



Tennessee Valley Authority, Sequoyah Nuclear Plant, P.O. Box 2000, Soddy Daisy, Tennessee 37384

February 13, 2017

10 CFR 50.4

ATTN: Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Sequoyah Nuclear Plant, Unit 1
Renewed Facility Operating License No. DPR-77
NRC Docket No. 50-327

Subject: Unit 1 Cycle 21 - 180-Day Steam Generator Tube Inspection Report

In accordance with Sequoyah Nuclear Plant (SQN), Unit 1, Technical Specification 5.5.7, "Steam Generator Program," and Technical Specification Section 5.6.6, "Steam Generator Tube Inspection Report" the Tennessee Valley Authority is submitting the 180-day Steam Generator (SG) Tube Inspection Report that includes the results of inservice inspections performed on Unit 1 SGs during the Unit 1 Cycle 21 refueling outage. Initial entry into MODE 4 following SQN's Unit 1 Cycle 21 refueling outage was completed on December 25, 2016, therefore; the due date for this report is June 23, 2017.

There are no new regulatory commitments contained in this letter. If you have any questions concerning this report, please contact Michael McBrearty, Licensing Manager, at (423) 843-7170.

Respectfully,

A handwritten signature in black ink, appearing to read 'Gregory A. Boerschig', written over a horizontal line.

Gregory A. Boerschig
Site Vice President (Interim)
Sequoyah Nuclear Plant

Enclosure:
Unit 1 Cycle 21 180-Day Steam Generator Tube Inspection Report

cc: See Page 2

U.S. Nuclear Regulatory Commission
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Enclosure

cc (Enclosure):

NRC Regional Administrator – Region II

NRC Senior Resident Inspector – Sequoyah Nuclear Plant

ENCLOSURE

**TENNESSEE VALLEY AUTHORITY
SEQUOYAH NUCLEAR PLANT**

UNIT 1 CYCLE 21

180-DAY STEAM GENERATOR TUBE INSPECTION REPORT

SG-SGMP-16-21
Revision 0

January 2017

Sequoyah U1R21
180 Day Steam Generator
Tube Inspection Report

**SG-SGMP-16-21
Revision 0**

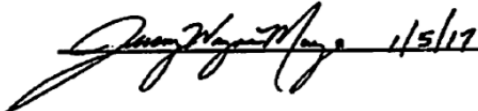
**Sequoyah U1R21
180 Day Steam Generator
Tube Inspection Report**

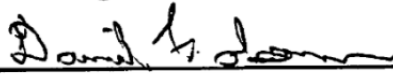
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Record of Revisions

Revision	Date	Description
0a	December 2016	Preliminary draft for Tennessee Valley Authority review and comment.
0	January 2017	Final incorporating review comments from Tennessee Valley Authority.

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1.0 Introduction

Inspections of the replacement steam generators (SGs) were performed during the Sequoyah Unit 1 (SQN1) fall 2016 refueling outage designated as (U1R21). These inspections included eddy current testing of the SG tubing as well as primary and secondary side cleanings and visual inspections. This report documents the “Sequoyah U1R21 180-Day Steam Generator Tube Inspection Report” as required by the SQN1 Technical Specifications.

The original steam generators at SQN1 were replaced in 2003 with Westinghouse Model 57AG SGs which have thermally treated Alloy 690 tubing. The U1R21 inspection was the fourth in-service inspection of the replacement SGs. Prior to the U1R21 inspection, the replacement SGs had operated for nine fuel cycles since replacement. The replacement SGs had operated for three fuel cycles since the previous inspection at U1R18. Figure 1-1 below provides the arrangement and location designation of the tube support structures for the SQN1 SGs.

