The Plus Point RPC Top of Tubesheet inspection program inspection totals are as follows:

Table 2: Plus Point RPC Top of Tubesheet Inspection 2003 Tubes inspected + 3 inches – 5 inches except for under expanded tubes which are inspected the full length of the tubesheet

SG	Tubes In Original Scope (Includes Stayrod Tubes)	Under-expanded Tubes	PLP or TRA Indications	C-2 Expansion	Total Tubes Inspected
E-50A	2176	8	59	5636	7879
E-50B	4044	2	83	3749	7880

2.4 ROW 1 AND 2 U-BEND PLUS POINT RPC INSPECTION

2.4.1 Row 1 And 2 U-Bend Plus Point RPC Original Scope

In Steam Generator E-50A a 100% Plus Point RPC inspection of Rows 1, 2 and 3 U-bends was performed. Row 1, 2 and 3 U-bend tubes were tested using a mid frequency plus point (400 kHz) probe.

In Steam Generator E-50B a 25% Plus Point RPC inspection of Rows 1, and 2 U-bends was performed. Row 1 and 2 U-bend tubes were tested using a mid frequency plus point (400 kHz) probe.

2.4.2 Row 1 And 2 U-Bend Plus Point RPC Scope Expansion

In Steam Generator E-50A, a Single Axial Indication was reported in the U-Bend of Row 2 Col 123. The U-bend RPC program already included 100% of Row 3 U-bend so no additional expansion was required in Steam Generator E-50A. No expansion was required for the U-bend RPC program in Steam Generator E-50B.

2.4.3 Row 1-3 U-Bend Plus Point RPC Inspection

The Low Row U Bend Plus Point RPC inspection program was completed as outlined in the initial scope. Inspection totals are as follows:

Table 3: Row 1-3 U-Bend Plus Point RPC Inspection 2003
Tubes inspected from tube end hot to tube end cold

Steam Generator	Tubes In Original Scope	Total Tubes Inspected
E-50A	176	176
E-50B	30	30

2.5 FREESPAN BOBBIN COIL INSPECTION

2.5.1 Freespan Bobbin Coil Original Scope

Palisades manufacturing burnish marks (MBM)s are now reported as freespan differential signals (FSD) in order to address current regulatory concerns. These indications were confirmed with tube pulls at Palisades during preservice activities. These indications were never sized. They are confirmed with a history review and if not found, they will be dispositioned with plus point RPC testing.

All FSD indications in the freespan areas tested by bobbin coil were reviewed for history. Any areas that have significant change or that are not present in history will be examined using a qualified plus point RPC method.

2.5.2 Free Span Bobbin Coil Inspection

An extensive history review was performed both prior to and during the bobbin coil inspection. All freespan indications in the 2003 bobbin scope were reviewed against baseline history. If the indication showed no significant change from 1990 pre-service inspection baseline to the present, it was reported as freespan differential signal (FSD) to designate that it was reviewed in history. Those indications which either could not be detected or showed a change from baseline history were reported as an I code (NQI, non-quantifiable) and RPC plus point tested. A total of 69 indications in Steam Generator E-50A and 194 indications in Steam Generator E-50B were reported as an I code in the freespan and showed no degradation when tested with plus point RPC. The result of the bobbin indications resolved to a NDE MBM code as non-repairable status by history review is as follows:

Table 4: Freespan Bobbin Coil Inspection 2003
Tube inspection from tube end hot to tube end cold

Steam Generator	Total Freespan Differential Signals (FSD)	Tubes With History Review In 2003 Scope	Tubes Requiring Dispositioned With RPC
E-50A	339	208	69
E-50B	1280	812	194

2.6 DENTS

Palisades does not have any dented tubes in the replacement steam generators. No dents in the Palisades replacement steam generators have been found that meet the EPRI PWR Steam Generator Examination Guidelines, Revision 5 definition of a dent, which is defined, as "a local reduction (plastic deformation) in the tube diameter due to a buildup of corrosion products (magnetite)".

If denting occurs it will detected during bobbin coil examination screening. If any bobbin coil indications are confirmed with plus point RPC testing as degradation, then we will expand the denting scope to 20% random sample of all dented tubes.

2.7 DINGS

2.7.1 Dings Original Scope

In the 2003 refueling outage, 64% of the dings in Steam Generator E-50A and 56% of the dings in Steam Generator E-50B were plus point RPC tested.

A bobbin coil review of freespan dings greater than or equal to 2 volts was performed in both steam generators.

During the assembly of Palisades' replacement steam generators, some minor dings occurred. Dings in the Palisades replacement steam generators have been found that meet the EPRI PWR Steam Generator Examination Guidelines, Revision 5 definition of a ding, which is defined, as "a local reduction (plastic deformation) in the tube diameter caused by manufacturing, support plate shifting, vibration or other mechanical means".

2.7.2 Ding Expansion Program

Dings were reviewed during bobbin coil examination and no changes were noted. No expansion was required. If any ding indications had changed and confirmed with plus point RPC testing as a degradation mechanism, then we would expand the ding scope to 100% of all dinged tubes in that voltage range.

2.7.3 Dings Reviewed In 2003 Refueling Outage Inspection

During the 2003 refueling outage, 304 of 478 dings in Steam Generator E-50A and 100 of 179 dings in Steam Generator E-50B were plus point RPC tested. No changes were observed in the dings from inservice baseline review.

Table 5: Ding Inspection 2003
Tube inspection at location from tube end hot to tube end cold

Steam Generator	Total Dings	Tubes Inspected
E-50A	478	304
E-50B	179	100

2.8 POSSIBLE LOOSE PARTS

2.8.1 Possible Loose Part Original Scope

In the 2003 refueling outage, there were a total of 122 possible loose parts (PLP) in E-50A and 80 PLP in E-50B. PLP were reported and tracked from the 1998, 1999 and 2001 refueling outages. The total of the new PLP indications reported in the 2003 refueling outage was 84 in E-50A and 51 in E-50B. All tubes tested by plus point RPC were reviewed for PLP. All PLP are tracked in history and reviewed each refueling outage.

2.8.2 Possible Loose Part Scope Expansion

A total of 127 tubes in Steam Generator E-50A and 23 tubes in Steam Generator E-50B were added to the top of tubesheet hot leg plus point RPC program to encompass adjacent tubes to reported new PLP indications. The tubes were tested +3 inches above the top of the hot leg tubesheet. No new PLP indications were found in the scope expansion during the 2003 refueling.

2.9 TUBE PLUG INSPECTIONS

2.9.1 Tube Plug Original Scope

The majority of plugs used in Steam Generators E-50A and E-50B are not designed to be examined by eddy current testing. EPRI PWR Steam Generator Examination Guidelines, Revision 5, Section 3.3.4 allows the visual method of inspection.

A technical justification was written in the Steam Generator Degradation Assessment for the 2003 Refueling Outage and is included in Appendix G, Justification for Exceptions to EPRI PWR Steam Generator Examination Guidelines, Rev. 5; G.3, "Tube Plug Visual Inspection". The technical justification is for visual examination of tube plugs only.

A visual inspection was performed of all tubes plugs in both hot and cold legs of Steam Generators E-50A and E-50B using a NDE analyst with a VT-2 qualification. Plugs were examined for signs of leakage, such as boron rings or moisture.

2.9.2 Tube Plug Inspection

In Steam Generator E-50A, 340 tubes with plugs were inspected. Of the 680 tube plugs, 614 plugs were Combustion Engineering rolled plugs manufactured from Inconel-690, 2 plugs were Combustion Engineering welded plugs and 64 plugs were the Westinghouse Inconel-690 expanded mechanical type.

In Steam Generator E-50B, 339 tubes with plugs were inspected. Of the 678 tube plugs, 611 plugs were the Combustion Engineering rolled plugs manufactured from Inconel-690, 7 plugs were Combustion Engineering welded plugs and 60 plugs were the Westinghouse Inconel-690 expanded mechanical type.

2.9.2.1 Steam Generator E-50A

During the 2003 refueling outage, the visual examination for all tube plugs in E-50A met the acceptance criteria per MSR 2.4.2 GEN-29, "Video Inspection and Tube Identification of Steam Generator Tubesheet."

2.9.2.2 Steam Generator E-50B

During the 2003 refueling outage, the visual examination for all tube plugs in E-50B met the acceptance criteria per MSR 2.4.2 GEN-29, "Video Inspection and Tube Identification of Steam Generator Tubesheet."

