EPRI | ELECTRIC POWER RESEARCH INSTITUTE

MRP Materials Reliability Program MRP 2010-023

(via email)

March 25, 2010

Document Control Desk
U. S. Nuclear Regulatory Commission
11555 Rockville Pike
Rockville, MD 20852

Subject: Document Submittal – EPRI MRP Comments on GALL Rev 2, Chapter IV B4 Table, Final Draft 03-04-2010

1) Text Document: *Comments on GALL Rev2 Chapter IV.B.4, March 24, 2010*

2) Spreadsheet: *GALL Rev 2, Chapter IV B4 Table Final Draft 03-04-2010*

To Whom It May Concern:

Enclosed are two copies of the subject documents. These are being provided to the NRC as part of the EPRI-MRP support of the update to the Generic Aging Lessons Learned (GALL) Report (NUREG 1801).

If you have any questions on this subject, please contact Anne Demma (ademma@epri.com, 650-855-2026) or Chuck Welty (cwelty@epri.com, 650-855-2371).

Sincerely,

Terry McAllister
SCANA
Chairman, Materials Reliability Program

cc: James Lash, First Energy
Tanya Mensah, NRC (with 8 copies of Subject documents)
William Greeson, INPO
Victoria Anderson, NEI
David Steininger, EPRI
Christine King, EPRI

NEI Project Nos. 669 and 689

D035
D046
NRO

Comments on GALL Rev2 Chapter IV.B.4

1. Adding the two rows on the first page of the table, in order to somehow address components that require No Additional Measures, is one possible way to deal with this issue. Further discussion is warranted.
2. In new line items AMR001 and 002 in the spreadsheet would it not be more appropriate to identify in the Structure and/or Component that these are components with no additional measures i.e. Reactor Vessel Internal Components w/ no additional measures instead of putting this information in the AMP column. This would make it easier to make a comparison for line items in an application that meet this criteria since it is kind of hidden in the AMP column. Putting this in the AMP column appears to not be the most appropriate location.
3. Adding the first two rows AMR003 and AMR004 on the second page of the table, in order to somehow address Primary and Expansion components that have limited accessibility, is not workable. It might be possible to make these rows work if the reference is to inaccessible Expansion components, but the accessibility of Primary components has already been addressed in MRP-227. If this is done would recommend moving Inaccessible Expansion components to the Structure and or Component Column information.
4. In item AMR020 do we not need to include the information that justification for continued operation will depend on the examination results for baffle-to-former bolts and their locking devices, and on evaluation or replacement somewhere in the line item such as further evaluation.
5. In the AMP discussion for AMR001 and 002 the statement of Note: Components with no additional measures are not included in GALL tables is not true since these line items are for these components aren't they? Would it be better revised to state This line item includes components with no additional measures that are not uniquely identified in the GALL tables.
6. I think the words (identified in the "Structure and Components" column) in the AMP column are kind of redundant since it is obvious this component is described in the structure and components column. Just include Primary Components or Expansion components since I assume this is referring to the discussion in M16.
7. In line item AMR040 and others the words No expansion components is not really necessary since if there were expansion components wouldn't they be listed as a separate line item?
8. What is the purpose of line item AMR084? Wouldn't line items 001 and 002 cover this line item?
9. AMR044 components are correctly identified as cast austenitic stainless steel; however, they are subject only to thermal aging embrittlement and not to neutron irradiation embrittlement. Change "ARM" in the AMP column to "AMR."
10. AMR043 components are cast austenitic stainless steel and nickel alloy; they are subject only to thermal aging embrittlement and not to neutron irradiation embrittlement.

11. It would appear that AMR040 and AMR090 are the same, except that AMR040 does not include the words "and associated loss of clamping load" in the Aging Mechanism/Effect column. We recommend eliminating AMR040.
12. AMR030 needs to be eliminated (the effects of neutron irradiation embrittlement are not significant for these components) and AMR029 should be divided into two separate rows – one for the Core Support Shield Assembly, with the accessible upper core barrel (UCB) bolts and locking devices, and the other for the Core Barrel Assembly, with the accessible lower core barrel (LCB) bolts and locking devices. The elimination of AMR030 also means that the Expansion component rows AMR028, AMR063, and AMR076 should also be eliminated.
13. AMR006 and AMR007 are acceptable, although it should be noted that changes in dimension due to void swelling have been found by Areva to be insignificant for these components. Therefore, we recommend the removal of void swelling from AMR006.
14. AMR033 should refer only to stainless steel, without nickel alloy. Otherwise, this row is fine.
15. AMR073 should refer only to nickel alloy. The components of interest are Alloy 82 weldments. In addition, eliminate the references to IASCC and PWSCC; it is only SCC that is the concern.
16. Both AMR065 and AMR066 should refer to "accessible top surfaces." Otehrwise, no changes are needed, although we lumped the 308L weld metal together with the spider castings because that weld metal has some of the same characteristics as cast material.
17. AMR074 needs to be divided into two rows – one for the Upper Grid Assembly, with the Alloy X-750 dowel-to-upper fuel assembly support pad welds (all plants except Davis-Besse), and the other for the Lower Grid Assembly, with the Alloy X-750 dowel-to-lower fuel assembly support pad welds (all plants). For the first of these rows, only nickel alloy should be used. For the second row, the current material references are correct. Eliminate the reference to IASCC and PWSCC; only SCC is of concern.
18. AMR013 should have the reference to neutron irradiation embrittlement eliminated; only thermal aging embrittlement is of concern.
19. AMR027 should be divided into two rows – one for the Core Barrel Assembly, with the upper thermal shield (UTS) bolts and the surveillance specimen holder tube (SSHT) studs/nuts (Crystal River 3) or bolts (Davis-Besse), and the other for the Lower Grid Assembly, with the lower thermal shield (LTS) bolts. We recommend that the reference to locking devices for all three sets of bolting be eliminated. Those locking devices, if any, are not mentioned in MRP-227. In addition, references to IASCC and PWSCC should be eliminated; it is only SCC that is of concern.
20. AMR028 should be eliminated. Neutron irradiation embrittlement is not a concern for these components.
21. AMR034 should refer only to stainless steel, with no reference to nickel alloy. Note that these components will not be examined. Justification for continued operation will be based on evaluation and/or replacement because of inaccessibility.