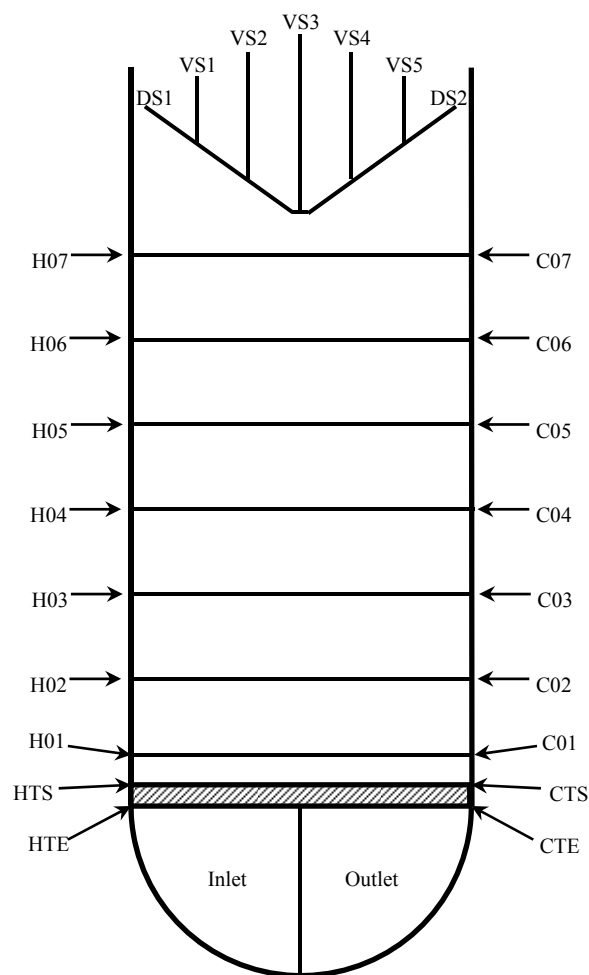


Figure 1-1: Tube Support Arrangement for Sequoyah Unit 1 Model 57AG Replacement Steam Generators

- Notes: VS = Vertical Strap
DS = Diagonal Strap
HTS/CTS = Hot/Cold Tubesheet (designates top of tubesheet)
HTE/CTE = Hot/Cold Tube End
Horizontal supports are a lattice grid design

2.0 180 Day Steam Generator Tube Inspection Report

In accordance with SQN1 Technical Specification Section 5.5.7, “Steam Generator Program”, and Technical Specification Section 5.6.6, “Steam Generator Tube Inspection Report”, this report documents the scope and results of the U1R21 SG inspections. There are eight specific reporting requirements associated with the Technical Specification. Each lettered reporting requirement listed below is followed with the associated information based on the inspections performed during U1R21.

a. The Scope of the Inspections Performed on Each SG

The U1R21 outage included a combination of bobbin and array coil inspections of 100% of the full length in all in-service tubes except for tubes in Rows 1 through 4. Tube Rows 1 through 4 were inspected to the first support with the combination bobbin and array coil from both the hot leg tube end (HTE) and the cold leg tube end (CTE). The remainder of the tube length in Rows 1 through 4 were inspected with a singular bobbin probe due to dimensional clearance restrictions in the U-bend region. As a result, the inspection included all tubes with prior indications of degradation and all tubes not inspected during the previous SG in-service inspection. The table below summarizes the number and type of eddy current examinations performed during U1R21.

Table 2-1: Sequoyah U1R21 Steam Generator Eddy Current Inspection Scope

Eddy Current Exam Type	SG 1	SG 2	SG 3	SG 4	Total
0.610 HL Bobbin & Array VS3-HTE	4,720	4,539	4,636	4,730	18,625
0.610 HL Bobbin & Array H01-HTE	248	247	248	248	991
0.610 CL Bobbin & Array VS3-CTE	4,720	4,539	4,636	4,730	18,625
0.610 CL Bobbin & Array C01-CTE	248	247	248	248	991
0.610 HL/CL Bobbin (VS3-HTE/CTE)	496	494	496	496	1,982
0.610 Full Length Array ¹	0	191	92	0	283

Note 1: These tube inspections were performed with the array coil only in order to capture both bobbin and array data full length in all tubes above Row 4.