Table 6: Tube Plug Inspection 2003

Steam Generator	ABB/CE Rolled Plugs Inspected	ABB/CE Welded Plugs Inspected	Westinghouse Mechanical Plugs Inspected	Total Plugs Inspected
E-50A	614	2	64	680
E-50B	611	7	60	678

2.10 SECONDARY SIDE INSPECTION

The secondary side inspection included bundle flushing, sludge lancing, and foreign object search and retrieval (FOSAR) with remote video inspections.

2.10.1 Secondary Side Visual Inspection Original Scope

2.10.1.1 Top Of Tubesheet Inspections

A FOSAR inspection was completed on the hot and cold legs of both steam generators at the top of the tubesheet at the periphery using the manual video probe. Foreign objects were identified in both steam generators included demister wire, weld slag and sludge rocks. The weld slag and large pieces of demister wire were removed using FOSAR equipment.

2.10.2 Sludge Lancing Scope

2.10.2.1 Bundle Flush

A bundle flush was completed on each steam generator concurrent with sludge lancing, which consisted of high-pressure condensate water being sprayed at the top of the tube bundle including the eggcrates lattice support plates to wash down any loose sludge.

2.10.2.2 Sludge Lancing

Top of the tubesheet sludge lancing was completed on both steam generators concurrent with bundle flushing. High-pressure condensate was sprayed from an articulating lance system between the tube columns toward the stay dome, were the suction headers removed the sludge. Three passes were completed in each steam generator at 60 degree, 90 degree and 150 degree location. The sludge and condensate water slurry was passed through a filter system where the sludge was removed and condensate recycled.

3.0 STEAM GENERATOR EDDY CURRENT SUMMARY 2003 REFUELING OUTAGE

3.1 STEAM GENERATOR E-50A SUMMARY FOR PLUGGING

A total of 25 tubes were plugged in E-50A in the 2003 refueling outage. Steam generator tube plugging is accomplished using Palisades Steam Generator procedure MRS 2.3.2, "Mechanical Plugging of Steam Generator Tubes." A listing of tube plugging for the 2003 refueling outage is as follows:

Table 7: Steam Generator E-50A Tube Plugging 2003

Outage	SG	Row	Column	Location	Reason For Plugging
2003	E-50A	79	38	VS4	40% Throughwall Wear (WAR)
2003	E-50A	133	68	VS7	44% Throughwall Wear (WAR)
2003	E-50A	133	78	VS1	40% Throughwall Wear (WAR)
2003	E-50A	135	80	DBC	42% Throughwall Wear (WAR)
2003	E-50A	134	97	VS1	41% Throughwall Wear (WAR)
2003	E-50A	78	83	TSH	Single Circumferential Indication (SCI)
2003	E-50A	102	129	TSH	Single Circumferential Indication (SCI)
2003	E-50A	2	123	DBH	Single Axial Indication (SAI)
2003	E-50A	122	51	TSH	Single Volumetric Indication (SVI)
2003	E-50A	78	77	TSH	Single Volumetric Indication (SVI)
2003	E-50A	77	84	TSH	Single Volumetric Indication (SVI)
2003	E-50A	130	105	TSH	Single Volumetric Indication (SVI)
2003	E-50A	122	109	TSH	Single Volumetric Indication (SVI)
2003	E-50A	84	113	TSH	Single Volumetric Indication (SVI)
2003	E-50A	86	121	TSH	Single Volumetric Indication (SVI)
2003	E-50A	87	122	TSH	Single Volumetric Indication (SVI)
2003	E-50A	107	126	02H	Single Volumetric Indication (SVI)
2003	E-50A	113	126	TSH	Single Volumetric Indication (SVI)

2003	E-50A	25	64	VS4	Single Volumetric Indication (SVI)
2003	E-50A	95	138	TSH	Single Volumetric Indication (SVI)
2003	E-50A	119	46	TSH	Single Volumetric Indication (SVI)
2003	E-50A	109	36	TSH	Single Volumetric Indication (SVI)
2003	E-50A	45	64	TSH	Single Axial Indication in Tubesheet (SAI)
2003	E-50A	106	127	02H	Single Volumetric Indication (SVI)
2003	E-50A	41	150	TSH	Single Axial Indication Tack Roll (SAI)

After eight cycles of operation, 57 additional tubes in Steam Generator E-50A have been plugged. This brings the total of plugged tubes in E-50A to 365 tubes. There are 7854 active tubes with 4.44% of the tubes plugged in this steam generator.

3.2 STEAM GENERATOR E-50B SUMMARY FOR PLUGGING

A total of 21 tubes total were plugged in Steam Generator E-50B in the 2003 refueling outage. Steam generator tube plugging is accomplished using Palisades Steam Generator procedure MRS 2.3.2, "Mechanical Plugging of Steam Generator Tubes." A listing of tube plugging for the 2003 refueling outage is as follows:

Table 8: Steam Generator E-50B Tube Plugging 2003

Outage	SG	Row	Column	Location	Reason For Plugging
2003	E-50B	47	10	TSH	Single Circumferential Indication (SCI)
2003	E-50B	41	50	TSH	Single Circumferential Indication (SCI)
2003	E-50B	104	55	TSH	Single Volumetric Indication (SVI)
2003	E-50B	69	60	TSH	Single Circumferential Indication (SCI)
2003	E-50B	71	92	TSH	Single Circumferential Indication (SCI)
2003	E-50B	72	105	TSH	Single Circumferential Indication (SCI)
2003	E-50B	64	91	TSH	Single Axial Indication (SAI)
2003	E-50B	71	72	TSH	Single Axial Indication (SAI)
2003	E-50B	61	60	TSH	Single Volumetric Indication (SVI)
2003	E-50B	83	44	TSH	Single Volumetric Indication (SVI)
2003	E-50B	83	46	TSH	Single Volumetric Indication (SVI)
2003	E-50B	86	55	TSH	Single Volumetric Indication (SVI)
2003	E-50B	130	61	TSH	Single Volumetric Indication (SVI)
2003	E-50B	59	62	TSH	Single Volumetric Indication (SVI)
2003	E-50B	63	64	TSH	Single Volumetric Indication (SVI)
2003	E-50B	108	65	TSH	Single Volumetric Indication (SVI)
2003	E-50B	44	133	VS4	41% Throughwall Wear (WAR)
2003	E-50B	45	134	VS4	42% Throughwall Wear (WAR)
2003	E-50B	47	106	VS4	41% Throughwall Wear (WAR
2003	E-50B	135	100	VS4	Restricted tube for RPC but not Bobbin Administratively Plugged
2003	E-50B	19	64	TSH	Single Axial Indication (SAI)

After eight cycles of operation, 51 additional tubes in Steam Generator E-50B have been plugged. This brings the total of plugged tubes in E-50A to 360 tubes. There are 7859 active tubes with 4.38% of the tubes plugged in this steam generator.

Table 9: Steam Generator Support Structure Nomenclature

Abbreviation	Support Structure
DBH	Diagonal Strap-Hot Side
DBC	Diagonal Strap -Cold Side
TEC	End of Tubesheet-Cold Side
TEH	End of Tubesheet-Hot Side
TSC	Top of Tubesheet-Cold Side
TSH	Top of Tubesheet-Hot Side
VS1	First Vertical Strap
VS2	Second Vertical Strap
VS3	Third Vertical Strap
VS4	Fourth Vertical Strap
VS5	Fifth Vertical Strap
VS6	Sixth Vertical Strap
VS7	Seventh Vertical Strap
02H	Second Eggcrate – Hot Side

3.3 STEAM GENERATOR SECONDARY SIDE INSPECTION SUMMARY 2003 REFUELING OUTAGE

In the 2003 refueling outage the tubesheet annulus was inspected using a manual video probe in Steam Generator E-50A and E-50B hot and cold legs. Foreign objects were identified in both steam generators included demister wire, weld slag and sludge rocks. Foreign objects were removed using foreign object search and retrieval (FOSAR) equipment. The large pieces of demister banding wire and weld slag were found in contact with steam generator tubing when removed. The tube location was identified for each loose part and eddy current data examined for wear. No degradation from wear or volumetric indications was detected. The demister banding wire and weld slag were found in the annulus and were not in contact with steam generator tubes. A cleanliness video was completed and reviewed for acceptance prior to completion of the FOSAR activity.

Both steam generators had an upper bundle flush completed. The amount of sludge removed during the upper bundle flush was 145.5 pounds per steam generator. Both steam generators had sludge lancing completed on the hot and cold leg tubesheet. A total of 25 pounds wet weight was removed from Steam Generator E-50A and 16 pounds wet weight was removed from Steam Generator E-50B during sludge lance operations.

