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Indiana Michigan Power
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Bridgman, MI 49106
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October 24, 2022

AEP-NRC-2022-58
10 CFR 50.4

Docket No.: 50-315

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

Donald C. Cook Nuclear Plant Unit 1
U1C31 Steam Generator Tube Inspection Report

Technical Specification (TS) 5.6.7 of Appendix A, to the Donald C. Cook Nuclear Plant (CNP) Unit 1 Operating License requires a report to be submitted within 180 days after initial entry into Mode 4 following the completion of an inspection performed in accordance with TS 5.5.7, Steam Generator (SG) Program. CNP Unit 1 entered Mode 4 on May 18, 2022. This report details specific attributes of the inspection in accordance with TS 5.6.7. Consistent with these requirements, Indiana Michigan Power Company, the licensee for CNP Unit 1, is submitting the Cook Nuclear Plant U1C31 Steam Generator Tube Inspection Report as an enclosure to this letter.

There are no new regulatory commitments made in this submittal. Should you have any questions, please contact Mr. Michael K. Scarpello, Regulatory Affairs Director, at (269) 466-2649.

Sincerely,

Kelly J. Ferneau
Site Vice President

JMT/mph

Enclosure: Cook Nuclear Plant U1C31 Steam Generator Tube Inspection Report

c: R. J. Ancona – MPSC
EGLE – RMD/RPS
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ENCLOSURE TO AEP-NRC-2022-58

Cook Nuclear Plant U1C31 Steam Generator Tube Inspection Report

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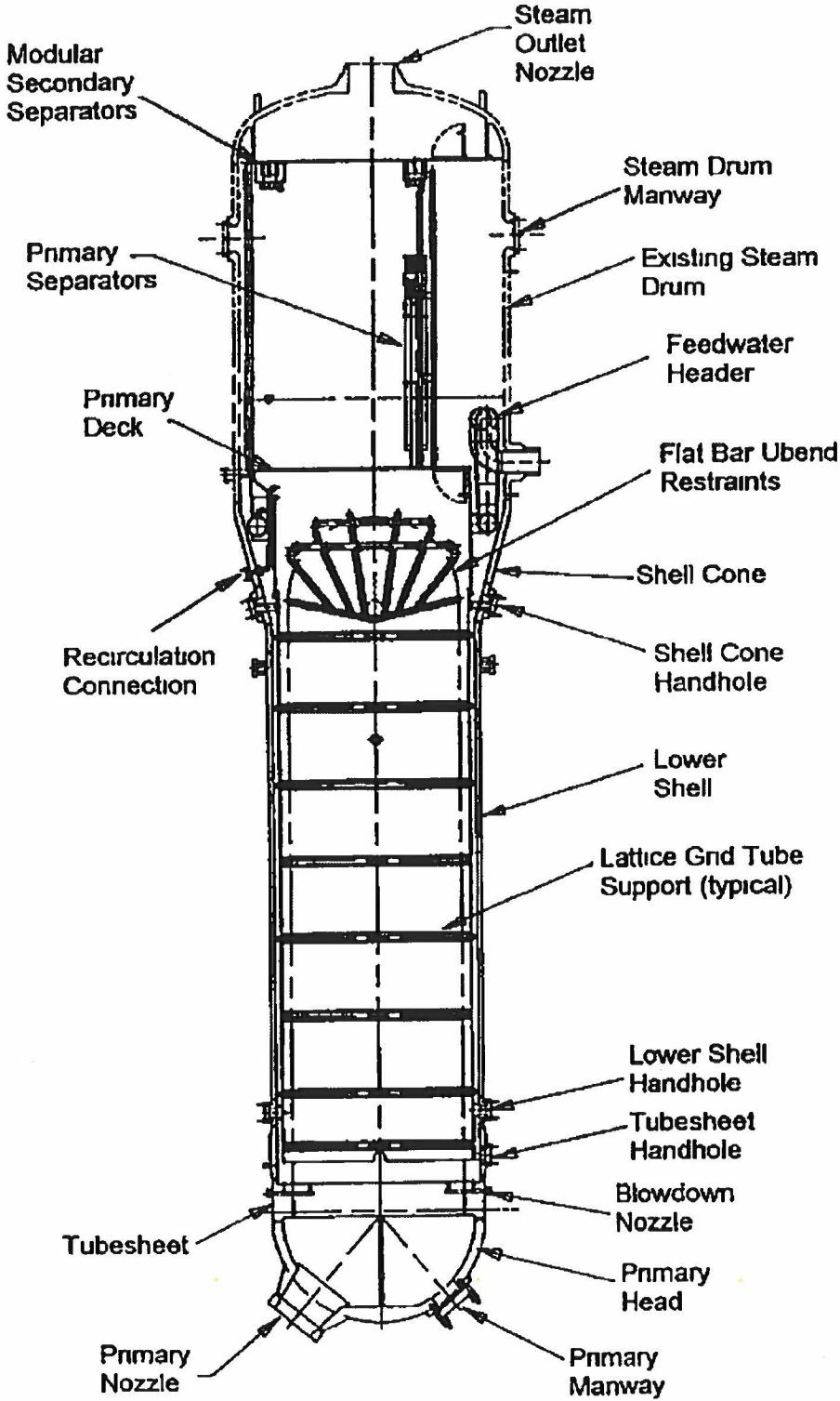
1. Design and Operating Parameters

