NRC00208B
Submitted: August 10, 2015

ENCLOSURE TO EPRI LETTER

MRP-2014-009

INDIVIDUAL UTILITY REPORTS OF MRP-227-A

RELATED INSPECTION RESULTS

Plant: Ginna Nuclear Power Plant **Utility:** Constellation Energy Nuclear Group **Date of Exams:** May 2011

Plant Age: 41.6 **(years) /** 33.51 **EFPY**

Item	Effect (Mechanism)	Expansion Link (Note 1)	Examination Method (Note 1)	Examination Coverage	Coverage Achieved	Examination Findings
Control Rod Guide Tube Assembly Guide plates (cards)	Loss of Material (Wear)	None	Visual (VT-3) examination.	20% examination of the number of CRGT assemblies, with all guide cards within each selected CRGT assembly examined.	100% of all Guide Cards along with the continuous section due to accessibility during Split Pin replacement activities	Initial on site results were Sat. Aggressive Guide Card wear or Backside wear was not observed at any measured Guide Tube locations. Westinghouse evaluation was to, "Inspect after an additional 35 EFPYs or as required per MRP-227".
Control Rod Guide Tube Assembly Lower flange welds	Cracking (SCC, Fatigue)	Bottom-mounted instrumentation (BMI) column bodies, Lower support column bodies (cast)	Enhanced visual (EVT-1) examination to determine the presence of crack-like surface flaws in flange welds.	100% of outer (accessible) CRGT lower flange weld surfaces and adjacent base metal.	100% of all Lower Flanges welds were inspected due to accessibility during Split Pin replacement activities	No Recordable Indications.
Access to 100% of the Guide Cards and Lower Flange welds was only achievable due to the Split Pin replacement activities.						

Item	Effect (Mechanism)	Expansion Link (Note 1)	Examination Method (Note 1)	Examination Coverage	Coverage Achieved	Examination Findings
Core Barrel Assembly Upper core barrel flange weld	Cracking (SCC)	Lower support column bodies (non cast)	Enhanced visual (EVT-1) examination.	100% of one side of the accessible surfaces of the selected weld and adjacent base metal.	(100% of the required coverage) of the OD weld and partial coverage of the ID weld of the Upper Core Barrel Flange weld per MRP-227 Rev 0.	No Recordable Indications.
Core Barrel Assembly Upper and lower core barrel cylinder girth welds	Cracking (SCC, IASCC, Fatigue) Aging Management (IE)	None	Enhanced visual (EVT-1) examination.	100% of one side of the accessible surfaces of the selected weld and adjacent base metal.	N/A per MRP-227 Rev 0, VT-3 per ISI Program, Examination Category B-N-3	No Recordable Indications.
Core Barrel Assembly Lower core barrel flange weld	Cracking (SCC, Fatigue)	None	Enhanced visual (EVT-1) examination.	100% of one side of the accessible surfaces of the selected weld and adjacent base metal.	N/A per MRP-227 Rev 0, VT-3 per ISI Program, Examination Category B-N-3	No Recordable Indications.

The ID was more accessible due to Baffle Former Bolt inspection and replacement activities; however, the ID surface was ground flush and very non-contrasting. It was difficult for the remote camera to focus on the area of interest, i.e., weld surface, HAZ and adjacent base material. We could not assure 100% coverage due to the camera's inability to maintain focus on these surfaces. The OD required multiple scans using an ROV to assure coverage and EVT-1 required scanning speed limits <½" /sec.

The "**Core Barrel Assembly** Upper and lower core barrel cylinder girth welds" and the "**Core Barrel Assembly** Lower core barrel flange weld" items were not inspected EVT-1 due to the MRP-227 Rev 0 requirements. VT-3s were performed per the ISI Program.

Item	Effect (Mechanism)	Expansion Link (Note 1)	Examination Method (Note 1)	Examination Coverage	Coverage Achieved	Examination Findings
Baffle-Former Assembly Baffle-edge bolts	Cracking (IASCC, Fatigue) that results in • Lost or broken locking devices • Failed or missing bolts • Protrusion of bolt heads	None	Visual (VT-3) examination.	Bolts and locking devices on high fluence seams. 100% of components accessible from core side.	100%	No Recordable Indications.
Although accessibility was not an issue, multiple color cameras were damaged during the inspections inside the Core Barrel due to high Radiation fields. A black and white camera was eventually used to complete these exams.						