4.0 ASSESSMENT OF ACTIVE AND POTENTIAL DEGRADATION MECHANISMS

4.1 STEAM GENERATOR TUBE INSPECTION TECHNIQUES

To disposition steam generator tube degradation in accordance with the repair limits in Palisades Technical Specifications and 10 CFR Part 50 Appendix B the inspection process must be capable of:

1) detecting indications of tube degradation,
2) characterizing the indications, and
3) accurately sizing the depth of degradation.

Palisades uses the requirements in the American Society of Mechanical Engineers (ASME) Code, Sections XI and V, 1989 edition and NRC Regulatory Guide 1.83, "Inservice Inspection of Pressurized Water Reactor Steam Generator Tubes" as the basis for sizing techniques. EPRI Steam Generator Examination Guidelines: Revisions 3 through 5, Appendix H, "Qualification Data Sets" and qualifications completed by Consumers Energy provide support for sizing degradation specific mechanisms. Within Table 10, " Palisades Steam Generator Active Degradation Mechanisms," is a list of active degradation mechanisms by degradation mechanism, location in or on the steam generator tube, authorized eddy current probe, the Palisades qualified eddy current techniques acquisition technique sheets (ACTS), the EPRI qualified technique (ETSS), NDE probability of detection, and NDE detection threshold at a 50% probability of detection.

Table 11, "Palisades Steam Generator Potential Degradation Mechanisms" is a list of all potential degradations, some of which are monitored but not active like wear at vertical straps, diagonal bars and eggcrates.

Table 10: Palisades Steam Generator Active Degradation Mechanisms

Degradation Mechanism	Location	Authorized Probe	ACT	ETSS	POD	Detection Threshold 50% POD
Axial PWSCC In SG E-50A	Row 1&2 U-bends	Mid range plus point 0.610" dia	PAL-04 PAL-05	#96511.1 #96511.2	0.91>27%TW	40% TW
Axial ODSCC In SG E-50B	Hot leg TTS expansion transition	Plus Point 0.610" dia	PAL-03	#20409.1	0.82>50%TW	61% TW
Circumferential ODSCC in SG E-50A/B	Hot leg TTS expansion transition	Plus Point 0.610" dia	PAL-03	#21410.1	0.91>50%TW	42% TW
Axial ODSCC in SG E-50A	Tubesheet in inspection area	Plus Point 0.610" dia	PAL-03	#20511.1	0.90>40%TW	37% TW
Axial PWSCC in SG E-50A/B	Tack roll region of no expanded tube	Plus Point 0.610" dia	PAL-03	#20511.1	0.90>40%TW	37% TW
Structure Wear In SG E-50A/B	Vertical strap	Bobbin 0.610" dia	PAL-01	#96004.1	0.91>40%TW	5%

Table 11: Palisades Steam Generator Potential Degradation Mechanisms

Degradation Mechanism	Location	Authorized Probe	ACT	ETSS	POD	Detection Threshold 50% POD
Potential FSDs	All	Bobbin 0.610" dia	PAL-01	#96008.1	0.85>50%TW	1% TW
Axial PWSCC	Row 1&2 U-bends	Mid range plus point 0.610" dia	PAL-04 PAL-05	#96511.1 #96511.2	0.91>27%TW	40% TW
Axial PWSCC	Row 1&2 U-bends	High freq. Plus point 0.610" dia	PAL-04 PAL-05	#99997.1 #99997.2	0.91>27%TW	40% TW
Axial ODSCC	Non-dented TSP intersections	Bobbin 0.610" dia	PAL-01	#96008.1	0.81>40%TW	13% TW
Axial ODSCC	Freespan	Bobbin 0.610" dia	PAL-01	#96008.1	0.81>40%TW	13% TW
Axial ODSCC	Freespan dings≤ 5 volts	Bobbin 0.610" dia	PAL-01	(W) SG-99-03-005	0.90>60%TW	50% TW
Axial ODSCC	Freespan dings> 5 volts	Plus Point 0.610" / 0.580" dia	PAL-03 PAL-04	#22401.1	0.91>53%TW	53% TW
Tube Wear	Vertical strap	Bobbin 0.610" dia	PAL-01	#96004.3	0.91>40%TW	5%
Tube Wear	Diagonal bar	Bobbin 0.610" dia	PAL-01	#96004.3	0.91>40%TW	5%
Tube Wear	Eggcrates	Bobbin 0.610" dia	PAL-01	#96004.3	0.95>41%TW	5%
Tube Wear (loose parts)	TTS periphery & tubelane	Bobbin 0.610" dia Plus Point 0.610" dia	PAL-01 PAL-03	#96001.1 #21998.1	0.83>50%TW 0.93>40%TW	21% TW 9% TW

Table 12: Palisades Steam Generator Secondary Side Degradation Mechanisms

Degradation Mechanism	Location	Inspection Technique	Inspection Frequency	Comments
Tube damage by loose parts	Tubes above support structures	Plus Point RPC Bobbin	Each outage	Same as scope for tubing
Upper internals erosion/corrosion	Moisture separator can deck	Visual UT	Per degradation assessment	Completed in Maintenance Outage Feb 2000
ODSCC at TTS due sodium intrusion	Top of the tubesheet OD	Plus Point RPC	Each outage	Same scope as for tubing
Shell weld cracking	Transition zone weld	UT, visual on ID for ID surface flaw	Per ISI schedule	Completed SG E-50B in 2003 refueling outage
Wrapper weld failure at support blocks	Welds at wrapper support blocks	Visual inspection video probe	Per degradation assessment	Completed in Maintenance Outage Feb 2000
Cracking of wrappers at supports	Wrapper near supports	Visual inspection video probe	Per degradation assessment	Completed in Maintenance Outage Feb 2000
Main steam nozzle wear	Main steam nozzle	UT, visual on ID for ID surface flaw	Per FAC Program	Completed in 1993 refueling outage
Feedwater ring and feedwater nozzle wear	Feedwater ring and nozzle welds	UT, visual on ID for ID surface flaw	Per FAC Program	Completed in 1999 refueling outage
FAC at eggcrates	Eggrates	Visual inspection video probe (Not FAC susceptible)	Per degradation assessment	Completed in 1999 refueling outage

4.2 ACQUISITION TECHNIQUE SHEETS AND ANALYSIS TECHNIQUE SHEETS

Palisades' acquisition technique sheets (ACTS) and analysis technique sheets (ANTS) list all analysis and acquisition parameters to be used for the eddy current inspection. These ACTS and ANTS are referenced in the Palisades Authorized Probe List, which is documented in EM-09-17, "Steam Generator Eddy Current Data Analysis Techniques". The following partial listing corresponds to the Palisades ACTS and ANTS numbers used for these probe types:

1. Bobbin probe - ACTS No PAL-01-03 and PAL-02-03, ANTS No PAL-A-03 and PAL-B-03.

2. 3 Coil Plus Point RPC (with .115" pancake and .080" HF pancake) - ACTS No PAL-03-03 and ANTS No PAL-C-03.

3. U-bend single mag-biased plus point - ACTS No PAL-04-03 and ANTS No PAL-D-03.

4. U-bend single .110" pancake coil - ACTS No PAL-05-03 and ANTS No PAL-D-03.

5.0 CONDITION MONITORING FOR 2003 REFUELING OUTAGE / OPERATIONAL ASSESSMENT CYCLE 17

5.1 ODSCC AT THE TOP OF THE TUBESHEET

5.1.1 2003 Axial and Circumferential ODSCC Indication Top of Tubesheet SG E-50A/B

Two tubes in Steam Generator (SG) E-50B were found to contain a single axial ODSCC indication just above the hot leg top of tubesheet. Two tubes in SG E-50A and five tubes in SG E-50B were found to contain a single circumferential indication just above the hot leg top of tubesheet. Evidence of sludge deposit was found coincident with the flaws. The flaw parameters are as follows:

Table 13: Axial and Circumferential ODSCC Indications Flaw Parameters

Steam Generator	Row	Column	Flaw Type	Location	Length Or Axial (in)	Max Plus Pt Volts	In-situ Required	Stabilizer Required
E-50A	78	83	SCI ODSCC	TSH	60 deg	0.17	No	Yes
E-50A	102	129	SCI ODSCC	TSH	54 deg	0.16	No	Yes
E-50B	47	10	SCI ODSCC	TSH	96 deg	0.20	No	Yes
E-50B	41	50	SCI ODSCC	TSH	79 deg	0.18	No	Yes
E-50B	69	60	SCI ODSCC	TSH	104 deg	0.12	No	Yes
E-50B	71	92	SCI ODSCC	TSH	71 deg	0.22	No	Yes
E-50B	72	105	SCI ODSCC	TSH	82 deg	0.20	No	Yes
E-50B	71	72	SAI ODSCC	TSH	0.328 in	0.34	No	No
E-50B	72	105	SAI ODSCC	TSH	0.180 in	0.18	No	No

5.1.2 Condition Monitoring In 2003 Refueling Outage

These indications were screened against in-situ screening parameters developed in the Steam Generator Degradation Assessment for 2003 Refueling Outage. For the seven circumferential indications reviewed the longest indication is 104 degrees compared to the degradation assessment screening criteria of 226 degrees in length for a 100% throughwall flaw. For the two axial indications the longest axial indication reviewed was 0.328 inch. The screen for axial indications length is 0.440 inch. All the circumferential and axial ODSCC indications screened out against the degradation assessment screening criteria. In-situ pressure testing was not required.