22. For AMR020 and AMR021, we recommend that only the Core Barrel Assembly be mentioned, without mention of the baffle-to-former assembly. We also recommend no reference to internal baffle-to-baffle bolts in the Structure/Component column, since these components have been covered as Primary components. The reference will then be to external baffle-to-baffle bolts and external baffle-to-baffle bolts locking devices. Finally, Areva has shown that changes in dimension caused by void swelling are insignificant for these components.
23. For AMR070 we recommend that the word "accessible" be inserted also prior to mention of the pad-to-rib section welds and the Alloy X-750 dowels, cap screws, and their locking welds.
24. AMR060 should be revised so that the assembly is the Lower Grid Assembly, rather than the Flow Distributor Assembly. Eliminate the reference to stainless steel, since the bolts are all Alloy X-750. Eliminate references to IASCC and PWSCC; only SCC is of concern.
25. Eliminate AMR061. Neutron irradiation embrittlement is not significant for these components.
26. AMR062 should reference only SCC, with no mention of IASCC and PWSCC.
27. AMR063 should be eliminated. Neutron irradiation embrittlement is not a concern for these components.
28. AMR090, under Structure/Component, needs to be corrected to read: Plenum Cover Assembly & Core Support Shield Assembly, with three components listed – plenum cover weldment rib pads, plenum cover support flange, and CSS top flange.

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AMR Unique ID	Gall Master ID	Item	Rev1 Related Item	New Rev2 Item	Structure and/or Component	Material	Environment	Aging Effect Mechanism	AMP	Further Evaluation
AMR001					Reactor vessel internal components	Stainless steel; nickel alloy	Reactor coolant and neurton flux	Cracking #*#due to stress corrosion cracking, irradiation-assisted stress corrosion cracking, and primary water stress corrosion cracking	Chapter XI.M2, "Water Chemistry" for PWR primary water, and #*#Chapter XI.M16A, "PWR Vessel Internals" #*#No additional measures #*#Note: Components with no additional measures are not included in GALL tables - Components with no additional measures are defined in Section 3.3.1 of MRP-227, "Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines"	No
AMR002					Reactor vessel internal components	Stainless steel; nickel alloy	Reactor coolant and neurton flux	Loss of fracture toughness #*#due to neutron irradiation embrittlement; #*#change in dimension #*#due to void swelling; #*#loss of preload #*#due to stress relaxation; #*#loss of material #*#due to wear	Chapter XI.M16A, "PWR Vessel Internals" #*#No additional measures #*#Note: Components with no additional measures are not included in GALL tables Components with no additional measures are defined in Section 3.3.1 of MRP-227, "Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines"	No
AMR003					Reactor vessel internal components	Stainless steel; nickel alloy	Reactor coolant and neurton flux	Cracking #*#due to stress corrosion cracking, irradiation-assisted stress corrosion cracking, and primary water stress corrosion cracking	Chapter XI.M2, "Water Chemistry" for PWR primary water, and #*#Chapter XI.M16A, "PWR Vessel Internals" #*#Inaccessible Primary components and Expansion components	Yes, further evaluation or replacement is recommended for inaccessible Primary and Expansion components, if accessible Primary components have defects
AMR004					Reactor vessel internal components	Stainless steel; nickel alloy	Reactor coolant and neurton flux	Loss of fracture toughness #*#due to neutron irradiation embrittlement; #*#change in dimension #*#due to void swelling; #*#loss of preload #*#due to stress relaxation; #*#loss of material #*#due to wear	Chapter XI.M16A, "PWR Vessel Internals" #*#Inaccessible Primary components and Expansion components	Yes, further evaluation or replacement is recommended for inaccessible Primary and Expansion components, if accessible Primary components have defects
AMR006					Core barrel assembly: #*#baffle/former assembly; #*# (a) accessible baffle-to-former bolts and screws; #*# (b) accessible locking devices (including welds) of baffle-to-former bolts and internal baffle-to-baffle bolts	Stainless steel	Reactor coolant and neurton flux	Loss of fracture toughness #*#due to neutron irradiation embrittlement; #*#change in dimension #*#due to void swelling; #*#loss of preload #*#due to stress relaxation	Chapter XI.M16A, "PWR Vessel Internals." #*#Primary components (identified in the "Structure and Components" column) #*# (for Expansion components see AMR Line Item AMR020.)	No