Item	Effect (Mechanism)	Expansion Link (Note 1)	Examination Method (Note 1)	Examination Coverage	Coverage Achieved	Examination Findings
Baffle-Former Assembly Baffle-former bolts	Cracking (IASCC, Fatigue)	Lower support column bolts, Barrel-former bolts	Volumetric (UT) examination.	100% of accessible bolts or as supported by plant-specific justification. Heads accessible from the core side. UT accessibility may be affected by complexity of head and locking device designs.	Plant Specific Justification per MRP-227 Rev 0	
					1-UT of 56 bolts replaced in 1999..	1-All Acceptable
					2-Replaced 25 of the originally planned replacement of 182 Bolts.	2-All Acceptable
					3-UT from the back side of 24 removed bolts.	3-All Acceptable
					4-UT of 99 Head to Shank region of the in-place original bolts in the minimum bolting pattern.	4-98 Acceptable 1 crack like indication. Acceptable by revised pattern analysis

Item	Effect (Mechanism)	Expansion Link (Note 1)	Examination Method (Note 1)	Examination Coverage	Coverage Achieved	Examination Findings
Baffle-Former Assembly Assembly (Includes: Baffle plates, baffle edge bolts and indirect effects of void swelling in former plates)	Distortion (Void Swelling), or Cracking (IASCC) that results in • Abnormal interaction with fuel assemblies • Gaps along high fluence baffle joint • Vertical displacement of baffle plates near high fluence joint • Broken or damaged edge bolt locking systems along high fluence baffle joint	None	Visual (VT-3) examination to check for evidence of distortion.	Core side surface as indicated.	100%	No Recordable Indications.
Although accessibility was not an issue, multiple color cameras were damaged during the inspections inside the Core Barrel due to high Radiation fields. A black and white camera was eventually used to complete these exams.						
Alignment and Interfacing Components Internals hold down spring	Distortion (Loss of Load) Note: This mechanism was not strictly identified in the original list of age-related degradation mechanisms [7].	None	Direct measurement of spring height.	Measurements should be taken at several points around the circumference of the spring, with a statistically adequate number of measurements at each point to minimize uncertainty.	N/A, The Ginna Internals hold down spring is 410 Stainless Steel.	N/A

Item	Effect (Mechanism)	Expansion Link (Note 1)	Examination Method (Note 1)	Examination Coverage	Coverage Achieved	Examination Findings
Thermal Shield Assembly Thermal shield flexures	Cracking (Fatigue) or Loss of Material (Wear) that results in thermal shield flexures excessive wear, fracture, or complete separation	None	Visual (VT-3).	100% of thermal shield flexures.	100%	No Recordable Indications.
No issues were experienced during these examinations. The Thermal Shield Flexures are accessible, in fact have previously been included in the ISI 10 Vessel Exams.						

Notes:

1. Examination acceptance criteria and expansion criteria for the Westinghouse components are in Table 5-3 of MRP-227 rev 0.

Tables for Reporting MRP-227-A Inspection Results for Westinghouse Plants

Plant Name: Kewanee Power Station_____ Utility: _Dominion_____

Date of Exams:_4-13-12 to 4-14-12_____ Plant Age: __38 _____(years) / ___31.1_____EFPY

Primary Components: The only MRP-227-A inspections performed at KPS during the KR32 RFO are the Control Rod Guide Tube Assembly
Guide plates (cards)

Item	Examination Method	Required Examination Coverage	Coverage Achieved	Examination Findings (Note 1)
Control Rod Guide Tube Assembly Guide plates (cards)	Visual examination (VT-3)	20% examination of the number of CRGT assemblies, with all guide cards within each selected CRGT assembly examined. See Figure 4-20 of MRP-227-A	100% examination of the number of CRGT assemblies, with all guide cards within each selected CRGT assembly VT-3 examined. A total of 29 CRGTs.	Each CRGT is acceptable until the next scheduled inspection required by MRP-227-A based upon wear projections performed in accordance with WCAP-17451-P and WCAP-17562-P. The inspection results are documented in WCAP-17598-P. Observed volumetric GC wear range from 21%-51%.
Comments: None				

Tables for Reporting MRP-227-A Inspection Results for Westinghouse Plants

Plant Name: Surry Unit 1 **Utility:** Dominion Generation

Date of Exams: May 13th – 18th, 2012 **Plant Age:** 40 (May 26, 1972) (years) / 29.6 EFPY

Primary Components

Item	Examination Method	Required Examination Coverage	Coverage Achieved	Examination Findings (Note 1)
Control Rod Guide Tube Assembly Guide plates (cards)	Visual examination (VT-3)	20% examination of the number of CRGT assemblies, with all guide cards within each selected CRGT assembly examined. See Figure 4-20 of MRP-227-A	100% of the 20% examination requirement. 10 CRGTs were selected, and a discussion of these CRGT assemblies is below.	No findings – all examinations were satisfactory. Ligament wear was ≤ 5%.

Comments: The following CRGTs were examined per the requirements of MRP – 227 – A: B8 (Bank D) Near 'B' Hot Leg Nozzle, B6 (Bank A), C7 (Shutdown Bank A), D6 (Bank B), E11 (Shutdown Bank B), G9 (Shutdown Bank B), H10 (Bank C), K14 (Bank A) Near 'A' Hot Leg Nozzle, K12 (Bank B), P8 (Bank B). Bank refers to control or shutdown bank group (typ). Of the CRGTs examined, four were common to H.B. Robinson: B8, B6, K14, and P8. No findings to report – all examinations were satisfactory, and ligament wear was ≤ 5%.