The seven circumferential indications did require stabilization by use of a stainless steel wire cable inserted prior to repair by tube plugging as referenced in Table 13 Stabilizer Required column.

The seven circumferential indications had a bounding arc length of 104 degrees. The limiting phase reports for all flaws represent less than 100% throughwall degradation. If the indications are assumed to be 100% throughwall over the reported arc length, the bounding percent degraded area is 28.9%, which is well less than the in situ screening percent degraded area (PDA) value, reduced for non destructive (NDE) uncertainty of 48.8%. At a PDA of 28.9%, the predicted burst pressure is 6942 psi. The circumferential ODSCC indications reported in the 2003 refueling outage satisfied the condition monitoring performance criteria of 4000 psi.

The two axial indications had a bounding axial length of 0.328 inch. Based on the depth profiles from the plus point RPC volts versus depth correlation, and using the lower 90% probability, 50% confidence flow stress, the limiting burst pressure is 6712 psi. If the plus point volts versus depth correlation is applied at the upper 90% probability, 50% confidence, the predicted burst pressure is 6010 psi, well above the performance criterion of 4000 psi.

5.1.3 Operational Assessment For Cycle 17

Based on the 2003 condition monitoring results, circumferential ODSCC at the top of the tubesheet in Steam Generator E-50A/B **is an active damage mechanism** for the 2004 refueling outage.

Based on the 2003 condition monitoring results, axial ODSCC at the top of the tubesheet in Steam Generator E-50B **is an active damage mechanism** for the 2004 refueling outage.

The limiting arc length for circumferential indications reported in the 2003 refueling outage was 104 degrees, which is well below the structural limit reduced for uncertainty assuming a 100% throughwall flaw over the entire flaw length of 226 degrees. Postulated arc lengths during Operational Cycle 17 would be expected to be slightly more limiting than that reported in

the 2003 refueling outage, but still well below the limiting 100% throughwall arc length of 226 degrees, including measurement uncertainty.

An historic review of the 2001 refueling outage plus point RPC data indicates that precursor signals were evident for both of the axial ODSCC indications reported. The Operational Cycle 17 upper bound average depth is expected to remain less than 54% throughwall. The Operational Cycle 17 flaw length and average depth of 0.44 inch and 54% throughwall is well below the 0.44-inch and 100% throughwall flaw parameters that provide burst capability consistent with the performance criteria.

Based on observed axial and circumferential ODSCC degradation and corresponding growth rates for Operational Cycle 16, it is anticipated that structural tube integrity and leakage integrity will be maintained during Operational Cycle 17.

5.2 WEAR

5.2.1 Condition Monitoring In 2001 Refueling Outage

5.2.1.1 Wear Growth Evaluation for 2003 Refueling Outage Inspection

During the 2003 refueling outage, inspection wear indications were observed at eggcrates, vertical straps, and hot and cold leg diagonal bars. These wear indications were sized using the bobbin coil and a qualified sizing technique (ETSS 96004.3).

The maximum observed depth for a wear indication was 44% throughwall in Steam Generator E-50A. The EPRI tube integrity guideline uncertainty is 12.42%. The maximum depth is conservatively represented at 56.42% throughwall, which is less than the structural limit depth of 62% for an assumed 2 inch long uniform deep wear scar.

5.2.1.2 Vertical Strap Wear

The summary of tubes with vertical strap wear is as follows (highest percentage per tube):

Table 14: Vertical Strap Wear 2003

S/G	# Tubes <20%	# Tubes 20-29%	# Tubes 30-39%	# Tubes ≥ 40%
E-50A	60	114	42	4
E-50B	62	267	60	3

5.2.1.3 Diagonal Bar Wear

The summary of tubes with diagonal bar wear is as follows (highest percentage per tube):

Table 15: Diagonal Bar Wear 2003

S/G	# Tubes <20%	# Tubes 20-29%	# Tubes 30-39%	# Tubes ≥ 40%
E-50A	7	13	5	1
E-50B	2	15	4	0

5.2.1.4 Eggcrate Wear

All eggcrate support plate with new indications or with indications that were plus point RPC tested in previous outages which exhibited any change or growth from bobbin history were RPC tested during the 2003 refueling outage and confirmed that wear is the only damage mechanism occurring.

There were 100 tubes in Steam Generator E-50A and 68 tubes in Steam Generator E-50B, which were reported as having a DSI (distorted support indication) from bobbin, were plus point RPC tested and reported as VOL (volumetric indication where qualified sizing technique is available). The indications were then sized by bobbin using the EPRI qualified method of sizing using a volts curve from the 300/150 kHz absolute mix on tapered wear scars on the standard.

All of the remaining DSI reported by bobbin were at supports. There were10 DSI in Steam Generator E-50A and 45 DSI in Steam Generator E-50B, which were plus point RPC tested and found to have no reportable degradation. They were subsequently changed to distorted support signal (DSS) on bobbin for tracking in future inspections. The largest support plate wear indication was 36% throughwall wear. The summary of tubes with eggcrate support wear is as follows (highest percentage per tube):

Table 16: Eggcrate Support Wear 2003

S/G	# Tubes <20%	# Tubes 20-29%	# Tubes 30-39%	# Tubes ≥ 40%
E-50A	32	65	17	0
E-50B	21	39	8	0

5.2.2 Operational Assessment For Cycle 17

In the 1999 refueling outage in Steam Generator E-50B, one tube R99 C140, had a 67% wear indication. This indication was evaluated and satisfied the structural integrity performance criterion for our steam generator tubing. In subsequent outages we will perform bobbin inspections of all surrounding tubes to monitor for this type of wear. If detected wear is greater than 20% or growth during operational cycle is

greater than 10%, then stabilization of this area would be required. There is a requirement that through the 2007 refueling outage that we RPC test the surrounding tubes to verify if there is any wear at this location. The largest diagonal bar wear indication identified in the 2003 refueling outage was a 42% throughwall indication in Steam Generator E-50A

The largest structural wear indication left in-service following the 2003 refueling outage was 39% throughwall in Steam Generator E-50A and 38% throughwall in Steam Generator E-50B. The EPRI uncertainty sizing is 12.45%. Adding growth at a 95% confidence results for Operational Cycle 17 the maximum throughwall wear depth predicted for Steam Generator E-50A is 61.4% and for Steam Generator E-50B is 58.3%. The plus point RPC length evaluation of the larger wear indications in E-50B resulted in a maximum reported flaw length of 1.40 inch. For this flaw length, using limiting threshold limit (LTL) material properties, the associated structural limit is 64.7% throughwall for a uniformly deep wear scar. Using the 10% burst capability allowance for tapered wear, the structural limit is 68.3% for a 1.40-inch long wear scar at LTL material properties. The maximum projected wear depth for Operational Cycle 17 remains bounded by the structural limit.

Steam Generators E-50A and E-50B wear indication growth was reviewed and compiled from the last operational cycle. The observed structure wear growth rates in Steam Generator E-50A and E-50B is considered **an active damage mechanism** for wear as defined in EPRI PWR Steam Generator Examination Guidelines: Revision 5 for the 2004 refueling outage.

Based on observed structural wear degradation and corresponding growth rates for Operational Cycle 16, it is anticipated that structural tube integrity and leakage integrity will be maintained during Operational Cycle 17.

5.3 AXIAL PRIMARY WATER STRESS CORROSION CRACKING (PWSCC)

5.3.1 2003 Axial U-Bend Indication SG E-50A

A single axial PWSCC indication was reported in R2 C123, in Steam Generator E-50A, at the U-bend apex of the tube. The 2001 refueling outage data for this tube was reviewed. No detectable degradation or a precursor flaw signal is observed. The reported flaw length from profile analysis is 0.13 inch, with a maximum depth from phase analysis of 100% throughwall. The maximum plus point RPC amplitude is 0.74 volts and indicates a depth from phase of 54% throughwall.