In addition to the eddy current inspections, visual inspections were also performed on both the primary and secondary sides. Primary side visual inspections included all previously installed tube plugs, the channel head bowl cladding, and the divider plate. Secondary side visual inspections were performed at the top of the tubesheet for the detection of foreign objects, assessment of hard deposit buildup in the tube bundle interior ‘kidney region’ and for determining the effectiveness of the tubesheet cleaning performed in all four SGs.

b. Active Degradation Mechanisms Found

Volumetric wear was the only degradation mechanism detected during the U1R21 inspection. All of the wear indications detected were located at either U-bend or horizontal tube support structures. Table 2-2 below shows the number of indications reported during the U1R21 inspection.

Table 2-2: Number of Indications Detected for Each Degradation Mechanism

Degradation Mechanism	SG11	SG12	SG13	SG14	Total
U-Bend Support Structure Wear	75	29	46	27	177
Horizontal Tube Support Grid Wear	4	3	1	1	9

c. Nondestructive Examination (NDE) Techniques Used for Each Degradation Mechanism

Table 2-3 below provides the NDE techniques that were used for the detection of each degradation mechanism that was considered as existing or potential for the U1R21 inspection.

Table 2-3: NDE Techniques for Each Existing or Potential Degradation Mechanism

Degradation Mechanism	Detection Technique	EPRI ETSS
U-Bend Support Structure Wear	Bobbin Array Array	96004.1, Revision 13 11956.1, Revision 2 11956.2, Revision 2
Horizontal Tube Support Grid Wear	Bobbin Array Array	96004.1, Revision 13 11956.1, Revision 2 11956.2, Revision 2
Foreign Object Wear	Bobbin Array Array	27091.2, Revision 2 11956.1, Revision 2 11956.2, Revision 2
Tube-to-Tube Wear	Bobbin	96010.1, Revision 7

d. Location, Orientation (if Linear), and Measured Sizes (if Available) of Service Induced Indications

Table 2-4 through 2-8 below provides a listing of all service-induced indications reported during the U1R21 inspection including the estimated depths from the bobbin coil.

Table 2-4: Sequoyah U1R21 U-bend Support Structure Wear Indications – SG1

SG	Row	Col	Locn	Inch	Ind	%TW	Characterization	Resolution
1	74	48	VS3	-0.82	PCT	9	Vertical Strap Wear	Remain In-Service
1	83	49	VS2	1.02	PCT	18	Vertical Strap Wear	Remain In-Service
1	88	52	VS3	0.94	PCT	21	Vertical Strap Wear	Remain In-Service
1	88	52	VS4	-0.97	PCT	16	Vertical Strap Wear	Remain In-Service
1	65	53	VS2	0.44	PCT	20	Vertical Strap Wear	Remain In-Service
1	30	54	VS3	-0.2	PCT	24	Vertical Strap Wear	Remain In-Service
1	75	55	VS2	-0.72	PCT	15	Vertical Strap Wear	Remain In-Service
1	69	59	VS3	1.15	PCT	4	Vertical Strap Wear	Remain In-Service
1	87	59	VS4	-0.95	PCT	16	Vertical Strap Wear	Remain In-Service
1	95	61	VS4	0.8	PCT	19	Vertical Strap Wear	Remain In-Service
1	97	61	VS4	0.63	PCT	18	Vertical Strap Wear	Remain In-Service
1	95	63	VS3	-0.35	PCT	23	Vertical Strap Wear	Remain In-Service
1	95	63	VS4	-1.07	PCT	20	Vertical Strap Wear	Remain In-Service
1	97	63	VS2	0.94	PCT	19	Vertical Strap Wear	Remain In-Service
1	84	64	VS4	1.13	PCT	22	Vertical Strap Wear	Remain In-Service
1	98	64	VS5	1.29	PCT	21	Vertical Strap Wear	Remain In-Service
1	98	64	VS5	0.62	PCT	18	Vertical Strap Wear	Remain In-Service
1	98	64	VS5	-0.09	PCT	16	Vertical Strap Wear	Remain In-Service
1	85	65	VS4	0.72	PCT	21	Vertical Strap Wear	Remain In-Service
1	93	65	VS2	0.51	PCT	20	Vertical Strap Wear	Remain In-Service
1	70	66	VS4	-1.31	PCT	22	Vertical Strap Wear	Remain In-Service
1	98	66	VS4	-0.68	PCT	15	Vertical Strap Wear	Remain In-Service
1	98	66	VS5	1.01	PCT	21	Vertical Strap Wear	Remain In-Service
1	85	67	VS4	0.61	PCT	22	Vertical Strap Wear	Remain In-Service
1	92	68	VS2	1.25	PCT	18	Vertical Strap Wear	Remain In-Service
1	92	68	VS4	0.54	PCT	26	Vertical Strap Wear	Remain In-Service
1	92	68	VS4	0	PCT	20	Vertical Strap Wear	Remain In-Service
1	99	69	VS3	0.89	PCT	20	Vertical Strap Wear	Remain In-Service