Surry is 3 loop design with 15 x 15 fuel. It operates as a "low flow" plant. The inspected guide tubes were installed in 1984 (at 6.8 EFPY) as replacements for the original tubes. The accumulated EFPY on the guide tubes was 22.8 EFPY. The wear rate is therefore approximately 0.22 %/EFPY. Extrapolation of the recorded results to the current plant age of 29.6 EFPY would not change the conclusion that the long term expected guide card wear for Surry Unit 1 is very small.

Item	Examination Method	Required Examination Coverage	Coverage Achieved	Examination Findings (Note 1)
Control Rod Guide Tube Assembly Lower flange welds	Enhanced visual examination (EVT-1) to determine the presence of crack-like surface flaws in flange welds	100% of outer (accessible) CRGT lower flange weld surfaces and adjacent base metal on the individual periphery CRGT assemblies. (Note 2) See Figure 4-21 of MRP-227-A.	Accessible Lower Flange Welds (Upper and Lower) 24 CRGT assemblies were inspected during the 1R24 outage. 128 welds achieved some level of EVT-1 access. Of these, some did not have 100% coverage. The average coverage for the 128 welds was 96.8% which exceeds the minimum 75% requirement of MRP-227-A.	All accessible welds were examined, and the MRP-227-A inspection requirement was satisfied. No relevant indications were noted.

Comments:

Specific Guide Tubes inspected: B – 6, B – 8, B – 10, D – 4, D – 6, D – 10, D – 12, F – 2, F – 4, F – 12, F – 14, H – 2, H – 14, K – 2, K – 4, K – 12, K – 14, M – 4, M – 6, M – 10, M – 12, P – 6, P – 8, and P – 10.

The continuous section of Surry's guide tubes is of the "open" design and is not enclosed by a shroud. Therefore, the welds of the continuous section "sheaths" were inspected.

Each guide tube sheath has a "U" shaped weldment, the three legs of which were considered to be three separate welds for inspection and coverage calculation purposes. The lower or end leg of each weldment was typically more accessible for an EVT-1 inspection than the two side legs. A greater number of welds could be inspected on the upper flange of the continuous section as compared to the lower. Some of the lower flanges were obstructed by core exit thermocouple mixer tubes.

An additional 42 welds were attempted but could not be inspected to the EVT-1 standard; these are recorded as "best effort" examinations. No relevant conditions were identified among these 42 best effort examinations.

The inspected guide tubes were installed in 1984 (at 6.8 EFPY) as replacements for the original tubes. The accumulated EFPY on the guide tubes was 22.8 EFPY. The degradation mechanisms of concern in this inspection are fatigue (high cycle) and SCC. For constant parameters conducive to degradation both these mechanisms would be expected to have observable effects at a relatively early stage in plant life. Since the replacement guide tubes have accumulated 22.8 EFPY (77%) of a total 29.6 EFPY plant operation, these examinations are considered valid for concluding that the linked Expansion components are also similarly free of significant degradation. This conclusion is also reinforced by the core barrel upper flange weld (original equipment) inspection, and is similarly free of SCC indications.

Item	Examination Method	Required Examination Coverage	Coverage Achieved	Examination Findings (Note 1)
Core Barrel Assembly Upper core barrel flange weld	Enhanced visual examination (EVT-1)	100% of one side of the accessible surfaces of the selected weld and adjacent base metal (Note 4). See Figure 4-22 of MRP-227-A.	100% of the accessible weld received an EVT – 1 examination.	The EVT – 1 examination of the one upper core barrel weld was SAT; the weld was examined from the ID surface as required per the MRP guidance. There were no indications. The exam fulfilled the requirements of MRP-227-A.
Comments: **It is not feasible to inspect the OD of this weld when the core barrel is removed because it sits above the water and must be heavily shielded.**				
Core Barrel Assembly Upper and lower core barrel cylinder girth welds	Enhanced visual examination (EVT-1)	100% of one side of the accessible surfaces of the selected weld and adjacent base metal (Note 4). See Figure 4-22 of MRP-227-A	Examination has not been done yet.	N/A
Comments:				
Core Barrel Assembly Lower core barrel flange weld (Note 5)	Enhanced visual examination (EVT-1)	100% of one side of the accessible surfaces of the selected weld and adjacent base metal (Note 4).	Examination has not been done yet.	N/A