AMR Unique ID	Gall Master ID	Item	Rev1 Related Item	New Rev2 Item	Structure and/or Component	Material	Environment	Aging Effect Mechanism	AMP	Further Evaluation
AMR007					Core barrel assembly: #*#baffle/former assembly; #*# (a) accessible baffle-to-former bolts and screws; #*# (b) accessible locking devices (including welds) of baffle-to-former bolts and internal baffle-to-baffle bolts	Stainless steel	Reactor coolant and neurton flux	Cracking #*#due to stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M2, "Water Chemistry" for PWR primary water, and #*#Chapter XI.M16A, "PWR Vessel Internals" #*#Primary Components (identified in the "Structure and Components" column) #*#(for Expansion components see AMR Line Item AMR021)	No
AMR013					Control rod guide tube (CRGT) assembly: #*#accessible surfaces at four screw locations (every 90°) for CRGT spacer castings	Cast austenitic stainless steel	Reactor coolant and neurton flux	Loss of fracture toughness #*#due to thermal aging, neutron irradiation embrittlement	Chapter XI.M16A, "PWR Vessel Internals," Expansion Components (identified in the "Structure and Components" column) #*# (for Primary components see AMR Line Items AMR044 and AMR065)	No
AMR020					Core barrel assembly; #*#baffle-to-former assembly; #*#(a) baffle-to-baffle bolts; #*#(b) core barrel-to-former bolts; #*#(c) locking devices (including welds) of external baffle-to-baffle bolts and internal baffle-to-former bolts	Stainless steel	Reactor coolant and neurton flux	Loss of fracture toughness #*#due to neutron irradiation embrittlement; #*#change in dimension #*#due to void swelling; #*#loss of preload #*#due to stress relaxation	Chapter XI.M16A, "PWR Vessel Internals" #*#Expansion components (identified in the "Structure and Components" column) #*#(for Primary components see AMR Line Item AMR006)	No
AMR021					Core barrel assembly; #*#baffle-to-former assembly; #*#(a) baffle-to-baffle bolts; (b) core barrel-to-former bolts; (c) locking devices (including welds) of external baffle-to-baffle bolts and internal baffle-to-former bolts	Stainless steel	Reactor coolant and neurton flux	Cracking #*#due to stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M2, "Water Chemistry" for PWR primary water, and #*#Chapter XI.M16A, "PWR Vessel Internals" #*#Expansion components (identified in the "Structure and Components" column) #*#(for Primary components see AMR Line Item AMR007	No
AMR027					Core barrel assembly: #*#(a) upper thermal shield bolts and locking devices; #*#(b) lower thermal shield bolts and locking devices; #*#(c) surveillance specimen holder tube bolts and locking devices (Davis-Besse, only); #*#(d) surveillance specimen holder studs, nuts and locking devices (Chrystal River Unit 3, only)	Stainless steel; nickel alloy	Reactor coolant and neurton flux	Cracking #*#due to stress corrosion cracking, irradiation-assisted stress corrosion cracking, and primary water stress corrosion cracking	'Chapter XI.M2, "Water Chemistry," for PWR primary water, and #*#Chapter XI.M16A, "PWR Vessel Internals" #*#Expansion components (identified in the "Structure and Components" column) #*#(for Primary components see AMR Line Item AMR029)	No