Table 17: Axial U-Bend PWSCC Indication Flaw Parameters

Row	Col	Type	Indication	Length	Max Depth % TW	Length > MD THR-L	Voltage	Tube Location	Distance
2	123	PWSCC	SAI	0.144"	100	0.02"	0.35	DBH	5.72

5.3.2 Condition Monitoring in the 2003 Refueling Outage

The indication was screened from burst testing by the first screen (consistent with the EPRI In Situ Pressure Test Guidelines) based on a length comparison. The indication length at 0.144 inches is less than 0.55 inches. The indication has been screened from leak testing based on a length at the threshold depth comparison (consistent with the EPRI In Situ Pressure Test Guidelines). The indication length is 0.02 inch, which is less than 0.1 inch.

The axial u-bend ODSCC indication screened out against the degradation assessment screening criteria. In-situ pressure testing was not required.

The predicted burst capability of 6758 psi and the burst pressure at the upper 95% probability, 50% confidence with applied uncertainty of 5487 psi for the axial u-bend indication in R2 C123 meets the structural performance criterion, which is 3 times the normal operating pressure differential, or 4000 psi.

5.3.3 Operational Assessment for Cycle 17

Axial PWSCC in the u-bends in Steam Generator E-50A **is an active damage mechanism** for the 2004 refueling outage.

An historic review of the axial u-bend indications in Steam Generator E-50A indicates that the PWSCC mechanism is more likely to experience depth growth than length growth, once the indication is initiated. Based on the historical U-bend PWSCC indications reported in Combustion Engineering steam generators, a flaw length exceeding the 100% throughwall critical flaw length for Row 2 of 0.55 inch is not expected.

The Operational Cycle 17 flaw length of 0.144 inch and average depth of 0.02 inch is well below the 0.44-inch and 0.1 inch flaw parameters that provide burst capability consistent with the performance criteria.

Based on observed axial PWSCC degradation and corresponding growth rates for Operational Cycle 16, it is anticipated that structural tube integrity and leakage integrity will be maintained during Operational Cycle 17.

5.4 SPECIAL INTEREST INSPECTIONS

5.4.1 Obstructed/Restricted Tube Condition Monitoring In 2003 Refueling Outage

One tube was found to be restricted in the 2003 refueling outage. Tube R135 C100 in SG E-50B, was found to be restricted for plus point RPC examination but not for bobbin examination. This tube was in the ding greater than 5 volt plus point inspection scope. This tube was administratively removed from service by tube plugging.

5.4.2 Obstructed/Restricted Tube Operational Assessment For Operational Cycle 17

In the 2003 refueling outage, 100 tubes out of 179 with dings greater than 5 volts or 56% were examined with plus point RPC. No additional tubes were found with restrictions. No additional tubes were identified with restrictions in either steam generator bobbin or plus point RPC eddy current scope. Continue to monitor for restricted or obstructed tubes in the 2004 bobbin and plus point RPC eddy current inspection.

5.4.3 Permeability Variations Condition Monitoring In The 2003 Refueling Outage

Permeability variations (PV) have been reported throughout the industry for a number of years. The historical approach to PV has been to rely upon the analyst to determine if the PV signal could mask a flaw. For a number of years, magnetically biased probes have been used to reduce PV effects, however, the use of magnetically biased probes may not totally eliminate the PV effects. The following approach to PV was applied at Palisades for the 2003 refueling outage inspection.

Magnetically biased probes will be used to reduce the potential for PV effects to mask a flaw. If it is determined that the application of such probes is not effective in reducing the PV effects such that an adequate inspection cannot be performed, the following PV disposition techniques will be applied:

1) PV signals with bobbin voltage greater than the bobbin voltage calibration value for 40% depth wear at strap and bar intersections will be repaired. This value has been established to be 1.5 volts in mix 1 (550/150 differential). A plus point RPC test can be used to determine if the PV signal has sufficient width to mask wear scar presence or that PV is not coincident with the location of the structure.

2) PV signals coincident with areas of the tube where active degradation mechanisms are applicable will be repaired.

3) PV signals 3 inches above to 5 inches below the top of the tubesheet (TTS) expansion transition down to 6" below the TTS in critical area tubes will be repaired for any of the following characteristics:

a. greater than 1 volt by Plus Point RPC
b. greater than 90° arc length
c. greater than 0.25 inch axial extent

4) PV signals coincident with confirmed foreign objects or foreign object wear will be repaired.

5) PV signals identified in an area of the tube where active degradation has not been previously identified in the remainder of the tube bundles of both steam generators, or an area not subject to structural or leakage potential can be permitted to remain in service.

The regions of the steam generator tube bundles to which item 5 can be applied is the hot leg tubesheet greater than 5 inches below the TTS and the freespan region above the expansion transition. For any postulated hot leg flaw greater than 5 inches below the TTS, the potential for tube pullout is negligible, as well as the potential for primary to secondary leakage. Combustion Engineering (CE) Owners Group Task Report 1154, "NDE Inspection Strategy for Tubesheet Regions in CE Designed Units" has evaluated the axial load capabilities of the explosively expanded tube joints. A 5-inch expansion region provides the necessary resistive load capability to prevent tube pullout for a postulated circumferential separation below the 5-inch location. No flaw signals were observed the 2003 refueling outage outside of the sludge region critical area or in crevice depths less than 0.4 inch.

No permeability variations were detected in the 2003 refueling outage.

5.4.4 Permeability Variations Operational Assessment For Operational Cycle 17

No permeability variations were detected in the 2003 refueling outage. Permeability variations will be monitored for in the 2004 refueling outage.

5.5 AXIAL PRIMARY WATER STRESS CORROSION (PWSCC) IN THE TUBESHEET

5.5.1 2003 Axial PWSCC Indications in the Tubesheet

A primary water stress corrosion crack (PWSCC) axial indication 2 inches below the top of the tubesheet was identified in the plus point RPC top of tubesheet program. The axial indication occurred in tube R 45 C64 in Steam Generator E-50A. The axial indication was entirely inside the

tubesheet and was bounded by the inspection scope of 5 inches into the tubesheet. This indication was repaired by tube plugging.

From the historical bobbin data, 8 tubes in Steam Generator E-50A (6 in the hot leg and 2 in the cold leg) and 2 tubes in Steam Generator E-50B (2 in the hot leg) were determined to not have evidence of explosive tube expansion through the tubesheet. For these tubes without expansion plus point RPC inspection was performed the entire tubesheet thickness. This inspection distance was selected to verify that crevice outside diameter stress corrosion cracking (ODSCC) was not occurring at depths below the top of tubesheet.

One tube with a multiple axial indication at the tack roll weld was hard rolled and plugged in E-50B in the 1999 refueling outage. In the 2003 refueling outage one tube in each steam generator had an axial PWSCC indication at a tack roll weld about one half inch from the end of the hot leg tubesheet. Both tubes were hard rolled prior to repair by tube plugging.

The tubesheet is inspected only to a depth of 5 inches. For any postulated hot leg flaw greater than 5 inches below the top of the tubesheet, the potential for tube pullout is negligible, as well as the potential for primary to secondary leakage. Combustion Engineering (CE) Owners Group Task Report 1154, "NDE Inspection Strategy for Tubesheet Regions in CE Designed Units" has evaluated the axial load capabilities of the explosively expanded tube joints. A 5-inch expansion region provides the necessary resistive load capability to prevent tube pullout for a postulated circumferential separation below the 5-inch location.

Table 18: Axial Tubesheet PWSCC Indication Flaw Parameters

SG	Row	Column	Type	Indication	Length	Voltage	Tubesheet	Location
E-50A	45	64	PWSCC	SAI in tubesheet	0.280"	1.67	TSH	0.37"
E-50A	41	150	PWSCC	SAI at tack roll weld	0.202"	0.14	TSH	0.30"
E-50A	19	64	PWSCC	SAI at tack roll weld	0.103	0.44	TSH	1.16

5.5.2 Condition Monitoring in the 2003 Refueling Outage

The axial indication in the tubesheet in SG E-50A at the upper 95% probability, 50% confidence using an amplitude correlation to axial PWSCC depth, the maximum depth of the indication in tube R45 C64, is estimated to be 80% throughwall (TW). Based on phase analysis, the maximum depth at the point of peak amplitude is 92%TW. This tube was last plus point RPC inspected in 1998. An historic review showed no evidence of a precursor signal. Bobbin analysis of this tube in 2003 indicates presence of a signal in all analysis channels. The 2001 bobbin data for this tube indicates the

precursor of a signal. ETSS 21511.1 data shows that all axial PWSCC indications with greater than 37%TW maximum depth were detected. Based on a total flaw length of 0.28 inch and a 100% top of tubesheet inspection in both steam generators in the 2004 refueling outage the maximum postulated flaw length is expected to be less than the 100%TW critical flaw length of 0.44 inch, thus structural integrity performance criteria are also expected to be satisfied. The amplitude screening does not exceed the in-situ pressure-testing threshold. No in-situ pressure testing was required.