Table 1: Steam Generator (SG) Design and Operating Parameters	
SG Model	Babcock & Wilcox International (BWI) Model 51R
Tube Material	Alloy 690 TT
No. of SGs per Unit	4
Number of Tubes	3496 tubes per SG
Nominal Tube Diameter / Wall Thickness	0.875 inches / 0.049 inches
Support Plates	Lattice Grid Assemblies (lattice bars are stainless steel)
Last Inspection	U1C28 (Fall 2017)
Effective Full Power Months (EFPM) since last inspection	48.1 EFPM
Cumulative EFPM of Steam Generators	212.2 EFPM (at start of U1C31)
Mode 4 Entry Date	5/18/2022
Observed Primary-to-Secondary Leak Rate	No primary-to-secondary leakage detected
T_{HOT} During the Prior Inspection Period	616.9 °F (Normal Operating Temperature) 650 °F (Design Temperature)
Loose Parts Strainer	A single basket type strainer is installed in the suction line to each main feed pump
Tube Sub-Populations with Increased Degradation Susceptibility	Tubes near periphery and no-tube lane (susceptibility to foreign object wear)
Deviations from Steam Generator Management Program (SGMP) Guidelines Since the Last Inspection	Secondary Water Chemistry Guidelines, Rev. 8: Deviation due to not meeting the 2018 implementation date. Guidelines were fully implemented in 2019.

Cook Nuclear Plant U1C31 Steam Generator Tube Inspection Report

Table 1: Steam Generator (SG) Design and Operating Parameters

Steam Generator Schematic:



Cook Nuclear Plant U1C31 Steam Generator Tube Inspection Report

2. Scope of Inspections

Inspections performed on all four steam generators during U1C31 included:

- 100% Eddy Current Testing (ECT) of all in-service tubes
- Visual inspection of channel head interior surfaces and all tube plugs
- Visual inspection of secondary side top-of-tubesheet region

Additionally, a visual inspection was performed inside the steam dome of SG 11.

No scope expansions were required.

3. Nondestructive Examination (NDE) Techniques Utilized for Tubes with Increased Degradation Susceptibility

Tubes near the periphery and no-tube lanes are susceptible to foreign object wear. In all four SGs, the outer tubes around the periphery and no-tube lanes were visually inspected at the top-of-tubesheet region.

In all four SGs, a sample of the top-of-tubesheet region was inspected using an array probe. The sample included a band around the periphery and no-tube lane (approximately 5 tubes deep). The extent of examination included the tube end to the first tube support.

4. NDE Techniques Utilized for Degradation Mechanisms Found

The only degradation mechanisms detected were support wear and foreign object (FO) wear. Support wear was found at fan bar (FB) and lattice grid (LG) locations. Table 2 lists the NDE technique and corresponding Examination Technique Specification Sheet (ETSS) utilized for each degradation mechanism found.

Table 2: NDE Techniques		
Degradation Mechanism	Detection Technique	Sizing Technique
Fan Bar Wear	Bobbin ETSS 96004.1	Bobbin ETSS 96004.1
Lattice Grid Wear	Bobbin ETSS 96004.1	Bobbin ETSS 96004.1
Foreign Object Wear	Bobbin ETSS 27091.1	+Point™ ETSS 27903.1

5. Degradation Indications

The total number of degradation indications is shown in Table 3, including the number of indications equal to or greater than 20 percent through-wall (% TW). Each indication 20% TW or greater is listed in Table 4.

Table 3: Degradation Indication Summary							
Indication	SG 11	SG 12	SG 13	SG 14	Total	≥ 20% TW	Max
Fan Bar Wear	429	335	267	670	1701	251	34% TW
Lattice Grid Wear	18	38	21	11	88	1	22% TW
Foreign Object Wear	1	0	0	1	2	2	36% TW