AMR Unique ID	Gall Master ID	Item	Rev1 Related Item	New Rev2 Item	Structure and/or Component	Material	Environment	Aging Effect Mechanism	AMP	Further Evaluation
AMR028					Core barrel assembly: #*#(a) upper thermal shield bolts and locking devices; #*#(b) lower thermal shield bolts and locking devices; #*#(c) surveillance specimen holder tube bolts and locking devices (Davis-Besse, only); #*#(d) surveillance specimen holder studs, nuts and locking devices (Chrystal River Unit 3, only)	Stainless steel; nickel alloy	Reactor coolant and neurton flux	Loss of fracture toughness #*#due to neutron irradiation embrittlement	Chapter XI.M16A, "PWR Vessel Internals" #*#Expansion components (identified in the "Structure and Components" column) #*#(for Primary components see AMR Line Item AMR030)	No
AMR029					Core barrel assembly: #*#accessible lower core barrel (LCB) bolts and locking devices; #*#accessible upper core barrel (UCB) bolts and locking devices	Stainless steel; nickel alloy	Reactor coolant and neutron flux	Cracking #*#due to stress corrosion cracking; irradiation-assisted stress corrosion cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water, and Chapter XI.M16A, "PWR Vessel Internals" #*#Primary components (identified in the "Structure and Components" column) #*#(for Expansion components see AMR Line Items AMR027, AMR062, and AMR075)	No
AMR030					Core barrel assembly: #*#accessible lower core barrel (LCB) bolts and locking devices; #*#accessible upper core barrel (UCB) bolts and locking devices	Stainless steel; nickel alloy	Reactor coolant and neutron flux	Loss of fracture toughness #*#due to neutron irradiation embrittlement	Chapter XI.M16A, "PWR Vessel Internals" #*#Primary components (identified in the "Structure and Components" column) #*#(for Expansion components see AMR Line Items AMR028, AMR063, and AMR076)	No
AMR033					Core barrel assembly: #*#baffle plate accessible surfaces within one inch around each baffle plate flow and bolt hole	Stainless steel; nickel alloy	Reactor coolant and neurton flux	Loss of fracture toughness #*#due to neutron irradiation embrittlement	Chapter XI.M16A, "PWR Vessel Internals" Primary components (identified in the "Structure and Components" column) #*#(for Expansion components see AMR Line Item AMR034)	No
AMR034					Core barrel assembly: #*#core barrel cylinder (including vertical and circumferential seam welds); #*#former plates	Stainless steel; nickel alloy	Reactor coolant and neurton flux	Loss of fracture toughness #*#due to neutron irradiation embrittlement	Chapter XI.M16A, "PWR Vessel Internals" Expansion components (identified in the "Structure and Components" column) #*#(for Primary components see AMR Line Item AMR033)	No
AMR040					Core support shield (CSS) assembly: #*#CSS cylinder (top flange); #*#differential height from the top of the plenum rib pads to the reactor vessel seating surface	Stainless steel; nickel alloy	Reactor coolant and neurton flux	Loss of material #*#due to wear	Chapter XI.M16A, "PWR Vessel Internals," #*#Primary component (identified in the "Structure and Components" column) #*#No Expansion components	No

AMR Unique ID	Gall Master ID	Item	Rev1 Related Item	New Rev2 Item	Structure and/or Component	Material	Environment	Aging Effect Mechanism	AMP	Further Evaluation
AMR043					Core support shield (CSS) assembly: #*#(a) CSS vent valve disc shaft or hinge pin #*#(b) CSS vent valve top retaining ring #*#(c) CSS vent valve bottom retaining ring	Stainless steel; nickel alloy	Reactor coolant and neurton flux	Loss of fracture toughness #*#due to thermal aging and neutron irradiation embrittlement	Chapter XI.M16A, "PWR Vessel Internals." #*#Primary Components (identified in the "Structure and Components" column) #*#No Expansion components	No
AMR044					Core support shield (CSS) assembly: #*#(a) CSS cast outlet nozzles (Oconee Unit 3 and Davis-Besse, only); #*#(b) CSS vent valve discs	Cast austenitic stainless steel	Reactor coolant and neurton flux	Loss of fracture toughness #*#due to thermal aging and neutron irradiation embrittlement	Chapter XI.M16A, "PWR Vessel Internals." #*#Primary Components (identified in the "Structure and Components" column) #*#(for Expansion components see ARM Line Item AMR013)	No
AMR060					Flow distributor assembly: #*#lower grid shock pad bolts and locking devices (TMI-1, only)	Stainless steel; nickel alloy	Reactor coolant and neurton flux	Cracking #*#due to stress corrosion cracking, irradiation-assisted stress corrosion cracking, and primary water stress corrosion cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water, and #*#Chapter XI.M16A, "PWR Vessel Internals," Expansion components (identified in the "Structure and Components" column) #*#(for Primary components see ARM Line Item AMR029)	No
AMR061					Flow distributor assembly: #*#lower grid shock pad bolts and locking devices (TMI-1, only)	Stainless steel; nickel alloy	Reactor coolant and neurton flux	Loss of fracture toughness #*#due to neutron irradiation embrittlement	Chapter XI.M16A, "PWR Vessel Internals" #*#Expansion components (identified in the "Structure and Components" column) #*#(for Primary components see ARM Line Item AMR030)	No
AMR062					Flow distributor assembly: #*#flow distributor bolts and locking devices	Stainless steel; nickel alloy	Reactor coolant and neurton flux	Cracking #*#due to stress corrosion cracking, irradiation-assisted stress corrosion cracking, and primary water stress corrosion cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water, and #*#Chapter XI.M16A, "PWR Vessel Internals," Expansion components (identified in the "Structure and Components" column) #*#(for Primary components see ARM Line Item AMR029)	No
AMR063					Flow distributor assembly: #*#flow distributor bolts and locking devices	Stainless steel; nickel alloy	Reactor coolant and neurton flux	Loss of fracture toughness #*#due to neutron irradiation embrittlement	Chapter XI.M16A, "PWR Vessel Internals" #*#Expansion components (identified in the "Structure and Components" column) #*#(for Primary components see AMR Line Item AMR030)	No
AMR065					Incore Monitoring Instrumentation (IMI) guide tube assembly: #*#accessible IMI Incore guide tube spider castings	Cast austenitic stainless steel	Reactor coolant and neurton flux	Loss of fracture toughness #*#due to thermal aging, neutron irradiation embrittlement	Chapter XI.M16A, "PWR Vessel Internals" #*#Primary components (identified in the "Structure and Components" column) #*#(for Expansion components see Line Items AMR013 and AMP070)	No
AMR066					Incore Monitoring Instrumentation (IMI) guide tube assembly: #*#IMI guide tube spider-to-lower grid rib sections welds	Stainless steel; nickel alloy	Reactor coolant and neurton flux	Loss of fracture toughness #*#due to thermal aging, neutron irradiation embrittlement	Chapter XI.M16A, "PWR Vessel Internals" #*#Primary components (identified in the "Structure and Components" column) #*#(for Expansion components see Line Item AMR070)	No