1	88	70	VS4	-1.4	PCT	22	Vertical Strap Wear	Remain In-Service
1	90	70	VS4	0.68	PCT	36	Vertical Strap Wear	Preventively Plugged
1	90	70	VS4	-0.03	PCT	25	Vertical Strap Wear	
1	90	70	VS4	-1.28	PCT	22	Vertical Strap Wear	
1	92	70	VS2	-0.98	PCT	21	Vertical Strap Wear	Remain In-Service
1	92	70	VS4	0.95	PCT	22	Vertical Strap Wear	Remain In-Service
1	94	70	VS1	-0.53	PCT	20	Vertical Strap Wear	Remain In-Service
1	94	70	VS3	-0.22	PCT	17	Vertical Strap Wear	Remain In-Service
1	97	71	VS1	-1.22	PCT	17	Vertical Strap Wear	Remain In-Service
1	92	72	VS2	1.16	PCT	19	Vertical Strap Wear	Remain In-Service
1	67	73	VS3	0.06	PCT	15	Vertical Strap Wear	Remain In-Service
1	75	73	VS2	0.87	PCT	18	Vertical Strap Wear	Remain In-Service
1	75	73	VS3	1.01	PCT	28	Vertical Strap Wear	Remain In-Service
1	87	73	VS2	1.11	PCT	23	Vertical Strap Wear	Remain In-Service
1	87	73	VS3	1.09	PCT	28	Vertical Strap Wear	Remain In-Service
1	88	74	VS2	0.83	PCT	19	Vertical Strap Wear	Remain In-Service
1	92	74	VS4	0.78	PCT	17	Vertical Strap Wear	Remain In-Service
1	68	76	VS2	-0.23	PCT	15	Vertical Strap Wear	Remain In-Service
1	96	76	VS3	1.16	PCT	20	Vertical Strap Wear	Remain In-Service
1	83	77	VS2	0.88	PCT	17	Vertical Strap Wear	Remain In-Service
1	95	77	VS4	-1.16	PCT	17	Vertical Strap Wear	Remain In-Service
1	78	78	VS2	1.11	PCT	21	Vertical Strap Wear	Remain In-Service
1	88	78	VS5	1.9	PCT	21	Vertical Strap Wear	Remain In-Service
1	96	80	VS2	1.05	PCT	19	Vertical Strap Wear	Remain In-Service
1	96	80	VS3	-0.95	PCT	22	Vertical Strap Wear	Remain In-Service
1	96	80	VS4	-1.2	PCT	16	Vertical Strap Wear	Remain In-Service
1	85	81	VS2	0.96	PCT	19	Vertical Strap Wear	Remain In-Service
1	87	81	VS4	-1.19	PCT	21	Vertical Strap Wear	Remain In-Service
1	89	81	VS4	0.6	PCT	21	Vertical Strap Wear	Remain In-Service
1	93	81	VS2	0.99	PCT	18	Vertical Strap Wear	Remain In-Service
1	76	82	VS3	-0.8	PCT	21	Vertical Strap Wear	Remain In-Service
1	98	82	VS5	-1.41	PCT	19	Vertical Strap Wear	Remain In-Service
1	95	83	VS2	1.13	PCT	20	Vertical Strap Wear	Remain In-Service
1	90	84	VS4	-1.43	PCT	17	Vertical Strap Wear	Remain In-Service
1	61	85	VS2	-1.13	PCT	16	Vertical Strap Wear	Remain In-Service
1	92	86	VS4	0.23	PCT	19	Vertical Strap Wear	Remain In-Service
1	92	86	VS5	1.18	PCT	25	Vertical Strap Wear	Remain In-Service
1	93	87	VS3	-0.74	PCT	19	Vertical Strap Wear	Remain In-Service
1	92	88	VS3	0.72	PCT	18	Vertical Strap Wear	Remain In-Service
1	92	88	VS4	-1.04	PCT	18	Vertical Strap Wear	Remain In-Service
1	70	98	VS2	0.97	PCT	16	Vertical Strap Wear	Remain In-Service
1	76	100	VS2	-1.03	PCT	23	Vertical Strap Wear	Remain In-Service
1	76	102	VS2	-0.65	PCT	25	Vertical Strap Wear	Remain In-Service
1	71	107	VS3	-0.94	PCT	18	Vertical Strap Wear	Remain In-Service
1	66	110	VS3	0.51	PCT	16	Vertical Strap Wear	Remain In-Service
1	62	112	VS3	0.87	PCT	16	Vertical Strap Wear	Remain In-Service
1	55	115	VS3	-1.4	PCT	17	Vertical Strap Wear	Remain In-Service