In the 1999 refueling outage inspection, one tube that had not received a full depth explosive expansion in the tubesheet region, R10 C105 in SG E-50B, was reported to contain multiple axial indications at the hard roll tack expansion. All non-expanded tubes were inspected in the 1999 refueling outage through the full tubesheet thickness. No additional indications were observed. In the 2001 refueling outage, all non-expanded tubes were again inspected through the full tubesheet thickness. No indications were reported.

In the 2003 refueling outage, all non-expanded tubes were plus point RPC inspected through the full tubesheet thickness. One tube in SG E-50A, R41 C150, was reported with a single axial PWSCC indication at the hard roll expansion transition. The reported flaw length was 0.14", with maximum plus point amplitude of 0.74 volts. One tube in SG E-50B, R19 C64, was reported with a single axial PWSCC indication at the hard roll expansion transition. The reported flaw length was 0.10", with maximum plus point amplitude of 0.44 volts. These reported flaw lengths are significantly less than the 100% throughwall critical flaw length. At the hard roll expansion, axial flaws are precluded from burst due to the tubesheet proximity. At 0.74 and 0.44 +Pt volts, the flaw depth is significantly less than 100% throughwall, thus no leakage potential exists for these indications.

5.5.3 Operational Assessment For Cycle 17

Axial PWSCC in the tubesheet in Steam Generator E-50A is considered **an active damage mechanism** for the 2004 refueling outage.

Axial PWSCC at the hard roll transition expansion of non-explosively expanded tubes **is an active damage mechanism** for the 2004 refueling outage. The non-expanded tube population is 6 tubes in Steam Generator E-50A and 1 tube in Steam Generator E-50B.

Based on the only Palisades observation of a total flaw length of 0.28 inch and 100% top of tubesheet inspection in both steam generators, maximum postulated flaw length at during Operational Cycle 17 is expected to be less than the 100% throughwall critical flaw length of 0.44 inch, thus structural integrity performance criteria are also expected to be satisfied.

Only seven tubes remained in service with no explosive expansion in the tubesheet region. Two tubes were reported with indications in the 2003 refueling outage, with a maximum length of 0.14 inch. As the tubesheet proximity precludes burst, leakage is the only consideration for this region. The maximum flaw amplitude of 0.74 volts represents a depth of 57% throughwall at the upper 90% probability, 50% confidence using the correlation of plus point RPC amplitude to maximum depth of axial PWSCC indications. Considering a detection threshold of approximately 20% throughwall, no 100% throughwall depths would be expected for axial PWSCC indications at the hard roll expansion of non-expanded tubes.

Based on observed axial PWSCC degradation and corresponding growth rates for Operational Cycle 16, it is anticipated that structural tube integrity and leakage integrity will be maintained during Operational Cycle 17.

5.6 FREESPAN DIFFERENTIAL SIGNAL INDICATIONS

5.6.1 Condition Monitoring In The 2003 Refueling Outage

In order to address current regulatory concerns, an extensive historic review was performed during the inspection. All freespan indications reported by bobbin were reviewed in baseline history. If the indication showed no significant change from 1990 baseline to the present, it was reported as freespan differential signal (FSD) with a historic review comment to designate that it was reviewed. Those indications, which either could not be detected or showed a change from baseline history were reported as an "I" code (NQI, non-quantifiable indication) and plus point RPC tested. A total of 69 indications in Steam Generator E-50A and 194 indications in Steam Generator E-50B were reported as an "I" code in the freespan and showed no degradation when tested with plus point RPC. NQI calls were then changed to non-quantifiable signal (NQS) for future tracking. The result of the freespan bobbin indications resolved to non-repairable status by history review is as follows:

Table 19: Freespan Differential Signals / Tube History Review

Steam Generator	Freespan Differential Signals (FSD)	Tubes With History Review
E-50A	339	208
E-50B	1280	812

5.6.2 Operational Assessment For Cycle 17

Palisades will continue to monitor freespan differential signals (FSD) indication each refueling outage. They were originally identified as manufacturing burnish marks (MBM) and will be confirmed with a history review and if not found dispositioned by examination with plus point RPC. All tubes examined by bobbin in the 2004 refueling outage will have FSD indications in the freespan areas reviewed for history. Any areas that have significant change or not present in history will be examined using a qualified plus point RPC method.

5.7 DENTS

Palisades does not have any dents in the replacement steam generators. No dents in the Palisades replacement steam generators have been found that conform to the EPRI PWR Steam Generator Examination Guidelines, Revision 5 definition of a dent, which is defined in this EPRI document (Appendix F), as "a local reduction (plastic deformation) in the tube diameter due to a buildup of corrosion products (magnetite)".
Denting is and will be monitored for during the 2004 refueling outage bobbin coil examination. If any bobbin coil indications are confirmed with plus point RPC testing as a degradation mechanism, then we will expand the denting scope per the 2004 degradation assessment.

5.8 DINGS

5.8.1 Condition Monitoring In The 2003 Refueling Outage

During the assembly of Palisades' replacement steam generators, some minor dings occurred. Dings in the Palisades replacement steam generators have been found that conform to the EPRI PWR Steam Generator Examination Guidelines, Revision 5 definition of a ding, which is defined in this EPRI document (Appendix F), as "a local reduction (plastic deformation) in the tube diameter caused by manufacturing, support plate shifting, vibration or other mechanical means".

This resulted in 478 tubes with dings in Steam Generator E-50A and 179 tubes with dings in Steam Generator E-50B. These dings were identified with bobbin coil examination during the pre-service inspection. In approximately 6 tubes, dings exist in the stainless steel eggcrate support plate area. The dings are within the vertical strap area in approximately 95% of the dinged tubes. Palisades has very few dings that occur in the support plate, free span, and diagonal bar areas.

In Steam Generator E-50A 304 tubes and in Steam Generator E-50B 100 tubes with bobbin ding indications greater than 5.0 volts in the freespan were plus point RPC tested. Dings less than or equal to 5 volts were monitored down to 2 volts during bobbin coil examination.

As the tubes are not constrained due to the design of the vertical straps, diagonal bars, and eggcrates such that a postulated axial or circumferential flaw would be precluded from burst, all dings are considered to act like freespan dings.

Monitoring for detection of axial ODSCC at freespan dings (including vertical straps, diagonal bars, and eggcrates) was performed using bobbin coil calling criteria established by Westinghouse report SG-99-03-005, "Appendix H Certification of Bobbin Coil Detection Performance in Freespan Dings". The bobbin qualification applies to freespan dings less than or equal to 5 volts.

5.8.2 Operational Assessment For Cycle 17

No axial ODSCC has been detected in Palisades steam generators freespan dings. The sample inspection of 64% of the freespan dings in Steam Generator E-50A and 56% in Steam Generator E-50B in the 2003 refueling outage showed no degradation. Axial ODSCC for freespan dings greater than 5 volts is **not** an active damage mechanism and will be tested in the 2004 refueling outage. Dings less than or equal to 5 volts down to at least 2 volts will be monitored with bobbin in the 2004 refueling outage.

5.9 POSSIBLE LOOSE PARTS AND VOLUMETRIC INDICATIONS

5.9.1 Possible Loose Parts in 2003 Refueling Outage

Steam Generator eddy current analysis in the top of tubesheet program has identified an increasing trend in possible loose parts (PLP) indications on the top of the tubesheet. In Steam Generator (SG) E-50A 84 PLP indications were identified in the 2003 refueling outage. In SG E-50B 51 new PLP indications were identified in the 2003 refueling outage. The current total for PLP indications are 122 in E-50A and 80 in E-50B. The steam generator top of tubesheet eddy current inspection scope was expanded to 100% in both steam generators. All tubes with wear from PLP indication and volumetric indication (normally a result of interaction with a PLP) were repaired by steam generator tube plugging.

5.9.2 Volumetric Indications in 2003 Refueling Outage

In the 2003 refueling outage 24 tubes were plugged with volumetric indications. A total 15 tubes were plugged in Steam Generator E-50A and 9 in Steam Generator E-50B. The majority of the indications were located at the top of the hot leg tubesheet and were associated with loose part indications. All the volumetric indications associated with loose parts were also stabilized with stainless steel wire cable prior to repair by tube plugging. A total of 9 volumetric indications associated with loose parts were stabilized and plugged in Steam Generator E-50A. A total of 4

volumetric indications associated with loose parts were stabilized and plugged in Steam Generator E-50B.