AMR Unique ID	Gall Master ID	Item	Rev1 Related Item	New Rev2 Item	Structure and/or Component	Material	Environment	Aging Effect Mechanism	AMP	Further Evaluation
AMR070					Lower grid assembly: #*#(a) accessible pads; #*#(b) pad-to-rib section welds; #*#(c) alloy X-750 dowels, cap screws and locking devices	Stainless steel; nickel alloy	Reactor coolant and neurton flux	Loss of fracture toughness #*#due to neutron irradiation embrittlement	Chapter XI.M16A, "PWR Vessel Internals" #*#Expansion components (identified in the "Structure and Components" column) #*#(for Primary componetns see AMR Line Items AMR065 and AMR066)	No
AMR073					Lower grid assembly: #*#alloy X-750 dowel-to-guide block welds	Stainless steel; nickel alloy	Reactor coolant and neurton flux	Cracking #*#due to stress corrosion cracking, irradiation-assisted stress corrosion cracking, and primary water stress corrosion cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water, and #*#Chapter XI.M16A, "PWR Vessel Internals" #*#Primary components (identified in the "Structure and Components" column) #*#(for Expansion components see AMR Line Item AMR074)	No
AMR074					Lower grid assembly: #*#accessible alloy X-750 dowel locking welds to the upper and lower fuel assembly suppport pads	Stainless steel; nickel alloy	Reactor coolant and neurton flux	Cracking #*#due to stress corrosion cracking, irradiation-assisted stress corrosion cracking, and primary water stress corrosion cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water, and #*#Chapter XI.M16A, "PWR Vessel Internals" #*#Expansion components (identified in the "Structure and Components" column) #*#(for Primary components see AMR Line Item AMR073)	No
AMR084	1006	RP-24	IV.B4-38(RP-24)	IV.B4.RP-24	Reactor vessel internal components	Stainless steel; nickel alloy	Reactor coolant and neurton flux	Loss of material #*#due to pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry" for PWR primary water	No
AMR090					Plenum cover and plenum cylinder assemblies: #*#(a) plenum rib pads (weldment rib pads); #*#(b) support flange #*#Differential height between top of plenum rib pads and reactor vessel seating surface, with plenum in vessel, for wear	Stainless steel	Reactor coolant and neurton flux	Loss of material and associated loss of clamping load #*#due to wear	Chapter XI.M16A, "PWR Vessel Internals." #*#Primary components (identified in the "Structure and Components" column) #*#No Expansion components	No
AMR200	479	R-53	IV.B4-37(R-53)	IV.B4.R-53	Reactor vessel internal components	Stainless steel; nickel alloy	Reactor coolant and neurton flux	Cumulative fatigue damage #*#due to fatigue	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, #*#TLAA