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Table 4: Indications \geq 20% TW						
SG	Row	Col	Indication	Volts	% TW	Location (in)
11	52	60	FB wear	0.68	20	FB3 -1.96
11	59	69	FB wear	1.00	22	FB4 +1.11
11	60	56	FB wear	0.96	22	FB5 +1.18
11	61	61	FB wear	0.99	22	FB4 +1.10
11	65	45	FB wear	0.95	20	FB4 +1.03
11	65	45	FB wear	1.30	24	FB5 -1.21
11	65	51	FB wear	0.85	21	FB6 +1.20
11	65	59	FB wear	1.61	29	FB4 +1.13
11	65	59	FB wear	0.85	22	FB5 -1.37
11	65	61	FB wear	1.00	24	FB3 +1.19
11	65	61	FB wear	1.20	26	FB4 +1.19
11	65	61	FB wear	1.05	24	FB5 -1.15
11	65	61	FB wear	0.84	22	FB6 -1.32
11	66	52	FB wear	0.94	22	FB5 -1.05
11	66	56	FB wear	0.91	21	FB5 -1.20
11	66	58	FB wear	0.77	21	FB4 +1.05
11	67	63	FB wear	1.02	24	FB5 +1.24
11	67	63	FB wear	0.88	22	FB6 +1.27
11	68	50	FB wear	0.74	20	FB4 +1.37
11	68	50	FB wear	1.38	27	FB5 -1.18
11	68	62	FB wear	0.90	21	FB5 +1.10
11	69	65	FB wear	1.03	25	FB3 +1.25
11	69	65	FB wear	1.97	32	FB4 +1.19
11	69	65	FB wear	0.65	20	FB5 -1.17
11	69	69	FB wear	0.86	20	FB4 +1.16
11	70	46	FB wear	0.70	20	FB5 +1.12
11	70	62	FB wear	1.24	26	FB4 -1.22
11	70	62	FB wear	1.83	31	FB5 +1.02
11	71	55	FB wear	1.58	28	FB4 -1.06
11	71	55	FB wear	1.82	30	FB5 +1.13
11	71	63	FB wear	1.18	23	FB6 -1.26
11	72	44	FB wear	1.12	25	FB4 -1.11
11	72	44	FB wear	0.76	21	FB5 +1.15
11	72	50	FB wear	0.81	21	FB5 +1.01
11	72	54	FB wear	1.58	29	FB4 +0.00
11	72	62	FB wear	1.76	30	FB5 +1.07
11	72	62	FB wear	1.26	26	FB6 +1.22
11	72	66	FB wear	0.85	23	FB4 -1.24
11	73	41	FB wear	1.14	25	FB3 +1.20
11	74	44	FB wear	0.71	24	FB4 -1.10
11	74	44	FB wear	0.61	22	FB5 +1.24

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Table 4: Indications \geq 20% TW						
SG	Row	Col	Indication	Volts	% TW	Location (in)
11	74	58	FB wear	1.52	27	FB4 -1.10
11	74	58	FB wear	1.15	24	FB5 +1.03
11	74	64	FB wear	1.04	21	FB4 -1.18
11	74	66	FB wear	0.88	23	FB4 -1.26
11	75	43	FB wear	0.59	22	FB4 +1.13
11	75	43	FB wear	0.99	28	FB5 -1.15
11	75	43	FB wear	0.96	28	FB6 -1.28
11	75	47	FB wear	0.86	21	FB5 -1.12
11	75	51	FB wear	1.12	24	FB5 +1.09
11	75	51	FB wear	0.78	20	FB6 +1.03
11	75	53	FB wear	0.78	21	FB5 -1.10
11	75	57	FB wear	1.11	23	FB4 -1.15
11	76	48	FB wear	0.92	21	FB4 -1.08
11	76	48	FB wear	1.06	23	FB5 +1.14
11	76	62	FB wear	1.16	23	FB5 +1.03
11	77	45	FB wear	0.77	21	FB4 +1.43
11	77	45	FB wear	1.28	27	FB5 -0.95
11	77	67	FB wear	2.16	31	FB4 +1.13
11	78	66	FB wear	1.15	23	FB5 +1.07
11	82	60	FB wear	0.97	23	FB6 +1.25
12	56	56	FB wear	0.88	26	FB4 +1.05
12	56	56	FB wear	0.67	23	FB5 -1.12
12	56	56	FB wear	0.57	21	FB6 -1.35
12	57	53	FB wear	0.75	24	FB4 -1.20
12	59	63	FB wear	0.62	22	FB5 -1.15
12	61	51	FB wear	0.91	26	FB4 +0.99
12	61	51	FB wear	0.67	23	FB4 -1.14
12	61	51	FB wear	0.84	25	FB5 +1.06
12	61	51	FB wear	0.92	26	FB5 -1.22
12	61	51	FB wear	0.85	25	FB6 +1.12
12	61	55	FB wear	0.62	21	FB4 -1.19
12	61	55	FB wear	0.82	24	FB5 -1.15
12	62	46	FB wear	0.79	22	FB3 -1.23
12	62	46	FB wear	0.99	24	FB4 +1.03
12	62	46	FB wear	0.92	23	FB4 -1.25
12	62	46	FB wear	1.54	30	FB5 +1.12
12	63	47	FB wear	0.67	23	FB4 +1.20
12	63	47	FB wear	0.52	20	FB5 -1.16
12	64	44	FB wear	1.34	28	FB4 -1.12
12	64	44	FB wear	1.06	25	FB5 +1.15
12	64	52	FB wear	0.57	21	FB4 +1.11