A review was completed of the foreign object search and retrieval (FOSAR) inspection video in 2003 refueling outage. This manual video inspection included the periphery of both steam generator hot and cold legs. Loose parts identified were demister wire, weld slag, and sludge. All loose parts attainable in the periphery were removed.

Table 20: Volumetric Indication Flaw Parameters

SG	Row	Column	Ind	Degrees	Length	Voltage	Tubesheet	Stabilization Required
E-50A	122	51	SVI	37	0.258	0.15	TSH	No
E-50A	25	64	SVI	71	0.313	0.82	VS4	No
E-50A	78	77	SVI	31	0.397	0.13	TSH	No
E-50A	77	84	SVI	55	0.256	0.23	TSH	No
E-50A	130	105	SVI	67	0.344	0.26	TSH	Yes
E-50A	122	109	SVI	40	0.126	0.15	TSH	Yes
E-50A	84	113	SVI	66	0.314	0.09	TSH	Yes
E-50A	86	121	SVI	76	0.278	0.10	TSH	Yes
E-50A	87	122	SVI	109	0.174	0.17	TSH	Yes
E-50A	107	126	SVI	66	0.335	0.86	02H	Yes
E-50A	113	126	SVI	76	0.302	1.05	TSH	Yes
E-50A	95	138	SVI	59	0.193	1.05	TSH	No
E-50A	119	46	SVI	67	0.218	0.13	TSH	Yes
E-50A	109	36	SVI	64	0.404	0.16	TSH	No
E-50A	106	127	SVI	76	0.333	0.40	02H	Yes
E-50B	130	61	SVI	37	0.189	0.20	TSH	Yes
E-50B	59	62	SVI	80	0.254	0.18	TSH	No
E-50B	63	64	SVI	90	0.151	0.31	TSH	No
E-50B	61	60	SVI	58	0.135	0.18	TSH	No
E-50B	83	44	SVI	82	0.131	0.14	TSH	Yes
E-50B	83	46	SVI	69	0.099	0.12	TSH	Yes
E-50B	86	55	SVI	35	0.198	0.19	TSH	No
E-50B	108	65	SVI	68	0.222	0.33	TSH	Yes
E-50B	104	55	SVI	26	0.096	0.12	TSH	No

5.9.3 Condition Monitoring in the 2003 Refueling outage

In Steam Generator E-50A, 9 tubes were reported with volumetric indications due to foreign object wear just above the top of tubesheet. Not all of these have corresponding possible loose part (PLP) reports. The elevation of these indications with corresponding PLP reports are slightly above the top of tubesheet and located in non-sludge region near the periphery. These indications were a result of foreign object wear and not a corrosion mechanism. The longest of these was reported at 0.404 inch. The maximum plus point RPC amplitude was 0.16 volts, with a maximum depth using the EPRI VOL standard at <20% throughwall. This indication showed no growth from the previous plus point inspection. A PLP signal was not associated with this tube.

Two tubes in Steam Generator E-50A were reported with foreign object wear just above the second hot leg eggcrate (02H). The most significant of these, R107 C126, was reported by the bobbin coil and confirmed by plus point. Flaw length from profile analysis was reported at 0.33 inch, with a maximum plus point amplitude of 1.05 volts. Based on the ETSS 21998.1 sizing evaluation, the maximum depth is estimated to be 55% throughwall. An adjacent tube, R106 C127 was also reported with wear based on plus point evaluation. Flaw length was reported at 0.38 inch, with a maximum amplitude of 0.40 volts, and depth based on ETSS 21998.1 of 33% throughwall. Burst pressure of this indication (R107 C126) is estimated to be 6520 psi, which meets the structural performance criterion, which is 3 times the normal operating pressure differential, or 4000 psi.

The indication judged to be the limiting foreign object wear scar with regard to burst capability was also found in Steam Generator E-50A just above the top of tubesheet. Flaw length from profile analysis was reported at 0.47 inch, with a maximum plus point amplitude of 1.05 volts. Based on the ETSS 21998.1 sizing evaluation, the maximum depth is estimated to be 55% throughwall. Burst pressure of this indication (R113 C126) is estimated to be 5920 psi, which meets the structural performance criterion, which is 3 times the normal operating pressure differential, or 4000 psi.

In Steam Generator E-50B, 9 tubes were plugged due to volumetric indications just above the top of tubesheet. The limiting axial length reported was 0.254 inch. The maximum plus point amplitude for all of the indications was 0.33 volts. Using the depth sizing curve based on ETSS 21998.1, a 0.33 volt signal represents a depth of 30% throughwall. Burst pressure for this indication is at least 3 times the normal operating pressure differential based on the limiting 55% throughwall indication in Steam Generator E-50A.

Tube plugging repaired all volumetric indications. In addition, all volumetric indications with a possible loose parts (PLP) indication had cable stabilizers installed in the event that the object continues to produce wear on the tube outside diameter. If two adjacent tubes were reported with volumetric wear indications but a PLP signal was reported on only one tube, both tubes were stabilized.

5.9.4 Operational Assessment For Cycle 17

Volumetric tube wear indications at the tubesheet due to foreign object / loose parts in Steam Generator E-50A/B is considered **an active damage mechanism** for the 2004 refueling outage.

In the 2004 refueling outage all tubes with recorded possible loose parts (PLP) indications will be tracked. All tubes tested by plus point RPC and

bobbin will be reviewed for PLP indications. All PLP indications will be tracked in history.

A Foreign Object Search And Retrieval (FOSAR) video inspection will be preformed in the hot and cold legs of both steam generators. Any possible loose parts identified in the periphery will be looked for in the FOSAR video.

5.10 TUBE PLUG INSPECTIONS

5.10.1 Condition Monitoring In The 2003 Refueling Outage

During the 2003 refueling outage the visual examination for all tube plugs in Steam Generator E-50A and E-50B met the acceptance criteria per MSR 2.4.2 GEN-29, "Video Inspection and Tube Identification of Steam Generator Tubesheet."

5.10.2 Operational Assessment For Cycle 17

The condition of all tube plugs in Steam Generator E-50A and E-50B hot and cold legs are acceptable for the next operational cycle. The condition of these tube plugs will be reviewed in the 2004 refueling outage and all subsequent refueling outages.

5.11 SECONDARY SIDE INSPECTIONS

5.11.1 Condition Monitoring In The 2003 Refueling Outage

Visual inspection of the steam generator secondary side is recommended by NEI 97-06, "Steam Generator Program Guidelines", to prevent tubing degradation by foreign object control. Steam generator secondary side inspections, bundle flushes and sludge lancing was addressed as Palisades' response to Generic Letter 97-06, "Steam Generator Internals Degradation".

In our NEI 97-06 required degradation assessment we have one observed degradation type on the secondary side:

- Tube damage induced by loose parts, was detected in 1996, 1998, 2001 and 2003 refueling outages.

Palisades also has one susceptible degradation type on the secondary side:

- Outside diameter stress corrosion cracking at the top of tubesheet

Palisades has five potential degradation types that we do not appear to be susceptible to:

- Shell weld cracking
- Wrapper weld failure at support blocks
- Cracking of wrappers at supports
- Feedwater ring and nozzle cracking
- Flow accelerated corrosion at eggcrates

The 2003 refueling outage secondary side inspection consisted of an inspection of the top of the hot and cold leg annulus region for loose parts using FOSAR. All loose parts identified in the annulus region inspection were removed. No loose part damage was visually identified.

The comprehensive steam generator secondary side inspection in 1999 refueling outage indicates that Palisades does not appear to be susceptible to weld failure internally at the support structures and eggcrates, cracking on components above the moisture separator can deck.

Flow Accelerated Corrosion (FAC) examination of the main steam nozzle was completed in the 1993 refueling outage. FAC examination of the feedwater nozzle and visual inspections of the feed rings were completed in the 1999 refueling outage. All FAC examinations identified very little degradation.

Shell weld cracking is included in the 10 year ISI program.

To address tube damage induced by loose parts, plus point RPC and bobbin tube examination was utilized. Potential loose parts will be monitored from previous refueling outages as well as new potential loose parts.

5.11.2 Operational Assessment For Cycle 17

Two issues have increased Palisades' susceptibility on the secondary side, sodium intrusion and possible foreign material intrusion due to extensive secondary side work during the 1999 and 2001 refueling outages. EPRI Steam Generator Reference Book recommends sludge lancing be considered for each refueling outage. The sodium intrusion event has introduced sodium at the crevices. EPRI Steam Generator Reference Book also recommends tubesheet crevice flushing be considered each refueling outage. Sodium in the form of sodium hydroxide does exist at the tubesheet crevice from hideout return chemical analysis.
Sludge lancing and an upper bundle flush are both recommended for both steam generators in the 2004 refueling outage.