Item	Examination Method	Required Examination Coverage	Coverage Achieved	Examination Findings (Note 1)
Comments:				
Baffle-Former Assembly Baffle-edge bolts	Visual examination (VT-3)	Bolts and locking devices on high fluence seams. 100% of components accessible from core side (Note 3). See Figure 4-23 of MRP-227-A.	During 1R23 (Fall 2010), 936 accessible baffle – edge bolts received VT – 3 inspection.	One baffle edge bolt was found to have a missing weld on one side of its lock bar. This was attributed to a fabrication error, not aging effects, and is acceptable for continued safe operation.
Comments: These exams were completed before EPRI had prepared a MRP – 227 reporting template. EPRI was notified of these data through a detailed narrative summary submitted to the MRP.				
Baffle-Former Assembly Baffle-former bolts	Volumetric examination (UT)	100% of accessible bolts (Note 3). Heads accessible from the core side. UT accessibility may be affected by complexity of head and locking device designs. See Figures 4-23 and 4-24 of MRP-227-A.	During 1R23 (Fall 2010), 1088 baffle – to – former bolts received UT examination and the locking bars received VT – 3 examinations.	The most significant examination result was detection of a likely flaw in one bolt, identified as "C113". The depth of the flaw in C113 is not quantified; however it is located at the head to shank region of the bolt. This condition was found acceptable by a bolting pattern analysis. Also, some channels of the UT signals showed a significant "back wall" reflection from the end of the bolt, so the bolt is not completely severed. The lock bar for this bolt has no relevant conditions and is considered capable of performing its retention function.
Comments: Four other relevant conditions were found on other bolts. Two bolt heads were deformed at the points of its hex head to the extent that the UT probe was slightly displaced from full contact with the bolt head. Because of this, the back wall signal, although strong, was slightly outside its parameters, and the bolts were classified as "non-inspectable". Nevertheless, review of the UT signals showed the strong back wall signal with no intervening indications of flaws between it and the bolt head. It was thus concluded that these bolts were not flawed. The bolt deformation is attributed to original manufacturing, since the bolts are both located at an inner corner adjacent to plate number 1 and have limited accessibility. The other two relevant conditions were one missing lock bar weld out of two required. One baffle-former bolt and one edge bolt had this condition. This condition is also attributed to original fabrication error. The integrity of the lock bar with a single weld is considered adequate in view of the many years of service with this condition. **These exams were completed before EPRI had prepared a MRP – 227 reporting template. EPRI was notified of these data through a detailed narrative summary submitted to the MRP.**				

Item	Examination Method	Required Examination Coverage	Coverage Achieved	Examination Findings (Note 1)
Baffle-Former Assembly Assembly (Includes: Baffle plates, baffle edge bolts and indirect effects of void swelling in former plates)	Visual examination (VT-3)	Core side surface as indicated. See Figures 4-24, 4-25, 4-26 and 4-27 of MRP-227-A.	The inspection for gaps and distortion due to void swelling has not been done yet. The edge bolt inspection is reported above.	
Comments:				
Alignment and Interfacing Components Internals hold down spring	Direct measurement of spring height	Measurements should be taken at several points around the circumference of the spring, with a statistically adequate number of measurements at each point to minimize uncertainty. See Figure 4-28 of MRP-227-A.	Direct measurement of the Reactor Vessel HDS was completed during 1R24 – measurements were taken at 8 locations in the same general areas as the as – built measurements. Unit 1's HDS is 304 – SS.	The estimated average spring height was 3.6312±0.0002 inches. This result is greater than the minimum requirement of 3.610 inches; therefore, the final result is acceptable. This result confirms adequate hold down capability through at least 60 total years of reactor operation.
Comments: Because Unit 1 has an austenitic (304 – SS) stainless steel hold down spring, measurements of its relaxation was required per the MRP-227-A guidance. Per analysis, considering Surry Unit 1 as-built dimensions and the required hold down force for design conditions, the minimum acceptable height for assuring a minimum for 60 year service life was computed. Spring height measurements were taken at eight locations (every 45°) with three individual measurements taken at each location. The estimated average spring height was 3.6312±0.0002 inches. This result is greater than the minimum requirement; therefore, the final result is acceptable. This result confirms adequate hold down capability through at least 60 total years of reactor operation, and no further measurements are required.				
Thermal Shield Assembly Thermal shield flexures	Visual examination (VT-3)	100% of thermal shield flexures. See Figures 4-29 and 4-36 of MRP-227-A.	N/A – examination scheduled for 1R25 – Fall of 2013.	N/A – examination scheduled for 1R25 – Fall of 2013.

Item	Examination Method	Required Examination Coverage	Coverage Achieved	Examination Findings (Note 1)
Comments:				

Notes to Westinghouse Primary Components Table:

1. Examination acceptance criteria and expansion criteria for the Westinghouse components are in Table 5-3 of MRP-227-A.
2. A minimum of 75% of the total identified sample population must be examined.
3. A minimum of 75% of the total population (examined + unexamined), including coverage consistent with the Expansion criteria in Table 5-3 of MRP-227-A, must be examined for inspection credit.
4. A minimum of 75% of the total weld length (examined + unexamined), including coverage consistent with the Expansion criteria in Table 5-3 of MRP-227-A, must be examined from either the inner or outer diameter for inspection credit.
5. The lower core barrel flange weld may be alternatively designated as the core barrel-to-support plate weld in some Westinghouse plant designs.