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Table 4: Indications \geq 20% TW						
SG	Row	Col	Indication	Volts	% TW	Location (in)
12	65	47	FB wear	0.52	20	FB4 +1.05
12	65	51	FB wear	0.76	24	FB5 +0.99
12	66	58	FB wear	0.87	25	FB4 +0.96
12	66	58	FB wear	0.57	20	FB5 -1.10
12	66	60	FB wear	0.52	20	FB3 +1.16
12	66	60	FB wear	1.19	29	FB4 +1.06
12	66	60	FB wear	0.87	26	FB5 -1.06
12	67	43	FB wear	0.57	23	FB5 -1.00
12	67	57	FB wear	0.70	23	FB5 -1.13
12	67	57	FB wear	0.55	20	FB6 -1.35
12	67	65	FB wear	0.64	22	FB5 -1.15
12	68	40	FB wear	1.22	27	FB4 -1.26
12	68	40	FB wear	0.74	21	FB5 +1.20
12	68	42	FB wear	1.29	32	FB4 -1.29
12	68	42	FB wear	0.58	23	FB5 +1.07
12	69	51	FB wear	0.77	23	FB3 +1.12
12	69	51	FB wear	0.55	20	FB4 -1.23
12	69	51	FB wear	1.59	32	FB5 -1.03
12	69	51	FB wear	1.08	27	FB6 -1.14
12	69	69	FB wear	0.83	23	FB4 -1.32
12	69	69	FB wear	0.98	25	FB5 +1.04
12	72	40	FB wear	1.44	29	FB4 -1.22
12	72	40	FB wear	1.23	27	FB5 +1.24
12	72	44	FB wear	0.67	20	FB5 +1.06
12	72	50	FB wear	0.65	21	FB4 -1.19
12	72	50	FB wear	1.06	27	FB5 +0.98
12	73	57	FB wear	0.76	23	FB4 +0.95
12	73	57	FB wear	0.57	20	FB4 -1.16
12	73	57	FB wear	1.81	34	FB5 -1.05
12	73	57	FB wear	1.25	29	FB6 -1.29
12	73	65	FB wear	0.66	23	FB6 -1.31
12	73	67	FB wear	0.66	20	FB4 +1.19
12	73	67	FB wear	0.62	20	FB5 -1.30
12	73	69	FB wear	0.80	23	FB4 +1.10
12	73	69	FB wear	0.63	20	FB5 -1.10
12	74	44	FB wear	0.95	24	FB4 -1.20
12	74	46	FB wear	0.57	20	FB4 -1.24
12	74	46	FB wear	1.59	32	FB5 +1.16
12	74	58	FB wear	0.58	20	FB5 -1.15
12	74	60	FB wear	0.68	23	FB4 +1.21
12	74	60	FB wear	0.78	24	FB4 -1.13

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Table 4: Indications \geq 20% TW						
SG	Row	Col	Indication	Volts	% TW	Location (in)
12	74	60	FB wear	0.54	20	FB5 +1.04
12	74	60	FB wear	1.23	29	FB5 -1.12
12	74	60	FB wear	0.78	24	FB6 -1.20
12	76	68	FB wear	1.23	28	FB4 -1.18
12	76	68	FB wear	1.10	26	FB5 +1.17
12	77	57	FB wear	0.57	20	FB3 -1.17
12	77	57	FB wear	0.58	20	FB4 +1.10
12	77	57	FB wear	1.13	28	FB4 -1.03
12	77	57	FB wear	1.70	33	FB5 +1.00
12	77	57	FB wear	0.66	22	FB5 -1.14
12	78	66	FB wear	0.69	21	FB4 -1.17
12	78	66	FB wear	0.63	20	FB5 +1.08
13	59	67	FB wear	0.93	21	FB4 +1.07
13	60	54	FB wear	0.60	20	FB4 +0.00
13	60	54	FB wear	1.14	27	FB5 +0.00
13	60	54	FB wear	0.67	21	FB6 -0.08
13	60	62	FB wear	0.75	22	FB4 -1.44
13	60	62	FB wear	0.73	22	FB5 +0.96
13	61	59	FB wear	0.87	22	FB4 -1.30
13	61	59	FB wear	1.53	28	FB5 +1.05
13	63	55	FB wear	1.34	25	FB5 +1.07
13	63	57	FB wear	0.67	21	FB4 -1.26
13	63	59	FB wear	0.95	23	FB4 -1.33
13	63	59	FB wear	1.26	26	FB5 +1.10
13	65	63	FB wear	1.44	28	FB5 +1.21
13	66	52	FB wear	0.94	21	FB4 -1.33
13	66	52	FB wear	0.99	21	FB5 +1.10
13	66	62	FB wear	1.21	29	FB5 -1.20
13	68	58	FB wear	1.21	25	FB5 -1.14
13	68	58	FB wear	0.80	20	FB6 -1.40
13	69	55	FB wear	1.01	22	FB4 -1.34
13	69	55	FB wear	1.10	23	FB5 +1.09
13	70	56	FB wear	0.79	24	FB5 -1.11
13	71	57	FB wear	0.97	25	FB4 -1.27
13	71	57	FB wear	0.69	21	FB5 +0.99
13	73	57	FB wear	0.60	20	FB4 -1.16
13	73	57	FB wear	0.59	20	FB5 -1.20
13	73	61	FB wear	1.43	31	FB4 -1.20
13	73	61	FB wear	1.40	30	FB5 +1.11
13	74	52	FB wear	0.87	24	FB4 -1.20
13	74	52	FB wear	0.68	21	FB5 +1.14

