Enclosure B

Davis-Besse Nuclear Power Station, Unit No. 1 (Davis-Besse)

Letter L-15-139

AREVA NP Report No. ANP-3285 Revision 0,
"Confirmation of Stress Relief for the
DB-1 Core Support Shield Upper Flange Weld"

8 pages follow

AREVA

Confirmation of Stress Relief for the DB-1 Core Support Shield Upper Flange Weld

ANP-3285
Revision 0

March 2014

AREVA Inc.

Contents

Nomenclature

Acronym	Definition
B&W	Babcock and Wilcox
CE	Combustion Engineering
DB-1	Davis-Besse Unit 1
CSS	Core Support Structure
MRP	Materials Reliability Program
NSSS	Nuclear Steam Supply System
PWR	Pressurized Water Reactor
QADP	Quality Assurance Data Package
RV	Reactor Vessel

1.0 INTRODUCTION

The Materials Reliability Program (MRP) developed inspection and evaluation guidelines in MRP-227-A (Reference 1) for managing long-term aging of reactor vessel internals components of pressurized water reactors (PWRs). These guidelines contain mandatory and needed requirements and an implementation schedule for Babcock & Wilcox (B&W) nuclear steam supply systems (NSSSs) currently operating in the United States. The guidelines also contain applicant/licensee action items that shall be addressed by applicants/licensees who choose to implement the NRC approved version of MRP-227.

The fourth of these applicant/licensee action items is for the applicants/licensees of currently operating B&W NSSS units to confirm that the core support structure (CSS) upper flange weld was stress relieved during the original fabrication of the reactor vessel (RV) in order to confirm the applicability of MRP-227, as approved by the NRC, to their facility. If the stress relief was not performed, applicants/licensees must inspect this component as a "Primary" inspection category component consistent with the recommendations in MRP-227, as approved by the NRC, for the Westinghouse and Combustion Engineering (CE) upper core support barrel welds.

The purpose of this report is to address the above action item for the B&W-fabricated Davis-Besse Unit 1 (DB-1) RV internals.

2.0 SUMMARY

A records search was conducted to confirm that the CSS upper flange weld in the RV internals was stress relieved during original fabrication of the DB-1 RV internals. The detailed, signed and dated, step-by-step fabrication records of interest were reviewed.

Based on the records search reported in the following sections, a low frequency, vibratory stress relief was performed on the CSS upper flange weld during original fabrication of the DB-1 RV internals.

3.0 RECORDS SEARCH

The double U-Groove, double V-Groove, and J-Groove welds listed in MRP-189, Rev. 1 (Reference 2) Table 4-2 were reviewed. The welds from this table selected for this records search are large structural vertical or circumferential seam welds and large nozzle welds.

After the welds were selected, applicable drawings were reviewed to gain possible fabrication sequence history, and the records for the applicable mark (MK) and assembly numbers were searched. The MK numbers were obtained from the appropriate design drawings and confirmed by review of the associated fabrication records and the quality assurance data package (QADP).

The DB-1 fabrication records at the AREVA Lynchburg Old Forest Road facility were reviewed. The records search focused on the actual weld fabrication sequences and any post-weld stress relief performed on the welds of interest. The goal of the search was to find the detailed fabrication process sheets that show signed and dated evidence of completed process steps.

The welds investigated in this records search, including the CSS Upper Flange weld, are confirmed to have been stress relieved with a low frequency, vibratory stress equalization (Reference 3).

4.0 REFERENCES

1. *Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines (MRP-227-A).* EPRI, Palo Alto, CA: 2011. 1022863.

2. *Materials Reliability Program: Screening, Categorization, and Ranking of B&W-Designed PWR Internals Component Items (MRP-189-Rev. 1).* EPRI, Palo Alto, CA: 2009. 1018292.

3. All supporting documents are available for NRC review at AREVA facilities.

Enclosure C

Davis-Besse Nuclear Power Station, Unit No. 1 (Davis-Besse)

Letter L-15-139

AREVA NP Report No. ANP-3359NP Revision 0,
"Davis-Besse Reactor Vessel Internals
License Renewal Scope and MRP-189, Revision 1 Comparison"
(Non-Proprietary)

54 pages follow

AREVA

Davis-Besse Reactor Vessel Internals License Renewal Scope and MRP-189, Revision 1 Comparison

ANP-3359NP
Revision 0

December 2014

AREVA Inc.