AMR Unique ID	Gall Master ID	Item	Rev1 Related Item	New Rev2 Item	Structure and/or Component	Material	Environment	Aging Effect Mechanism	AMP	Further Evaluation
AMR001					Reactor vessel internal components	Stainless steel; nickel alloy	Reactor coolant and neurton flux	Cracking #*#due to stress corrosion cracking, irradiation-assisted stress corrosion cracking, and primary water stress corrosion cracking	Chapter XI.M2, "Water Chemistry" for PWR primary water, and #*#Chapter XI.M16A, "PWR Vessel Internals" #*#No additional measures #*#Note: Components with no additional measures are not included in GALL tables - Components with no additional measures are defined in Section 3.3.1 of MRP-227, "Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines"	No
AMR002					Reactor vessel internal components	Stainless steel; nickel alloy	Reactor coolant and neurton flux	Loss of fracture toughness #*#due to neutron irradiation embrittlement; #*#change in dimension #*#due to void swelling; #*#loss of preload #*#due to stress relaxation; #*#loss of material #*#due to wear	Chapter XI.M16A, "PWR Vessel Internals" #*#No additional measures #*#Note: Components with no additional measures are not included in GALL tables - Components with no additional measures are defined in Section 3.3.1 of MRP-227, "Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines"	No
AMR003					Reactor vessel internal components	Stainless steel; nickel alloy	Reactor coolant and neurton flux	Cracking #*#due to stress corrosion cracking, irradiation-assisted stress corrosion cracking, and primary water stress corrosion cracking	Chapter XI.M2, "Water Chemistry" for PWR primary water, and #*#Chapter XI.M16A, "PWR Vessel Internals" #*#Inaccessible Primary components and Expansion components	Yes, further evaluation or replacement is recommended for inaccessible Primary and Expansion components, if accessible Primary components have defects
AMR004					Reactor vessel internal components	Stainless steel; nickel alloy	Reactor coolant and neurton flux	Loss of fracture toughness #*#due to neutron irradiation embrittlement; #*#change in dimension #*#due to void swelling; #*#loss of preload #*#due to stress relaxation; #*#loss of material #*#due to wear	Chapter XI.M16A, "PWR Vessel Internals" #*#Inaccessible Primary components and Expansion components	Yes, further evaluation or replacement is recommended for inaccessible Primary and Expansion components, if accessible Primary components have defects
AMR006					Core barrel assembly: #*#baffle/former assembly; #*# (a) accessible baffle-to-former bolts and screws; #*# (b) accessible locking devices (including welds) of baffle-to-former bolts and internal baffle-to-baffle bolts	Stainless steel	Reactor coolant and neurton flux	Loss of fracture toughness #*#due to neutron irradiation embrittlement; #*#change in dimension #*#due to void swelling; #*#loss of preload #*#due to stress relaxation	Chapter XI.M16A, "PWR Vessel Internals." #*#Primary components (identified in the "Structure and Components" column) #*# (for Expansion components see AMR Line Item AMR020.)	No

AMR Unique ID	Gall Master ID	Item	Rev.1 Related Item	New Rev2 Item	Structure and/or Component	Material	Environment	Aging Effect Mechanism	AMP	Further Evaluation
AMR007					Core barrel assembly: #*#baffle/former assembly; #*# (a) accessible baffle-to-former bolts and screws; #*# (b) accessible locking devices (including welds) of baffle-to-former bolts and internal baffle-to-baffle bolts	Stainless steel	Reactor coolant and neurton flux	Cracking #*#due to stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M2, "Water Chemistry" for PWR primary water, and #*#Chapter XI.M16A, "PWR Vessel Internals" #*#Primary Components (identified in the "Structure and Components" column) #*#(for Expansion components see AMR Line Item AMR021)	No
AMR013					Control rod guide tube (CRGT) assembly: #*#accessible surfaces at four screw locations (every 90°) for CRGT spacer castings	Cast austenitic stainless steel	Reactor coolant and neurton flux	Loss of fracture toughness #*#due to thermal aging, neutron irradiation embrittlement	Chapter XI.M16A, "PWR Vessel Internals," Expansion Components (identified in the "Structure and Components" column) #*# (for Primary components see AMR Line Items AMR044 and AMR065)	No
AMR020					Core barrel assembly; #*#baffle-to-former assembly; #*#(a) baffle-to-baffle bolts; #*#(b) core barrel-to-former bolts; #*#(c) locking devices (including welds) of external baffle-to-baffle bolts and internal baffle-to-former bolts	Stainless steel	Reactor coolant and neurton flux	Loss of fracture toughness #*#due to neutron irradiation embrittlement; #*#change in dimension #*#due to void swelling; #*#loss of preload #*#due to stress relaxation	Chapter XI.M16A, "PWR Vessel Internals" #*#Expansion components (identified in the "Structure and Components" column) #*#(for Primary components see AMR Line Item AMR006)	No
AMR021					Core barrel assembly; #*#baffle-to-former assembly; #*#(a) baffle-to-baffle bolts; (b) core barrel-to-former bolts; (c) locking devices (including welds) of external baffle-to-baffle bolts and internal baffle-to-former bolts	Stainless steel	Reactor coolant and neurton flux	Cracking #*#due to stress corrosion cracking, irradiation-assisted stress corrosion cracking	Chapter XI.M2, "Water Chemistry" for PWR primary water, and #*#Chapter XI.M16A, "PWR Vessel Internals" #*#Expansion components (identified in the "Structure and Components" column) #*#(for Primary components see AMR Line Item AMR007	No
AMR027					Core barrel assembly: #*#(a) upper thermal shield bolts and locking devices; #*#(b) lower thermal shield bolts and locking devices; #*#(c) surveillance specimen holder tube bolts and locking devices (Davis-Besse, only); #*#(d) surveillance specimen holder studs, nuts and locking devices (Chrystal River Unit 3, only)	Stainless steel; nickel alloy	Reactor coolant and neurton flux	Cracking #*#due to stress corrosion cracking, irradiation-assisted stress corrosion cracking, and primary water stress corrosion cracking	'Chapter XI.M2, "Water Chemistry," for PWR primary water, and #*#Chapter XI.M16A, "PWR Vessel Internals" #*#Expansion components (identified in the "Structure and Components" column) #*#(for Primary components see AMR Line Item AMR029)	No