Expansion Components

Item	Examination Method	Required Examination Coverage	Coverage Achieved	Examination Findings (Note 1)
Upper Internals Assembly Upper core plate	Enhanced visual examination (EVT-1)	100% of accessible surfaces (Note 2).	N/A	N/A
Comments:				
Lower Internals Assembly Lower support forging or castings	Enhanced visual examination (EVT-1)	100% of accessible surfaces (Note 2). See Figure 4-33 of MRP-227-A.	N/A	N/A
Comments:				
Core Barrel Assembly Barrel-former bolts	Volumetric examination (UT)	100% of accessible bolts. Accessibility may be limited by presence of thermal shields or neutron pads (Note 2). See Figure 4-23 of MRP-227-A.	N/A	N/A

Item	Examination Method	Required Examination Coverage	Coverage Achieved	Examination Findings (Note 1)
Comments:				
Lower Support Assembly Lower support column bolts	Volumetric examination (UT)	100% of accessible bolts or as supported by plant-specific justification (Note 2). See Figures 4-32 and 4-33 of MRP-227-A.	N/A	N/A
Comments:				
Core Barrel Assembly Core barrel outlet nozzle welds	Enhanced visual examination (EVT-1)	100% of one side of the accessible surfaces of the selected weld and adjacent base metal (Note 2). See Figure 4-22 of MRP-227-A.	N/A	N/A
Comments:				

Item	Examination Method	Required Examination Coverage	Coverage Achieved	Examination Findings (Note 1)
Core Barrel Assembly Upper and lower core barrel cylinder axial welds	Enhanced visual examination (EVT-1)	100% of one side of the accessible surfaces of the selected weld and adjacent base metal (Note 2). See Figure 4-22 of MRP-227-A.	N/A	N/A
Comments:				
Lower Support Assembly Lower support column bodies (non cast)	Enhanced visual examination (EVT-1)	100% of accessible surfaces (Note 2). See Figure 4-34 of MRP-227-A.	N/A	N/A
Comments:				
Lower Support Assembly Lower support column bodies (cast)	Enhanced visual examination (EVT-1)	100% of accessible support columns (Note 2). See Figure 4-34 of MRP-227-A.	N/A	N/A

Item	Examination Method	Required Examination Coverage	Coverage Achieved	Examination Findings (Note 1)
Comments:				
Bottom Mounted Instrumentation System Bottom-mounted instrumentation (BMI) column bodies	Visual examination (VT-3)	100% of BMI column bodies for which difficulty is detected during flux thimble insertion/withdrawal. See Figure 4-35 of MRP-227-A.	N/A	N/A
Comments:				

Notes to Westinghouse Expansion Component Table:

1. Examination acceptance criteria and expansion criteria for the Westinghouse components are in Table 5-3 of MRP-227-A .

2. A minimum of 75% coverage of the entire examination area or volume, or a minimum sample size of 75% of the total population of like components of the examination is required (including both the accessible and inaccessible portions).

Existing Programs Components

Item	Examination Method	Required Examination Coverage	Coverage Achieved	Examination Findings
Core Barrel Assembly Core barrel flange	Visual examination (VT-3) to determine general condition for excessive wear.	All accessible surfaces at specified frequency.	N/A – examination scheduled for 1R25 – Fall of 2013.	N/A – examination scheduled for 1R25 – Fall of 2013.
Comments:				
Upper Internals Assembly Upper support ring or skirt	Visual examination (VT-3)	All accessible surfaces at specified frequency.	N/A – examination scheduled for 1R25 – Fall of 2013.	N/A – examination scheduled for 1R25 – Fall of 2013.
Comments:				
Lower Internals Assembly Lower core plate XL lower core plate (Note 1)	Visual (VT-3) examination of the lower core plates to detect evidence of distortion and/or loss of bolt integrity.	All accessible surfaces at specified frequency.	N/A – examination scheduled for 1R25 – Fall of 2013.	N/A – examination scheduled for 1R25 – Fall of 2013.

Item	Examination Method	Required Examination Coverage	Coverage Achieved	Examination Findings
Comments:				
Lower Internals Assembly Lower core plate XL lower core plate (Note 1)	Visual examination (VT-3)	All accessible surfaces at specified frequency.	N/A – examination scheduled for 1R25 – Fall of 2013.	N/A – examination scheduled for 1R25 – Fall of 2013.
Comments:				
Bottom Mounted Instrumentation System Flux thimble tubes	Surface examination (ET)	Eddy current surface examination as defined in plant response to IEB 88-09.	1R24 (May 2012) 49 of 50 flux thimble tubes for SPS Unit 1. 1 flux thimble tube is capped – removed from service (tube F-4).	No issues were noted.
Comments: **The following flux thimble tubes were replaced prior to the May 2012 inspection: B10, D12, E5, F2, H1, H13, J3, J12, L4, L5, L14, N12, & R8.** **Flux Thimble tube B7 had 43% OUTER WALL DEGRADATION.** **Flux Thimble tube E11 had 10% INNER WALL DEGRADATION.**				
Alignment and Interfacing Components Clevis insert bolts	Visual examination (VT-3)	All accessible surfaces at specified frequency.	N/A – examination scheduled for 1R25 – Fall of 2013.	N/A – examination scheduled for 1R25 – Fall of 2013.