Table 2-5: Sequoyah U1R21 U-bend Support Structure Wear Indications – SG2

SG	Row	Col	Locn	Inch	Ind	%TW	Characterization	Resolution
2	63	15	VS4	1.03	PCT	18	Vertical Strap Wear	Remain In-Service
2	68	18	VS4	0.71	PCT	17	Vertical Strap Wear	Remain In-Service
2	70	18	VS4	1.05	PCT	17	Vertical Strap Wear	Remain In-Service
2	71	19	VS4	1.05	PCT	18	Vertical Strap Wear	Remain In-Service
2	73	21	VS4	0.98	PCT	17	Vertical Strap Wear	Remain In-Service
2	75	21	VS4	0.95	PCT	20	Vertical Strap Wear	Remain In-Service
2	76	22	VS2	1.03	PCT	20	Vertical Strap Wear	Remain In-Service
2	77	23	VS4	0.89	PCT	19	Vertical Strap Wear	Remain In-Service
2	78	24	VS2	1.08	PCT	21	Vertical Strap Wear	Remain In-Service
2	81	25	VS4	1.18	PCT	16	Vertical Strap Wear	Remain In-Service
2	81	27	VS4	0.85	PCT	15	Vertical Strap Wear	Remain In-Service
2	83	27	VS4	0.9	PCT	20	Vertical Strap Wear	Remain In-Service
2	74	28	VS2	0.88	PCT	18	Vertical Strap Wear	Remain In-Service
2	91	37	VS4	0.67	PCT	19	Vertical Strap Wear	Remain In-Service
2	89	39	VS4	0.66	PCT	15	Vertical Strap Wear	Remain In-Service
2	92	42	VS2	-0.83	PCT	21	Vertical Strap Wear	Remain In-Service
2	77	49	VS2	0.92	PCT	19	Vertical Strap Wear	Remain In-Service
2	77	49	VS3	-0.69	PCT	17	Vertical Strap Wear	Remain In-Service
2	89	51	VS4	0.68	PCT	16	Vertical Strap Wear	Remain In-Service
2	94	52	VS1	-0.76	PCT	18	Vertical Strap Wear	Remain In-Service
2	94	52	VS2	1.27	PCT	21	Vertical Strap Wear	Remain In-Service
2	93	59	VS4	-1.05	PCT	18	Vertical Strap Wear	Remain In-Service
2	86	64	VS2	1.2	PCT	16	Vertical Strap Wear	Remain In-Service
2	68	68	VS4	0.8	PCT	16	Vertical Strap Wear	Remain In-Service
2	97	69	VS3	0.88	PCT	16	Vertical Strap Wear	Remain In-Service
2	100	70	VS3	-0.58	PCT	18	Vertical Strap Wear	Remain In-Service
2	20	80	VS3	0	PCT	20	Vertical Strap Wear	Remain In-Service
2	24	84	VS3	-1	PCT	19	Vertical Strap Wear	Remain In-Service
2	78	84	VS3	1.28	PCT	17	Vertical Strap Wear	Remain In-Service