AMR Unique ID	Gall Master ID	Item	Rev1 Related Item	New Rev2 Item	Structure and/or Component	Material	Environment	Aging Effect Mechanism	AMP	Further Evaluation
AMR028					Core barrel assembly: #*#(a) upper thermal shield bolts and locking devices; #*#(b) lower thermal shield bolts and locking devices; #*#(c) surveillance specimen holder tube bolts and locking devices (Davis-Besse, only); #*#(d) surveillance specimen holder studs, nuts and locking devices (Chrystal River Unit 3, only)	Stainless steel; nickel alloy	Reactor coolant and neurton flux	Loss of fracture toughness #*#due to neutron irradiation embrittlement	Chapter XI.M16A, "PWR Vessel Internals" #*#Expansion components (identified in the "Structure and Components" column) #*#(for Primary components see AMR Line Item AMR030)	No
AMR029					Core barrel assembly: #*#accessible lower core barrel (LCB) bolts and locking devices; #*#accessible upper core barrel (UCB) bolts and locking devices	Stainless steel; nickel alloy	Reactor coolant and neutron flux	Cracking #*#due to stress corrosion cracking; irradiation-assisted stress corrosion cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water, and Chapter XI.M16A, "PWR Vessel Internals" #*#Primary components (identified in the "Structure and Components" column) #*#(for Expansion components see AMR Line Items AMR027, AMR062, and AMR075)	No
AMR030					Core barrel assembly: #*#accessible lower core barrel (LCB) bolts and locking devices; #*#accessible upper core barrel (UCB) bolts and locking devices	Stainless steel; nickel alloy	Reactor coolant and neutron flux	Loss of fracture toughness #*#due to neutron irradiation embrittlement	Chapter XI.M16A, "PWR Vessel Internals" #*#Primary components (identified in the "Structure and Components" column) #*#(for Expansion components see AMR Line Items AMR028, AMR063, and AMR076)	No
AMR033					Core barrel assembly: #*#baffle plate accessible surfaces within one inch around each baffle plate flow and bolt hole	Stainless steel; nickel alloy	Reactor coolant and neurton flux	Loss of fracture toughness #*#due to neutron irradiation embrittlement	Chapter XI.M16A, "PWR Vessel Internals" Primary components (identified in the "Structure and Components" column) #*#(for Expansion components see AMR Line Item AMR034)	No
AMR034					Core barrel assembly: #*#core barrel cylinder (including vertical and circumferential seam welds); #*#former plates	Stainless steel; nickel alloy	Reactor coolant and neurton flux	Loss of fracture toughness #*#due to neutron irradiation embrittlement	Chapter XI.M16A, "PWR Vessel Internals" Expansion components (identified in the "Structure and Components" column) #*#(for Primary components see AMR Line Item AMR033)	No
AMR040					Core support shield (CSS) assembly: #*#CSS cylinder (top flange); #*#differential height from the top of the plenum rib pads to the reactor vessel seating surface	Stainless steel; nickel alloy	Reactor coolant and neurton flux	Loss of material #*#due to wear	Chapter XI.M16A, "PWR Vessel Internals," #*#Primary component (identified in the "Structure and Components" column) #*#No Expansion components	No

AMR Unique ID	Gall Master ID	Item	Rev1 Related Item	New Rev2 Item	Structure and/or Component	Material	Environment	Aging Effect Mechanism	AMP	Further Evaluation
AMR043					Core support shield (CSS) assembly: #*#(a) CSS vent valve disc shaft or hinge pin #*#(b) CSS vent valve top retaining ring #*#(c) CSS vent valve bottom retaining ring	Stainless steel; nickel alloy	Reactor coolant and neurton flux	Loss of fracture toughness #*#due to thermal aging and neutron irradiation embrittlement	Chapter XI.M16A, "PWR Vessel Internals." #*#Primary Components (identified in the "Structure and Components" column) #*#No Expansion components	No
AMR044					Core support shield (CSS) assembly: #*#(a) CSS cast outlet nozzles (Oconee Unit 3 and Davis-Besse, only); #*#(b) CSS vent valve discs	Cast austenitic stainless steel	Reactor coolant and neurton flux	Loss of fracture toughness #*#due to thermal aging and neutron irradiation embrittlement	Chapter XI.M16A, "PWR Vessel Internals." #*#Primary Components (identified in the "Structure and Components" column) #*#(for Expansion components see ARM Line Item AMR013)	No
AMR060					Flow distributor assembly: #*#lower grid shock pad bolts and locking devices (TMI-1, only)	Stainless steel; nickel alloy	Reactor coolant and neurton flux	Cracking #*#due to stress corrosion cracking, irradiation-assisted stress corrosion cracking, and primary water stress corrosion cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water, and #*#Chapter XI.M16A, "PWR Vessel Internals," Expansion components (identified in the "Structure and Components" column) #*#(for Primary components see ARM Line Item AMR029)	No
AMR061					Flow distributor assembly: #*#lower grid shock pad bolts and locking devices (TMI-1, only)	Stainless steel; nickel alloy	Reactor coolant and neurton flux	Loss of fracture toughness #*#due to neutron irradiation embrittlement	Chapter XI.M16A, "PWR Vessel Internals" #*#Expansion components (identified in the "Structure and Components" column) #*#(for Primary components see ARM Line Item AMR030)	No
AMR062					Flow distributor assembly: #*#flow distributor bolts and locking devices	Stainless steel; nickel alloy	Reactor coolant and neurton flux	Cracking #*#due to stress corrosion cracking, irradiation-assisted stress corrosion cracking, and primary water stress corrosion cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water, and #*#Chapter XI.M16A, "PWR Vessel Internals," Expansion components (identified in the "Structure and Components" column) #*#(for Primary components see ARM Line Item AMR029)	No
AMR063					Flow distributor assembly: #*#flow distributor bolts and locking devices	Stainless steel; nickel alloy	Reactor coolant and neurton flux	Loss of fracture toughness #*#due to neutron irradiation embrittlement	Chapter XI.M16A, "PWR Vessel Internals" #*#Expansion components (identified in the "Structure and Components" column) #*#(for Primary components see AMR Line Item AMR030)	No
AMR065					Incore Monitoring Instrumentation (IMI) guide tube assembly: #*#accessible IMI Incore guide tube spider castings	Cast austenitic stainless steel	Reactor coolant and neurton flux	Loss of fracture toughness #*#due to thermal aging, neutron irradiation embrittlement	Chapter XI.M16A, "PWR Vessel Internals" #*#Primary components (identified in the "Structure and Components" column) #*#(for Expansion components see Line Items AMR013 and AMP070)	No
AMR066					Incore Monitoring Instrumentation (IMI) guide tube assembly: #*#IMI guide tube spider-to-lower grid rib sections welds	Stainless steel; nickel alloy	Reactor coolant and neurton flux	Loss of fracture toughness #*#due to thermal aging, neutron irradiation embrittlement	Chapter XI.M16A, "PWR Vessel Internals" #*#Primary components (identified in the "Structure and Components" column) #*#(for Expansion components see Line Item AMR070)	No