Item	Examination Method	Required Examination Coverage	Coverage Achieved	Examination Findings
Comments:				
Alignment and Interfacing Components Upper core plate alignment pins	Visual examination (VT-3)	All accessible surfaces at specified frequency.	N/A – examination scheduled for 1R25 – Fall of 2013.	N/A – examination scheduled for 1R25 – Fall of 2013.
Comments:				

Notes to Westinghouse Existing Programs Components Table:

1. XL = "Extra Long" referring to Westinghouse plants with 14-foot cores.

Tables for Reporting MRP-227-A Inspection Results for Westinghouse Plants

Plant Name: Surry Unit 2 **Utility:** Dominion Generation

Date of Exams: Nov 13th – 18th, 2012 **Plant Age:** 40 (Jan 29, 1973) (years) / 30.04 EFPY

Primary Components

Item	Examination Method	Required Examination Coverage	Coverage Achieved	Examination Findings (Note 1)
Control Rod Guide Tube Assembly Guide plates (cards)	Visual examination (VT-3)	20% examination of the number of CRGT assemblies, with all guide cards within each selected CRGT assembly examined. See Figure 4-20 of MRP-227-A	100% of the 20% examination requirement. 10 CRGTs were selected, and a discussion of these CRGT assemblies is below.	No findings – all examinations were satisfactory. Ligament wear was ≤ 10%.

Comments: The following CRGTs were examined per the requirements of MRP – 227 – A: C7 (Shutdown Bank A) Near 'C' Cold Leg Nozzle, D4 (Bank C) Near 'C' Cold Leg Nozzle, F10 (Bank D) Control Bank Near 'B' Cold Leg Nozzle, G9 (Shutdown Bank B) Shutdown Bank Near Core Center, J7 (Shutdown Bank B) Shutdown Bank Near Core Center, J13 (Shutdown Bank A) Shutdown Bank Near 'B' Hot Leg, K4 (Bank B) Control Bank B Near 'A' Hot Leg Nozzle [RHR Supply], L11 (Shutdown Bank B) Shutdown Bank Near 'B' Hot Leg Nozzle, M10 (Bank B) Control Bank B Between 'A' Cold Leg Nozzle and 'B' Hot Leg Nozzle, N9 (Shutdown Bank A) Near 'A' Cold Leg. Bank refers to control or shutdown bank group (typ). Of the CRGTs examined, one was common to Surry Unit 1. No findings to report – all examinations were satisfactory, and ligament wear was ≤ 10% (<5% by volume). These CRGTs are different than the ones inspected for Surry Unit 1 in that they have 9 card levels instead of 8; the 20% sample included most CRGTs that were identified by Westinghouse as having high wear based on an FME inspection in 2005.

Surry is 3 loop design with 15 x 15 fuel. It operates as a "low flow" plant, and it has operated with a "very low leakage" core since 1984. The inspected guide tubes are original except for the split pins with 9 guide cards per tube; the split pins were replaced in 2005. Since the replacement split pins were functionally equivalent to the original ones, the replacements should not affect guide card wear rates. The accumulated EFPY on the guide tubes was 30.22 EFPY.

The guide card listed below had wear volume equal to approximately 5%: N – 9 – 7 – Ligament C. The rest had wear < 5%; therefore, all guide cards examined fell into a wear level of GREEN described in WCAP – 17562 – P, Rev. 0.

Item	Examination Method	Required Examination Coverage	Coverage Achieved	Examination Findings (Note 1)
Control Rod Guide Tube Assembly Lower flange welds	Enhanced visual examination (EVT-1) to determine the presence of crack-like surface flaws in flange welds	100% of outer (accessible) CRGT lower flange weld surfaces and adjacent base metal on the individual periphery CRGT assemblies. (Note 2) See Figure 4-21 of MRP-227-A.	Accessible Lower Flange Welds (Upper and Lower) 24 outer CRGT assemblies were inspected during the 1R24 outage. 272 welds achieved some level of EVT-1 access. Of these, some did not have 100% coverage. The average coverage for the 272 welds was 95.7% which exceeds the minimum 75% requirement of MRP-227-A.	All accessible welds were examined, and the MRP-227-A inspection requirement was satisfied. No relevant indications were noted.