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Table 4: Indications \geq 20% TW						
SG	Row	Col	Indication	Volts	% TW	Location (in)
13	78	66	FB wear	0.86	24	FB5 -1.22
14	44	62	FB wear	0.62	21	FB3 -2.26
14	55	65	FB wear	0.58	21	FB4 +1.22
14	55	65	FB wear	0.86	25	FB5 -1.27
14	59	65	FB wear	1.11	29	FB4 +1.15
14	59	65	FB wear	0.53	20	FB5 +1.06
14	59	65	FB wear	0.68	23	FB5 -1.09
14	59	65	FB wear	0.83	25	FB6 -1.24
14	60	62	FB wear	1.16	27	FB5 +1.13
14	61	61	FB wear	0.57	21	FB5 +1.16
14	61	65	FB wear	0.91	26	FB4 +1.13
14	61	65	FB wear	0.70	23	FB5 -1.18
14	62	54	FB wear	0.73	22	FB4 -0.04
14	62	60	FB wear	0.53	20	FB5 +1.11
14	63	45	FB wear	1.39	29	FB5 -1.15
14	63	51	FB wear	0.54	21	FB4 -1.18
14	63	53	FB wear	1.34	28	FB5 -0.95
14	64	64	FB wear	0.69	23	FB4 -1.30
14	64	64	FB wear	0.61	21	FB5 +1.13
14	64	64	FB wear	0.56	21	FB6 +1.27
14	65	61	FB wear	0.65	22	FB4 -1.21
14	65	61	FB wear	0.62	22	FB5 +1.17
14	65	63	FB wear	0.74	22	FB4 -1.18
14	65	65	FB wear	0.63	22	FB4 +1.10
14	65	65	FB wear	0.52	20	FB4 -1.24
14	65	69	FB wear	0.88	24	FB4 +1.08
14	65	69	FB wear	0.70	22	FB5 -1.28
14	66	54	FB wear	1.14	27	FB4 -0.04
14	66	54	FB wear	1.10	27	FB5 -0.11
14	66	54	FB wear	0.80	23	FB6 -0.02
14	66	58	FB wear	1.18	28	FB5 +1.19
14	66	60	FB wear	0.53	20	FB4 -1.23
14	66	60	FB wear	1.21	30	FB5 +1.07
14	66	62	FB wear	0.79	23	FB4 -1.14
14	66	62	FB wear	1.49	30	FB5 +1.16
14	67	61	FB wear	0.52	20	FB5 -1.24
14	67	61	FB wear	0.53	20	FB6 -1.24
14	70	58	FB wear	0.91	24	FB5 +1.06
14	70	62	FB wear	0.70	22	FB4 +1.21
14	70	62	FB wear	0.73	22	FB4 -1.12
14	70	62	FB wear	0.86	24	FB5 +1.14

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Table 4: Indications \geq 20% TW						
SG	Row	Col	Indication	Volts	% TW	Location (in)
14	70	70	FB wear	0.87	23	FB4 -1.26
14	71	61	FB wear	0.72	22	FB4 -1.33
14	71	61	FB wear	0.65	21	FB6 -1.25
14	71	69	FB wear	0.59	20	FB4 -1.14
14	72	54	FB wear	1.38	29	FB4 -0.03
14	72	54	FB wear	0.84	23	FB5 -0.05
14	72	56	FB wear	0.99	26	FB4 +0.99
14	72	56	FB wear	0.95	25	FB5 -1.14
14	72	58	FB wear	0.81	23	FB4 +1.08
14	72	58	FB wear	1.15	28	FB5 -1.08
14	72	60	FB wear	0.67	21	FB4 +1.13
14	72	64	FB wear	1.09	26	FB4 +0.99
14	72	64	FB wear	1.00	25	FB5 +1.11
14	72	64	FB wear	1.03	26	FB6 +1.16
14	72	66	FB wear	0.60	20	FB4 +1.10
14	73	59	FB wear	0.84	24	FB5 -1.13
14	73	59	FB wear	0.72	22	FB6 -1.22
14	74	66	FB wear	0.79	23	FB3 -1.14
14	75	65	FB wear	0.58	20	FB3 +1.28
14	77	59	FB wear	0.80	23	FB3 -1.22
14	77	59	FB wear	1.12	27	FB4 -1.17
14	77	59	FB wear	1.03	26	FB5 +1.14
14	78	50	FB wear	0.71	21	FB3 -1.35
14	78	50	FB wear	0.67	20	FB4 -1.22
14	78	56	FB wear	0.58	20	FB4 -1.18
14	78	58	FB wear	0.99	25	FB4 -1.13
14	78	60	FB wear	0.81	23	FB3 -1.15
14	78	60	FB wear	0.67	21	FB5 +1.17
14	78	60	FB wear	0.94	25	FB6 +1.14
14	78	64	FB wear	0.61	20	FB4 -1.11
14	78	66	FB wear	1.10	27	FB5 +1.14
14	79	47	FB wear	0.97	25	FB5 -1.13
14	79	51	FB wear	0.84	23	FB3 +0.99
14	79	51	FB wear	1.14	28	FB4 +1.03
14	79	71	FB wear	1.03	28	FB5 -1.11
14	80	52	FB wear	0.53	20	FB3 -1.28
14	80	52	FB wear	0.70	23	FB4 -1.15
14	80	52	FB wear	0.68	22	FB5 +1.08
14	81	51	FB wear	0.96	27	FB4 +1.13
14	81	51	FB wear	0.86	25	FB5 -1.02
14	81	55	FB wear	0.76	24	FB4 +1.09