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Nomenclature

Acronym or Abbreviation	Definition
AMP	Aging management program
AMR	Aging management review
ASTM	American Society of Testing and Materials
B&W	Babcock and Wilcox
BB	Baffle-to-baffle
CBF	Core barrel-to-former
CFR	Code of Federal Regulations
CRGT	Control rod guide tube
CSS	Core support shield
D-B	Davis-Besse Nuclear Power Station
EPRI	Electric Power Research Institute
FB	Baffle-to-former
FD	Flow distributor
FENOC	FirstEnergy Nuclear Operating Company
FMECA	Failure modes, effects, and criticality analysis
HTH	Hot-rolled, high temperature annealed and aged condition
I&E	Inspection and evaluation
IASCC	Irradiation assisted stress corrosion cracking
IE	Irradiation embrittlement
IMI	Incore monitoring instrumentation
ISI	Inservice inspection
ISR	Irradiation enhanced stress relaxation
LCB	Lower core barrel
LOCA	Loss of coolant accident
LRA	License renewal application
LTS	Lower thermal shield
MRP	Materials Reliability Program
NRC	Nuclear Regulatory Commission
PH	Precipitation hardenable
PWR	Pressurized water reactor
RV	Reactor vessel
SER	Safety evaluation report

Acronym or Abbreviation	Definition
SS	Stainless steel
SCC	Stress corrosion cracking
SSCs	Systems, structures, and components
SSHT	Surveillance specimen holder tube
TE	Thermal embrittlement
UCB	Upper core barrel
US	United States
UTS	Upper thermal shield
VS	Void swelling

1.0 INTRODUCTION

As part of the safety evaluation report (SER) for the license renewal application (LRA) of the Davis-Besse Nuclear Power Station (D-B), the United States (US) Nuclear Regulatory Commission (NRC) confirmed the applicability of License Renewal Commitment Item Number 15 [1]. Item Number 15 describes the D-B commitment to submit a plant-specific inspection plan for ensuring the implementation of the Electric Power Research Institute (EPRI) Materials Reliability Program (MRP) 227 program guidelines as amended by the MRP-227 NRC safety evaluation.

In December 2008, EPRI issued Revision 0 of MRP-227 inspection and evaluation (I&E) guidelines for managing long-term aging of pressurized water reactor (PWR) reactor vessel (RV) internals and submitted the report to the NRC for review and approval in January 2009. In June 2011, the SER for MRP-227, Revision 0 was issued by the NRC and was revised to Revision 1 in December 2011. This revised SER Revision 1 is included in the NRC-approved MRP-227-A report [2]. MRP-227-A provides generic augmented inspection requirements for the currently operating fleet of US PWRs.

Section 3.0 of the SER for MRP-227 documents the staff's evaluation and findings pertaining to the adequacy of the included aging management program (AMP) recommendations. In particular, Section 3.0 documents NRC staff concerns with MRP-227 and the basis for limitations and conditions being placed on the use of MRP-227 as well as licensee/applicant action items that are required to be addressed by applicants/licensees who choose to implement the NRC-approved version of MRP-227. FirstEnergy Nuclear Operating Company (FENOC) plans to implement MRP-227-A for D-B. To meet the commitment detailed in the D-B LRA and the NRC conditions upon the use of MRP-227, FENOC must perform the appropriate evaluation, analyses, and other required actions to fulfill the applicant/licensee action items specified in MRP-227-A. Of specific interest to this document, Section 4.2.2 of the MRP-227 SER defines Applicant/Licensee Action Item 2 as follows:

> *"As discussed in Section 3.2.5.2 of this SE, consistent with the requirements addressed in 10 CFR 54.4, each applicant/licensee is responsible for identifying which RV Internals components are within the scope of LR for its facility. Applicants/licensees shall review the information in Tables 4-1 and 4-2 in MRP-189, Revision 1, and Tables 4-4 and 4-5 in MRP-191 and identify whether these tables contain all of the RV Internals components that are within the scope of LR for their facilities in accordance with 10 CFR 54.4. If the tables do not identify all the RV Internals components that are within the scope of LR for its facility, the applicant or licensee shall identify the missing component(s) and propose any necessary modifications to the program defined in MRP-227, as modified by this SE, when submitting its plant-specific AMP. The AMP shall provide assurance that the effects of aging on the missing component(s) will be managed for the period of extended operation.* ***This issue is Applicant/Licensee Action Item 2.***"