Comments:

Specific Guide Tubes inspected: B – 6, B – 8, B – 10, C – 7, C – 9, D – 4, D – 6, D – 10, D – 12, E – 5, E – 11, F – 2, F – 4, F – 12, F – 14, G – 3, G – 13, H – 2, H – 14, J – 3, J – 13, K – 2, K – 4, K – 12, K – 14, L – 5, L – 11, M – 4, M – 6, M – 10, M – 12, N – 9, P – 6, P – 8, and P – 10.

The continuous section of Surry's guide tubes is of the "open" design and is not enclosed by a shroud. Therefore, the welds of the continuous section "sheaths" were inspected.

Each guide tube sheath has a "U" shaped weldment, the three legs of which were considered to be three separate welds for inspection and coverage calculation purposes. The lower or end leg of each weldment was typically more accessible for an EVT-1 inspection than the two side legs. A greater number of welds could be inspected on the upper flange of the continuous section as compared to the lower. Some of the lower flanges were obstructed by core exit thermocouple mixer tubes.

An additional 21 welds were attempted but could not be inspected to the EVT-1 standard; these are recorded as "best effort" examinations. No relevant conditions were identified among these 21 best effort examinations.

The inspected guide tubes are the original tubes. The accumulated EFPY on the guide tubes was 30.04 EFPY. The degradation mechanisms of concern in this inspection are fatigue (high cycle) and SCC. For constant parameters conducive to degradation both these mechanisms would be expected to have observable effects at a relatively early stage in plant life.

Item	Examination Method	Required Examination Coverage	Coverage Achieved	Examination Findings (Note 1)
Core Barrel Assembly Upper core barrel flange weld	Enhanced visual examination (EVT-1)	100% of one side of the accessible surfaces of the selected weld and adjacent base metal (Note 4). See Figure 4-22 of MRP-227-A.	100% of the accessible weld received an EVT – 1 examination.	The EVT – 1 examination of the one upper core barrel weld was SAT; the weld was examined from the ID surface as required per the MRP guidance. There were no indications. The exam fulfilled the requirements of MRP-227-A.
Comments: **It is not feasible to inspect the OD of this weld when the core barrel is removed because it sits above the water and must be heavily shielded. There were no reportable indications observed on the Upper Core Barrel Flange Weld, but a rub – mark was observed below the Upper Core Barrel Flange Weld in the 90° - 180° Quadrant.**				
Core Barrel Assembly Upper and lower core barrel cylinder girth welds	Enhanced visual examination (EVT-1)	100% of one side of the accessible surfaces of the selected weld and adjacent base metal (Note 4). See Figure 4-22 of MRP-227-A	Examination has not been done yet. These exams are scheduled for 2R25.	N/A
Comments: Scheduled during 2R25 – Spring 2014.				

Item	Examination Method	Required Examination Coverage	Coverage Achieved	Examination Findings (Note 1)
Core Barrel Assembly Lower core barrel flange weld (Note 5)	Enhanced visual examination (EVT-1)	100% of one side of the accessible surfaces of the selected weld and adjacent base metal (Note 4).	Examination has not been done yet. These exams are scheduled for 2R25.	N/A
Comments: Scheduled during 2R25 – Spring 2014.				
Baffle-Former Assembly Baffle-edge bolts	Visual examination (VT-3)	Bolts and locking devices on high fluence seams. 100% of components accessible from core side (Note 3). See Figure 4-23 of MRP-227-A.	During 2R23 (Spring 2011), 936 accessible baffle – edge bolts received VT – 3 inspection.	All 936 accessible edge bolts received the required VT – 3 examinations. No issues were note; all examinations were acceptable.
Comments: These exams were completed before EPRI had prepared a MRP – 227 reporting template. EPRI was notified of these data through a detailed narrative summary submitted to the MRP.				

Item	Examination Method	Required Examination Coverage	Coverage Achieved	Examination Findings (Note 1)
Baffle-Former Assembly Baffle-former bolts	Volumetric examination (UT)	100% of accessible bolts (Note 3). Heads accessible from the core side. UT accessibility may be affected by complexity of head and locking device designs. See Figures 4-23 and 4-24 of MRP-227-A.	During 2R23 (Spring 2011), 1088 baffle – to – former bolts received UT examination and the locking bars received VT – 3 examinations.	The most significant examination results were detection of likely flaws in two bolts, identified as Baffle Plate 22 Bolt "G63" and Baffle Plate 42 Bolt "A125". The depth of the flaw in G63 and A125 were not quantified; however, each flaw was located at the head to shank region of the bolt. Also, some channels of the UT signals showed a "back wall" reflection from the end of each bolt, so each bolt is not completely severed. The lock bar for each of these bolts has no relevant conditions and is considered capable of performing its retention function.
Comments: See above. **These exams were completed before EPRI had prepared a MRP – 227 reporting template. EPRI was notified of these data through a detailed narrative summary submitted to the MRP.**				
Baffle-Former Assembly Assembly (Includes: Baffle plates, baffle edge bolts and indirect effects of void swelling in former plates)	Visual examination (VT-3)	Core side surface as indicated. See Figures 4-24, 4-25, 4-26 and 4-27 of MRP-227-A.	The inspection for gaps and distortion due to void swelling has not been done yet. The edge bolt inspection is reported above. These exams are scheduled for 2R25.	
Comments: Scheduled during 2R25 – Spring 2014.				