Foreign object search and retrieval (FOSAR) is recommended on both steam generators as minimum effort to determine if loose parts exist on the secondary side annulus on top of both tubesheets. Both steam generators

had loose parts retrieved from the periphery of the hot and cold leg tubesheets in the 2003 refueling outage. Palisades does not have a steam generator secondary side loose parts monitor and our primary tube inspection is 50% bobbin examination each outage. The 50% bobbin scope is set up to test every other tube. Tubes not tested are in close enough proximity to tested tubes to detect possible loose parts. Any existing possible loose part (PLP) is tracked each refueling outage and documented in a single condition report. The minimum steam generator inspection each refueling outage is a 50% bobbin examination encompassing all possible loose parts and a FOSAR inspection at the top of tubesheet annulus for both hot and cold sides with sludge lancing and an upper bundle flush.

6.0 CONDITION MONITORING CONCLUSION FOR THE 2003 REFUELING OUTAGE

Based on 2003 refueling outage inspection results, no tubes contained indications, which represented a challenge to structural or leakage integrity performance criterion and all condition monitoring requirements are satisfied. Observed wear indications due to steam generator internal structure interaction had burst capability well in excess of the three times steam generator operational differential pressure limit.

7.0 OPERATIONAL ASSESSMENT EVALUATION FOR CYCLE 17

Based on the observed degradation and corresponding wear growth rates for Operational Cycle 16, Palisades' steam generators are expected to satisfy the NEI 97-06 structural and leakage integrity performance criterion in Operational Cycle 17.

8.0 REFERENCES

8.1 Nuclear Energy Institute NEI-97-06, "Steam Generator Program Guidelines," Revision 1, dated January 2001

8.2 NRC Generic Letter 97-06, "Degradation of Steam Generator Internals," dated December 30, 1997

8.3 Electric Power Research Institute (EPRI) Report TR-107569-V1R5, "PWR Steam Generator Examination Guidelines: Revision 5," dated September 1997

8.4 EPRI Report TR-107621-R1, "Steam Generator Tube Integrity Assessment Guideline: Revision 1," dated March 2000

8.5 EPRI Report TR-107620-R1,"In-situ Pressure Testing Guidelines: Revision 1," dated June 1999

8.6 EPRI Report TR-109495, "PWR Steam Generator Tube Plug Assessment Document: Revision 0," dated December 1997

8.7 NRC Regulatory Guide 1.83, "Inservice Inspection of Pressurized Water Reactor Steam Generator Tubes"

8.8 American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code Section V, "Nondestructive Examination," 1989 Edition

8.9 ASME Boiler and Pressure Vessel Code Section XI, "Rules for Inservice Inspection of Nuclear Power Plant Components," 1989 Edition

8.10 NRC Information Notice IN 98-27, "Steam Generator Tube End Cracking"

8.11 Technical Specification Surveillance Procedure RT-60, "Inspection Program for Steam Generator Tubing"

8.12 Palisades Engineering Manual Procedure EM-09-05, "Steam Generator Program"

8.13 Engineering Manual Procedure EM-09-17, "Steam Generator Eddy Current Data Analysis Techniques"

8.14 Palisades 199-2003 Refueling Outage Degradation, Condition Monitoring and Operational Assessments

9.0 APPENDIX

9.1 DEFINITIONS

9.1.1 Active Damage Mechanism

An active damage mechanism is:

1. A combination of ten or more new indications of degradation (20% through wall) and previous indications of degradation which display an average growth rate equal to or greater than 25% of the repair limit per cycle in any one steam generator, or

2. One or more new or previously identified indications of degradation, including cracks, which display a growth greater than or equal to the repair limit in one cycle of operation.

9.1.2 Condition Monitoring Assessment

A comparison of the as found inspection results against the performance criteria for structural integrity and accident leakage. Condition monitoring assessment is performed at the conclusion of each operating cycle.

9.1.3 Defective Tube

A tube containing an imperfection of such severity that it exceeds the plugging limit.

9.1.4 Degradation Assessment

An assessment of both existing and potential degradation mechanisms performed and documented prior to each inservice inspection. The assessment shall address degradation associated with tubes, tube supports, plugs and all other types of repair.

9.1.5 Dent

A local reduction (plastic deformation) in the tube diameter due to a buildup of corrosion products (magnetite).

9.1.6 Distorted Tube Support Plate Signal

A support signal which forms abnormally.

9.1.7 Eddy Current Test

A nondestructive test method that is based on the generation of eddy currents in a conductive material that is used to (1) detect and measure steam generator tube wall degradation and (2) monitor tube damage precursors such as denting.

9.1.8 Foreign Object Search And Retrieval

A visual inspection of the steam generator secondary side using remote equipment for foreign object location and retrieval equipment for foreign object removal.

9.1.9 Freespan Differential Signal

A flaw like signal in freespan found with bobbin and reviewed in history.

9.1.10 Intergranular Attack / Outside Diameter Stress Corrosion Cracking

Corrosive attack of grain boundaries in materials with no preferential (stress related) orientation, with intergranular cracking of tubes which is a result of complex interactions between stress, environment and material.

9.1.11 Manufacturing Burnish Marks

A tube condition where localized tube imperfections were removed in the tubing mill or fabrication shop by buffing ans are detectable due to the effects of cold working and localized wall thinning.

9.1.12 Non Destructive Examination

Testing of material involving investigative methods (ie, ultrasound, radiography, eddy current) without causing destruction to the material being tested.

9.1.13 Operational Assessment

Forward looking prediction of the steam generator tube conditions that is used to ensure that the structural integrity and accident leakage performance criteria will not be exceeded during the next operating cycle. The operational assessment needs to consider factors such as NDE uncertainty, indication growth, and degradation specific repair limits.

9.1.14 Possible Loose Parts

Possible foreign objects (metal) or sludge material detected on the secondary side of steam generator tubes during eddy current analysis as a result of having ferromagnetic properties.

9.1.15 Pre-service Inspection

A pre-service 100% eddy current inspection of both steam generators. The pre-service inspection checks for active degradation and manufacturing type indications. Also at this time tubes in high potential wear areas are preventively plugged.

9.1.16 Primary Water Stress Corrosion Cracking

Stress corrosion cracking on the reactor coolant side (inside) of steam generator tubes.

9.1.17 Repair

The NDE measured parameters at or beyond which the tube must be repaired or removed from service by plugging. The repair limit will be determined by subtracting margins from eddy current uncertainty and growth from the structural limit.

9.1.18 Sludge

An accumulation of magnetic particulate matter found on the secondary side of the steam generator in low flow areas.

9.1.19 Volumetric

Indications of volumetric wall loss when using rotating coil techniques indicative of general localized thinning, pitting wear or impingement.

9.1.20 Wear

The loss of tube material caused by excessive rubbing of the tube against its support structure, a loose part or another tube.

9.2 ACRONYMS

Acronym	Compound Term
ACTS	Acquisition Technique Sheets
ANTS	Analysis Technique Sheets
ASME	American Society of Mechanical Engineers
CE	Combustion Engineering
CEOG	Combustion Engineering Owner's Group
EFPM	Effective Full Power Months
EPRI	Electric Power Research Institute
ET	Eddy Current Testing
FAC	Flow Accelerated Corrosion
FOSAR	Foreign Object Search And Retrieval
IGA	Intergranular Attack
IN	Industry Experience
NEI	Nuclear Energy Institute
NDE	Non Destructive Examination
ODSCC	Outside Diameter Stress Corrosion Cracking
OTSG	Once Through Steam Generator
PDA	Percent Degraded Area
POD	Probability Of Detection
PSI	Preservice Inspection
PWR	Pressure Water Reactor
PWSCC	Primary Water Stress Corrosion Cracking
QA	Quality Assurance
RPC	Rotating Pancake Coil

9.3 THREE LETTER NDE CODES

Three Letter Code	NDE Term
DSI	Distorted Support Indication
DSS	Distorted Support Signal
FSD	Freespan Differential Signal
MBM	Manufacturing Burnish Mark
MAI	Multiple Axial Indication
NQI	Non Quantifiable Indication
NQS	Non Quantifiable Signal
NTE	No Tube Expansion
OBS	Obstructed
OXP	Overexpanded Tube
PLP	Possible Loose Part
RRT	Restricted Tube
TRA	Trackable Anomaly
VOL	Volumetric
WAR	Wear

10.0 ATTACHMENTS

Attachment 1,"Steam Generator E-50A Indications"
Attachment 2,"Steam Generator E-50B Indications"