Table 2-6: Sequoyah U1R21 U-bend Support Structure Wear Indications – SG3

SG	Row	Col	Locn	Inch	Ind	%TW	Characterization	Resolution
3	36	50	VS3	-0.15	PCT	18	Vertical Strap Wear	Remain In-Service
3	96	52	VS3	-0.12	PCT	17	Vertical Strap Wear	Remain In-Service
3	96	52	VS4	1.06	PCT	15	Vertical Strap Wear	Remain In-Service
3	47	53	VS2	1.03	PCT	16	Vertical Strap Wear	Remain In-Service
3	64	54	VS2	-1.22	PCT	15	Vertical Strap Wear	Remain In-Service
3	96	56	VS3	0.95	PCT	19	Vertical Strap Wear	Remain In-Service
3	98	56	VS4	-1.04	PCT	24	Vertical Strap Wear	Remain In-Service
3	100	56	VS3	1.04	PCT	16	Vertical Strap Wear	Remain In-Service
3	101	57	VS3	0.77	PCT	17	Vertical Strap Wear	Remain In-Service
3	101	57	VS4	0.77	PCT	16	Vertical Strap Wear	Remain In-Service
3	91	61	VS4	-0.95	PCT	15	Vertical Strap Wear	Remain In-Service
3	94	62	VS3	1.48	PCT	17	Vertical Strap Wear	Remain In-Service
3	87	63	VS2	1.39	PCT	21	Vertical Strap Wear	Remain In-Service
3	87	65	VS3	0.89	PCT	23	Vertical Strap Wear	Remain In-Service
3	75	69	VS4	0.63	PCT	21	Vertical Strap Wear	Remain In-Service
3	77	69	VS4	0.84	PCT	17	Vertical Strap Wear	Remain In-Service
3	85	69	VS4	0.82	PCT	22	Vertical Strap Wear	Remain In-Service
3	89	69	VS4	-0.88	PCT	20	Vertical Strap Wear	Remain In-Service
3	91	69	VS2	0.73	PCT	19	Vertical Strap Wear	Remain In-Service
3	89	71	VS4	1.04	PCT	17	Vertical Strap Wear	Remain In-Service
3	97	71	VS3	0.76	PCT	16	Vertical Strap Wear	Remain In-Service
3	80	72	VS4	-0.86	PCT	19	Vertical Strap Wear	Remain In-Service
3	91	73	VS4	0.71	PCT	18	Vertical Strap Wear	Remain In-Service
3	67	75	VS2	1.24	PCT	18	Vertical Strap Wear	Remain In-Service
3	73	75	VS3	0.84	PCT	17	Vertical Strap Wear	Remain In-Service
3	66	76	VS2	1	PCT	16	Vertical Strap Wear	Remain In-Service
3	77	77	VS2	0.97	PCT	20	Vertical Strap Wear	Remain In-Service
3	79	79	VS2	-0.71	PCT	17	Vertical Strap Wear	Remain In-Service
3	79	79	VS3	0.88	PCT	20	Vertical Strap Wear	Remain In-Service
3	34	80	VS3	-0.37	PCT	19	Vertical Strap Wear	Remain In-Service
3	67	81	VS2	0.85	PCT	19	Vertical Strap Wear	Remain In-Service
3	67	81	VS3	-0.75	PCT	17	Vertical Strap Wear	Remain In-Service
3	77	81	VS2	0.81	PCT	19	Vertical Strap Wear	Remain In-Service
3	76	82	VS2	1.03	PCT	18	Vertical Strap Wear	Remain In-Service
3	67	87	VS3	-0.71	PCT	17	Vertical Strap Wear	Remain In-Service
3	73	87	VS3	-0.49	PCT	20	Vertical Strap Wear	Remain In-Service
3	76	90	VS2	0.79	PCT	19	Vertical Strap Wear	Remain In-Service
3	71	91	VS2	1.13	PCT	16	Vertical Strap Wear	Remain In-Service
3	70	92	VS3	-0.74	PCT	19	Vertical Strap Wear	Remain In-Service
3	76	92	VS3	-0.83	PCT	19	Vertical Strap Wear	Remain In-Service
3	78	92	VS3	-0.87	PCT	18	Vertical Strap Wear	Remain In-Service
3	68	96	VS3	-0.81	PCT	19	Vertical Strap Wear	Remain In-Service
3	73	103	VS2	0.88	PCT	18	Vertical Strap Wear	Remain In-Service
3	66	106	VS2	-0.66	PCT	19	Vertical Strap Wear	Remain In-Service
3	66	106	VS3	0.73	PCT	19	Vertical Strap Wear	Remain In-Service
3	59	113	VS4	1.15	PCT	19	Vertical Strap Wear	Remain In-Service