AMR Unique ID	Gall Master ID	Item	Rev1 Related Item	New Rev2 Item	Structure and/or Component	Material	Environment	Aging Effect Mechanism	AMP	Further Evaluation
AMR070					Lower grid assembly: #*#(a) accessible pads; #*#(b) pad-to-rib section welds; #*#(c) alloy X-750 dowels, cap screws and locking devices	Stainless steel; nickel alloy	Reactor coolant and neurton flux	Loss of fracture toughness #*#due to neutron irradiation embrittlement	Chapter XI.M16A, "PWR Vessel Internals" #*#Expansion components (identified in the "Structure and Components" column) #*#(for Primary componetns see AMR Line Items AMR065 and AMR066)	No
AMR073					Lower grid assembly: #*#alloy X-750 dowel-to-guide block welds	Stainless steel; nickel alloy	Reactor coolant and neurton flux	Cracking #*#due to stress corrosion cracking, irradiation-assisted stress corrosion cracking, and primary water stress corrosion cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water, and #*#Chapter XI.M16A, "PWR Vessel Internals" #*#Primary components (identified in the "Structure and Components" column) #*#(for Expansion components see AMR Line Item AMR074)	No
AMR074					Lower grid assembly: #*#accessible alloy X-750 dowel locking welds to the upper and lower fuel assembly suppport pads	Stainless steel; nickel alloy	Reactor coolant and neurton flux	Cracking #*#due to stress corrosion cracking, irradiation-assisted stress corrosion cracking, and primary water stress corrosion cracking	Chapter XI.M2, "Water Chemistry," for PWR primary water, and #*#Chapter XI.M16A, "PWR Vessel Internals" #*#Expansion components (identified in the "Structure and Components" column) #*#(for Primary components see AMR Line Item AMR073)	No
AMR084	1006	RP-24	IV.B4-38(RP-24)	IV.B4.RP-24	Reactor vessel internal components	Stainless steel; nickel alloy	Reactor coolant and neurton flux	Loss of material #*#due to pitting and crevice corrosion	Chapter XI.M2, "Water Chemistry" for PWR primary water	No
AMR090					Plenum cover and plenum cylinder assemblies: #*#(a) plenum rib pads (weldment rib pads); #*#(b) support flange #*#Differential height between top of plenum rib pads and reactor vessel seating surface, with plenum in vessel, for wear	Stainless steel	Reactor coolant and neurton flux	Loss of material and associated loss of clamping load #*#due to wear	Chapter XI.M16A, "PWR Vessel Internals." #*#Primary components (identified in the "Structure and Components" column) #*#No Expansion components	No
AMR200	479	R-53	IV.B4-37(R-53)	IV.B4.R-53	Reactor vessel internal components	Stainless steel; nickel alloy	Reactor coolant and neurton flux	Cumulative fatigue damage #*#due to fatigue	Fatigue is a time-limited aging analysis (TLAA) to be evaluated for the period of extended operation. See the Standard Review Plan, Section 4.3 "Metal Fatigue," for acceptable methods for meeting the requirements of 10 CFR 54.21(c)(1).	Yes, #*#TLAA