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Table 4: Indications \geq 20% TW						
SG	Row	Col	Indication	Volts	% TW	Location (in)
14	81	55	FB wear	0.91	26	FB6 -1.27
14	82	54	FB wear	1.06	27	FB4 -0.03
14	82	54	FB wear	1.13	27	FB5 -0.05
14	82	54	FB wear	0.85	24	FB6 -0.05
14	82	56	FB wear	0.82	25	FB4 +1.06
11	2	44	FO wear	0.18	28	05H -1.26
14	31	67	FO wear	0.28	36	06H +0.56
13	1	71	LG wear	0.78	22	06C +1.01

6. Condition Monitoring Assessment

All indications found during the U1C31 inspection satisfied the condition monitoring (CM) requirements for structural integrity and accident-induced leakage integrity. No in-situ pressure testing was required.

Condition Monitoring for Fan Bar Wear

Historical fan bar wear length measurements have all been less than 1.7 inches. A sample during U1C31 confirmed that 1.7 inches remains bounding. The CM limit for a 1.7 inch fan bar wear indication is 42.1% TW using the NDE technique uncertainties for ETSS 96004.1.

The largest fan bar wear indication observed during U1C31 was measured at 34% TW. Therefore, all fan bar wear indications satisfied the structural integrity performance criterion. For volumetric wear flaws with pressure-only loading conditions, tube burst and ligament tearing (i.e., pop-through) are coincident. Therefore, the accident-induced leakage performance criterion was also satisfied.

The previous operational assessment (OA) completed after U1C28 used a fully probabilistic model to evaluate fan bar wear. The probability of survival (POS) was calculated to be greater than the required 0.95 for each SG. No indications observed at U1C31 exceeded the performance criteria, which aligns with the U1C28 OA projections.

Condition Monitoring for Lattice Grid Wear

The largest axial length of a lattice grid wear scar measured from all prior inspections was found to be 1.24 inches. Conservatively, 1.5 inches was used as the bounding length. The CM limit for a 1.5 inch lattice grid wear indication is 42.5% TW using the NDE technique uncertainties for ETSS 96004.1.

The largest lattice grid wear indication observed during U1C31 was measured at 22% TW. Therefore, all lattice grid wear indications satisfied the structural integrity performance criterion. For volumetric wear flaws with pressure-only loading conditions, tube burst and ligament tearing (i.e., pop-through) are coincident. Therefore, the accident-induced leakage performance criterion was also satisfied.

The U1C28 OA projected a maximum end-of-cycle (EOC) depth of 36% TW for lattice grid wear. The largest lattice grid wear indication observed during U1C31 (22% TW) was well below that projection.

Condition Monitoring for Foreign Object Wear

Two volumetric wear indications were reported during U1C31 that were attributed to foreign object wear. Both indications were near support structures with no foreign object observed by ECT in the tubes where the indication was detected or in the surrounding tubes. Both flaws were initially detected with the bobbin probe followed by diagnostic testing with array and +Point™ probes. Flaw morphology was determined to

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be “tapered football” shaped and ETSS 27903.1 was used to size both indications with the +Point™ probe data. The flaws measured 28% TW and 36% TW. The length of both flaws was less than 0.5 inches.

The CM limit for a 0.5 inch long indication evaluated for ETSS 27903.1 is 52.1% TW. Therefore, both foreign object wear indications satisfied the structural integrity performance criterion. For both flaws, it was determined that tube burst and ligament tearing (i.e., pop-through) were coincident. Therefore, the accident-induced leakage performance criterion was also satisfied.

All foreign object wear indications were bounded by the behavior projected in the previous OA as demonstrated by satisfying all CM limits.

7. Number of Tubes Plugged During the Inspection Outage

As shown in Table 5, fifty six tubes were plugged during U1C31.

Count	SG	Row	Col	Reason for Tube Plugging
1	11	75	43	Fan Bar Wear ≥ 26% TW
2	11	2	44	Foreign Object Wear (stabilizer also installed)
3	11	77	45	Fan Bar Wear ≥ 26% TW
4	11	68	50	Fan Bar Wear ≥ 26% TW
5	11	72	54	Fan Bar Wear ≥ 26% TW
6	11	71	55	Fan Bar Wear ≥ 26% TW
7	11	74	58	Fan Bar Wear ≥ 26% TW
8	11	65	59	Fan Bar Wear ≥ 26% TW
9	11	65	61	Fan Bar Wear ≥ 26% TW
10	11	70	62	Fan Bar Wear ≥ 26% TW
11	11	72	62	Fan Bar Wear ≥ 26% TW
12	11	69	65	Fan Bar Wear ≥ 26% TW
13	11	77	67	Fan Bar Wear ≥ 26% TW
14	12	68	40	Fan Bar Wear ≥ 26% TW
15	12	72	40	Fan Bar Wear ≥ 26% TW
16	12	68	42	Fan Bar Wear ≥ 26% TW
17	12	64	44	Fan Bar Wear ≥ 26% TW
18	12	62	46	Fan Bar Wear ≥ 26% TW
19	12	74	46	Fan Bar Wear ≥ 26% TW
20	12	72	50	Fan Bar Wear ≥ 26% TW
21	12	61	51	Fan Bar Wear ≥ 26% TW
22	12	69	51	Fan Bar Wear ≥ 26% TW
23	12	56	56	Fan Bar Wear ≥ 26% TW
24	12	73	57	Fan Bar Wear ≥ 26% TW
25	12	77	57	Fan Bar Wear ≥ 26% TW
26	12	66	60	Fan Bar Wear ≥ 26% TW
27	12	74	60	Fan Bar Wear ≥ 26% TW
28	12	76	68	Fan Bar Wear ≥ 26% TW