Table 2-7: Sequoyah U1R21 U-bend Support Structure Wear Indications – SG4

SG	Row	Col	Locn	Inch	Ind	%TW	Characterization	Resolution
4	92	38	VS2	0.8	PCT	16	Vertical Strap Wear	Remain In-Service
4	27	45	VS3	0.07	PCT	18	Vertical Strap Wear	Remain In-Service
4	95	47	VS3	1.2	PCT	16	Vertical Strap Wear	Remain In-Service
4	95	47	VS3	-0.72	PCT	17	Vertical Strap Wear	Remain In-Service
4	96	48	VS3	-0.8	PCT	22	Vertical Strap Wear	Remain In-Service
4	97	49	VS3	-0.72	PCT	15	Vertical Strap Wear	Remain In-Service
4	56	50	VS3	0.14	PCT	19	Vertical Strap Wear	Remain In-Service
4	98	52	VS3	-0.55	PCT	17	Vertical Strap Wear	Remain In-Service
4	30	54	VS3	-0.2	PCT	21	Vertical Strap Wear	Remain In-Service
4	55	55	VS3	0.11	PCT	17	Vertical Strap Wear	Remain In-Service
4	97	55	VS2	-0.72	PCT	16	Vertical Strap Wear	Remain In-Service
4	97	55	VS4	-0.45	PCT	15	Vertical Strap Wear	Remain In-Service
4	97	55	VS4	-1.01	PCT	17	Vertical Strap Wear	Remain In-Service
4	99	55	VS2	-0.79	PCT	23	Vertical Strap Wear	Remain In-Service
4	99	55	VS3	-0.24	PCT	17	Vertical Strap Wear	Remain In-Service
4	58	56	VS3	-0.47	PCT	22	Vertical Strap Wear	Remain In-Service
4	50	60	VS3	-0.21	PCT	17	Vertical Strap Wear	Remain In-Service
4	28	62	VS3	-1.07	PCT	19	Vertical Strap Wear	Remain In-Service
4	99	63	VS5	0.96	PCT	16	Vertical Strap Wear	Remain In-Service
4	68	64	VS3	-0.76	PCT	18	Vertical Strap Wear	Remain In-Service
4	70	64	VS2	0.64	PCT	16	Vertical Strap Wear	Remain In-Service
4	70	64	VS4	0.73	PCT	16	Vertical Strap Wear	Remain In-Service
4	70	66	VS2	0.94	PCT	15	Vertical Strap Wear	Remain In-Service
4	62	74	VS2	-0.74	PCT	15	Vertical Strap Wear	Remain In-Service
4	45	75	VS3	0.03	PCT	21	Vertical Strap Wear	Remain In-Service
4	45	79	VS3	-0.69	PCT	21	Vertical Strap Wear	Remain In-Service
4	51	85	VS3	0.06	PCT	21	Vertical Strap Wear	Remain In-Service

Table 2-8: Sequoyah U1R21 Horizontal Tube Support Grid Wear Indications – All SGs