Item	Examination Method	Required Examination Coverage	Coverage Achieved	Examination Findings (Note 1)
Alignment and Interfacing Components Internals hold down spring	Direct measurement of spring height	Measurements should be taken at several points around the circumference of the spring, with a statistically adequate number of measurements at each point to minimize uncertainty. See Figure 4-28 of MRP-227-A.	Direct measurement of the Reactor Vessel HDS was completed during 2R24 – measurements were taken at 8 locations in the same general areas as the as – built measurements. Unit 2's HDS is 304 – SS.	The estimated average spring height was 3.6384±0.0001 inches. This result is greater than the minimum requirement of 3.621 inches; therefore, the final result is acceptable. This result confirms adequate hold down capability through at least 60 total years of reactor operation.
Comments: Because Unit 2 has an austenitic (304 – SS) stainless steel hold down spring, measurements of its relaxation was required per the MRP-227-A guidance. Per analysis, considering Surry Unit 2 as-built dimensions and the required hold down force for design conditions, the minimum acceptable height for assuring a minimum for 60 year service life was computed. Spring height measurements were taken at eight locations (every 45°) with three individual measurements taken at each location. The estimated average spring height was 3.6384±0.0001 inches. This result is greater than the minimum requirement; therefore, the final result is acceptable. This result confirms adequate hold down capability through at least 60 total years of reactor operation, and no further measurements are required.				
Thermal Shield Assembly Thermal shield flexures	Visual examination (VT-3)	100% of thermal shield flexures. See Figures 4-29 and 4-36 of MRP-227-A.	N/A – examination scheduled for 2R25 – Spring of 2014.	N/A – examination scheduled for 2R25 – Spring of 2014.
Comments: Scheduled during 2R25 – Spring 2014.				

Notes to Westinghouse Primary Components Table:

1. Examination acceptance criteria and expansion criteria for the Westinghouse components are in Table 5-3 of MRP-227-A.
2. A minimum of 75% of the total identified sample population must be examined.

3. A minimum of 75% of the total population (examined + unexamined), including coverage consistent with the Expansion criteria in Table 5-3 of MRP-227-A, must be examined for inspection credit.

4. A minimum of 75% of the total weld length (examined + unexamined), including coverage consistent with the Expansion criteria in Table 5-3 of MRP-227-A, must be examined from either the inner or outer diameter for inspection credit.

5. The lower core barrel flange weld may be alternatively designated as the core barrel-to-support plate weld in some Westinghouse plant designs.

Expansion Components

Item	Examination Method	Required Examination Coverage	Coverage Achieved	Examination Findings (Note 1)
Upper Internals Assembly Upper core plate	Enhanced visual examination (EVT-1)	100% of accessible surfaces (Note 2).	N/A	N/A
Comments:				
Lower Internals Assembly Lower support forging or castings	Enhanced visual examination (EVT-1)	100% of accessible surfaces (Note 2). See Figure 4-33 of MRP-227-A.	N/A	N/A
Comments:				
Core Barrel Assembly Barrel-former bolts	Volumetric examination (UT)	100% of accessible bolts. Accessibility may be limited by presence of thermal shields or neutron pads (Note 2). See Figure 4-23 of MRP-227-A.	N/A	N/A

Item	Examination Method	Required Examination Coverage	Coverage Achieved	Examination Findings (Note 1)
Comments:				
Lower Support Assembly Lower support column bolts	Volumetric examination (UT)	100% of accessible bolts or as supported by plant-specific justification (Note 2). See Figures 4-32 and 4-33 of MRP-227-A.	N/A	N/A
Comments:				
Core Barrel Assembly Core barrel outlet nozzle welds	Enhanced visual examination (EVT-1)	100% of one side of the accessible surfaces of the selected weld and adjacent base metal (Note 2). See Figure 4-22 of MRP-227-A.	N/A	N/A
Comments:				

Item	Examination Method	Required Examination Coverage	Coverage Achieved	Examination Findings (Note 1)
Core Barrel Assembly Upper and lower core barrel cylinder axial welds	Enhanced visual examination (EVT-1)	100% of one side of the accessible surfaces of the selected weld and adjacent base metal (Note 2). See Figure 4-22 of MRP-227-A.	N/A	N/A
Comments:				
Lower Support Assembly Lower support column bodies (non cast)	Enhanced visual examination (EVT-1)	100% of accessible surfaces (Note 2). See Figure 4-34 of MRP-227-A.	N/A	N/A
Comments:				
Lower Support Assembly Lower support column bodies (cast)	Enhanced visual examination (EVT-1)	100% of accessible support columns (Note 2). See Figure 4-34 of MRP-227-A.	N/A	N/A