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Table 5: Tubes Plugged during U1C31				
Count	SG	Row	Col	Reason for Tube Plugging
29	13	60	54	Fan Bar Wear ≥ 26% TW
30	13	61	59	Fan Bar Wear ≥ 26% TW
31	13	63	59	Fan Bar Wear ≥ 26% TW
32	13	73	61	Fan Bar Wear ≥ 26% TW
33	13	66	62	Fan Bar Wear ≥ 26% TW
34	13	65	63	Fan Bar Wear ≥ 26% TW
35	13	1	71	Lattice Grid Wear ≥ 19% TW
36	14	63	45	Fan Bar Wear ≥ 26% TW
37	14	79	51	Fan Bar Wear ≥ 26% TW
38	14	81	51	Fan Bar Wear ≥ 26% TW
39	14	63	53	Fan Bar Wear ≥ 26% TW
40	14	66	54	Fan Bar Wear ≥ 26% TW
41	14	72	54	Fan Bar Wear ≥ 26% TW
42	14	82	54	Fan Bar Wear ≥ 26% TW
43	14	81	55	Fan Bar Wear ≥ 26% TW
44	14	72	56	Fan Bar Wear ≥ 26% TW
45	14	66	58	Fan Bar Wear ≥ 26% TW
46	14	72	58	Fan Bar Wear ≥ 26% TW
47	14	77	59	Fan Bar Wear ≥ 26% TW
48	14	66	60	Fan Bar Wear ≥ 26% TW
49	14	60	62	Fan Bar Wear ≥ 26% TW
50	14	66	62	Fan Bar Wear ≥ 26% TW
51	14	72	64	Fan Bar Wear ≥ 26% TW
52	14	59	65	Fan Bar Wear ≥ 26% TW
53	14	61	65	Fan Bar Wear ≥ 26% TW
54	14	78	66	Fan Bar Wear ≥ 26% TW
55	14	31	67	Foreign Object Wear (stabilizer also installed)
56	14	79	71	Fan Bar Wear ≥ 26% TW

8. Repair Methods Utilized

No tube repairs were completed during U1C31.

9. Operational Assessment

An OA was completed to evaluate continued operation through the end of operating cycle 35, which coincides with the start of the U1C36 refueling outage. The OA evaluated all existing degradation mechanisms using a bounding operating period of 7.5 EFPY (Effective Full Power Years). The OA illustrates reasonable assurance that tube integrity will be maintained until the U1C36 refueling outage.

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Operational Assessment for Fan Bar Wear

Growth rates were determined by comparative analysis of the fan bar wear sites. Fan bar growth rates from U1C28 to U1C31 are shown in Table 6. The same degradation sizing technique was applied as in the previous inspection and no technique adjustments were necessary. The cumulative distribution functions of historical growth rates confirmed that growth rate trends continue to decrease. Therefore, the lower growth rates observed at U1C31 were appropriate for use in the OA.

SG	95th Percentile Growth (% TW/EFPY)	Max Growth (% TW/EFPY)
11	1.00	2.00
12	1.50	1.75
13	1.00	1.50
14	1.25	2.74
ALL	1.25	2.74

The largest fan bar wear indication returned to service in each SG was 25% TW. A simplified OA analysis was completed by conservatively assuming a bounding growth rate of 2.00% TW/EFPY for 7.5 EFPY. This results in an EOC fan bar wear depth of 40.0% TW, which is less than the 42.1% TW condition monitoring limit.

Operational Assessment for Lattice Grid Wear

Growth rates were determined by comparative analysis of the lattice grid wear sites. The same degradation sizing technique was applied as in the previous inspection and no technique adjustments were necessary. The cumulative distribution functions of historical growth rates confirmed that growth rate trends remain stable. The 95th percentile growth rate for U1C31 was determined to be 1.50% TW/EFPY. Conservatively, the maximum observed growth rate at U1C31 (2.24% TW/EFPY) was used for the OA projections.

The largest lattice grid wear indication returned to service was 18% TW. A simplified OA analysis was completed by using a bounding growth rate of 2.24% TW/EFPY for 7.5 EFPY. This results in an EOC lattice grid wear depth of 34.8% TW, which is less than the 42.5% TW condition monitoring limit. The projected EOC depth is also less than the CM limit of 39.9% TW for uniform thinning, providing additional assurance in case there are multiple lattice grid flaws at the same elevation which could exceed 135°.

Operational Assessment for Foreign Object Wear

A foreign object evaluation was performed that concluded the objects remaining on the secondary side of the SGs are acceptable for at least five operating cycles (7.5 EFPY). Therefore, it is projected that there will be no challenge to structural or leakage integrity performance criteria relative to foreign object wear before the U1C36 refueling outage.