SG	Row	Col	Locn	Inch	Ind	%TW	Characterization	Resolution
1	4	36	C06	-0.99	PCT	15	Horizontal Grid Wear	Remain In-Service
1	98	70	C07	0.69	PCT	20	Horizontal Grid Wear	Remain In-Service
1	98	72	C07	0.57	PCT	19	Horizontal Grid Wear	Remain In-Service
1	98	82	C07	0.67	PCT	17	Horizontal Grid Wear	Remain In-Service
2	5	37	H02	0.57	PCT	22	Horizontal Grid Wear	Remain In-Service
2	5	37	H02	-0.94	PCT	17	Horizontal Grid Wear	Remain In-Service
2	10	102	C05	-0.86	PCT	17	Horizontal Grid Wear	Remain In-Service
3	5	33	H06	-0.95	PCT	17	Horizontal Grid Wear	Remain In-Service
4	11	33	H03	-1.13	PCT	17	Horizontal Grid Wear	Remain In-Service

e. Number of Tubes Plugged During the Inspection Outage for Each Active Degradation Mechanism

Table 2-9 below provides the numbers of tubes plugged for each degradation mechanism detected. As shown in the table, one tube was plugged for wear at the U-bend support structure. This table also shows the numbers of tubes plugged before and after the U1R21 outage as well as the percentage of tubes currently plugged.

Table 2-9: Number of Tubes Plugged for Each Degradation Mechanism

	SG11	SG12	SG13	SG14	Total
Plugged Tubes prior to U1R21	15	6	7	5	33
Plugged for U-bend Support Structure Wear	1	0	0	0	1
Plugged for Horizontal Grid Wear	0	0	0	0	0
Total Plugged to Date	16	6	7	5	34
Percentage Plugged to Date	0.32%	0.12%	0.14%	0.10%	0.17%

f. Total Number and Percentage of Tubes Plugged to Date

Table 2-9 in the previous section provides the number and percentage of tubes plugged to date.

g. The Results of Condition Monitoring, Including the Results of Tube Pulls and In-Situ Testing

Tube Integrity

A condition monitoring (CM) assessment was performed as required by the SQN1 steam generator program. The only tube degradation detected during the U1R21 inspection was wear at tube support structures. The deepest indication had an estimated depth of 36%TW from the bobbin coil exam and was located at a vertical strap. Conservatively assuming an enveloping flaw length slightly greater than the width of the support (2.5 inches), the CM limit for U-bend support structure wear is 47%TW. This CM limit includes uncertainties for material properties, NDE depth sizing, and the burst pressure relationship. Since the deepest flaw has an estimated depth less than the conservatively determined CM limit, the structural integrity performance criterion was met for the operating interval prior to U1R21.

Since volumetric wear indications will leak and burst at essentially the same pressure, accident-induced leakage integrity at a much lower accident pressure differential is also demonstrated. Operational leakage integrity was demonstrated by the absence of any detectable primary-to-secondary leakage during the operating interval prior to U1R21. Since tube integrity was demonstrated analytically, in-situ pressure testing was not required nor performed during the U1R21 outage. No tube pulls were planned or performed during U1R21.

Visual Inspection Results

Visual inspections were also performed on both the primary and secondary sides during U1R21. Primary side inspections included visual inspections of all previously installed tube plugs as well as the channel head bowl cladding and the divider plate. The installed tube plug inspections showed no conditions indicative of improper installation or in-service degradation. The visual inspections of the channel head bowl cladding and the divider plate showed no visually apparent evidence of degradation of the cladding, divider plate, or divider plate welds.

Prior to the secondary side foreign object search and retrieval (FOSAR) inspections, sludge, scale, foreign objects, and other deposit accumulations at the top of the tubesheet were removed as part of the top of tubesheet water lancing process. The secondary side FOSAR inspections performed in all four SGs included visual examination of tube bundle periphery tubes from the hot leg and cold leg annulus and center no tube lane. A total of 15 foreign objects were removed from the top of the tubesheet region and 23 objects remain on the secondary side among the four

SGs. The foreign objects remaining are all small pieces of gasket, wires, bristles and graphite. Any foreign objects not able to be retrieved were characterized and an analysis performed to demonstrate acceptability of continued operation without exceeding the performance criteria. A limited top of tubesheet in-bundle visual inspection was also performed in each SG for the purpose of assessing and trending the level of hardened deposit buildup in the kidney region.

h. The Effective Plugging Percentage for All Plugging in Each SG

There are no sleeves installed in the SQN1 replacement SGs. Therefore, the effective plugging percentage is the same as the plugging percentage shown in Table 2-9.