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10. Total Number of Tubes Plugged

Table 7 shows the total number of tubes plugged in the Unit 1 steam generators following U1C31.

Table 7: Total Tubes Plugged			
SG	Number of Tubes	Number of Tubes Plugged	Plugging Percentage
11	3,496	69	1.97%
12	3,496	47	1.34%
13	3,496	63	1.80%
14	3,496	61	1.74%
Total	13,984	240	1.72%

11. Secondary Side Inspections

Visual inspections of the steam dome internals were performed on SG 11. The scope included the feedwater header, J-pipes, primary moisture separators, secondary moisture separators, and the U-bend region. All steam dome components were found to be in solid mechanical condition. Some minor erosion was observed on some of the primary moisture separators.

After water lancing, the top-of-tubesheet region was visually inspected in each SG. The scope included the annulus region, no-tube lane, and multiple in-bundle passes in the hot leg and cold leg of each SG. Possible loose part signals from eddy current were visually investigated where accessible. Hard sludge accumulation was identified in some areas, which is not new or unexpected.

Table 8 provides the list of known foreign objects remaining in the steam generators following U1C31. Sludge piles and sludge rocks are not included.

Table 8: Foreign Objects Remaining in Steam Generators			
SG	Description	Location	Disposition
11	Metallic Rod Length ≈ 2.90" Diameter ≈ 0.13"	Hot Leg Tubesheet Col ≈ 19-21 Row ≈ 53-56	The object was discovered in U1C25 and has remained constrained in the same location. ECT during U1C31 confirmed the object has not caused any degradation to surrounding tubes over 6 cycles of operation.
11	Wire Bristle Length ≈ 1.0" Diameter ≈ 0.01"	Hot Leg Tubesheet Col ≈ 50-51 Row ≈ 40-42	The object was discovered in U1C28 and has remained constrained in the same location. ECT during U1C31 confirmed the object has not caused any degradation to surrounding tubes over 3 cycles of operation. The wire is fixed in the hard sludge pile and located in a lower flow velocity region.
12	Weld Slag Length ≈ 1.5" Width ≈ 0.5" Height ≈ 1.5"	Hot Leg Tubesheet Col ≈ 49-50 Row ≈ 81-83	The object was discovered in U1C24 and has remained constrained in the same location. ECT during U1C31 confirmed the object has not caused any degradation to surrounding tubes over 7 cycles of operation.

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Table 8: Foreign Objects Remaining in Steam Generators			
SG	Description	Location	Disposition
12	Wire Bristle Length ≈ 0.25" Diameter ≈ 0.015"	Hot Leg Tubesheet Col ≈ 62-63 Row ≈ 85	The object was discovered during U1C31 secondary side inspections. Retrieval attempts were not successful. ECT during U1C31 confirmed the object has not caused any degradation to surrounding tubes. The size of this object does not present any tube integrity concerns.
12	Wire Bristle Length ≈ 0.25" Diameter ≈ 0.015"	Hot Leg Tubesheet Col ≈ 55-56 Row ≈ 10	The object was discovered during U1C31 secondary side inspections. Retrieval attempts were not successful. ECT during U1C31 confirmed the object has not caused any degradation to surrounding tubes. The size of this object does not present any tube integrity concerns.
13	Hex Nut Height ≈ 0.3" Diameter ≈ 0.3"	Cold Leg Tubesheet Col ≈ 60-61 Row ≈ 83-85	The object was discovered in U1C24 and has remained constrained in the same location. ECT during U1C31 confirmed the object has not caused any degradation to surrounding tubes over 7 cycles of operation.
13	Rectangular Plate Length ≈ 1.5" Height ≈ 0.5" Thickness ≈ 0.07"	Cold Leg Tubesheet Col ≈ 27-29 Row ≈ 68-69	The object was discovered in U1C21. Surrounding tubes were plugged to mitigate wear. The object has remained constrained in the same location. ECT during U1C31 confirmed the object has not caused any degradation to in-service tubes over 10 cycles of operation.
13	Wire Bristle Length ≈ 0.5" Diameter ≈ 0.015"	Cold Leg Tubesheet Col ≈ 60-61	The object was discovered during U1C31 secondary side inspections. Retrieval attempts were not successful. ECT during U1C31 confirmed the object has not caused any degradation to surrounding tubes. The size of this object does not present any tube integrity concerns.

12. Secondary Side Cleaning

Water lancing was performed in each SG. In total, approximately 42 pounds of material was removed.

13. Primary Side Visual Inspections

Each of the steam generator channel heads (hot leg and cold leg sides) were visually inspected. The scope included low-lying areas, channel head cladding, tubesheet cladding, divider plate, divider plate welds, and nozzle dam rings. The inspections looked for evidence of gross defects such as degraded welds, unusual discoloration, dings, or gouges. No discrepancies or anomalous conditions were identified.

A visual inspection was performed on all previously installed tube plugs. No degraded tube plugs were identified.

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14. Plant-Specific Reporting Requirements

Cook Nuclear Plant has no plant-specific reporting requirements.