The purpose of this document is to perform a comparison between the D-B RV internals license renewal scope and Tables 4-1 and 4-2 of MRP-189, Revision 1 to satisfy Applicant/Licensee Action Item 2. MRP-189, Revision 1 performs a categorization of the RV internals component items specific to the Babcock & Wilcox (B&W) design [3]. Note that MRP-191 is not considered because it is not applicable to the B&W design. Any D-B RV internals component items not reported in the relevant MRP-189 tables will be identified and evaluated and any necessary modifications to the MRP-227-A program will be proposed.

Information considered by AREVA to be proprietary is bracketed using the following brackets: **[ ]**

2.0 METHODOLOGY

The methodology used in this document to complete the comparison described in Section 1.0 is as follows:

1. Define the scope for license renewal.
2. Identify the RV internals component items within the scope of the license renewal and subject to aging management review (AMR) for D-B.
3. List the relevant RV internals component items and welds.
4. List component items and welds contained in Tables 4-1 and 4-2 of MRP-189, Revision 1.
5. Compare the tabulated component items defined in Steps 3 and 4 and identify whether the MRP-189, Revision 1 tables contain all of the RV internals component items and welds that are within the scope of license renewal and subject to AMR for D-B.
6. Propose any necessary modifications to the program defined in MRP-227-A to manage the aging effects of the identified D-B RV internals component items that are not included in MRP-189, Revision 1. This will be completed through the same screening methodology used to develop MRP-227-A. As described in MRP-227-A, the following sequence steps will be used:
    a. Identify RV internals components, materials, and environments
    b. Identify degradation screening criteria
    c. Characterize components and screen for degradation (A, non-A)
    d. Failure Modes, Effects, and Criticality Analysis (FMECA) review
    e. Severity categorization (A, B, C)
    f. Engineering evaluation and assessment
    g. Categorize for inspection (primary, expansion, existing, no additional measures) and aging management strategy

3.0 COMPARISON

3.1 *Scope Definition*

License renewal requirements for power reactors are defined in Title 10 of the Code of Federal Regulations, Part 54 (10 CFR 54) [4] and are based on the following key principles:

1. The regulatory process is adequate to ensure that the licensing bases of all currently operating plants maintain an acceptable level of safety with the possible exceptions of the detrimental aging effects on the functions of certain systems, structures, and components (SSCs), as well as a few other safety-related issues, during the period of extended operation.
2. The plant-specific licensing basis must be maintained during the renewal term in the same manner and to the same extent as during the original licensing term.

In implementing these two principles, 10 CFR 54.4, "Scope," defines SSCs included in the scope of license renewal as the following:

1. those that are safety-related,
2. those whose failure could affect safety-related functions, and
3. those that are relied on to demonstrate compliance with NRC regulations for fire protection, environmental qualification, pressurized thermal shock, anticipated transients without scram, and station blackout.

Following the determination of the SSCs that fall within the scope of 10 CFR 54.4, the applicant reviews these SSCs to determine which are subject to AMR. An in-scope SSC is subject to AMR if the component:

1. performs an intended function without moving parts or without a change in configuration or properties, and
2. is not subject to replacement based on a qualified life or specified time period.

3.1.1 *Identification of D-B License Renewal Scope for RV Internals*

The D-B RV internals components within the scope of license renewal and subject to AMR are determined based on the safety-related intended functions of the components. The safety-related intended functions are defined as:

1. Provide support for the core and maintain core in a coolable configuration under all operating conditions
2. Provide shielding to attenuate radiation generated in the core
3. Control primary coolant distribution to the core as required for design heat removal capability
4. Provide support and alignment for control rod drive mechanisms, control rods, and incore detectors

The D-B RV internals components within the scope of license renewal that support these intended functions are detailed in the Aging Management Review of the Reactor Vessel Internals for D-B (herein referred to as the "D-B AMR document").

3.1.2 *Component Items Contained in MRP-189, Rev. 1*

The RV internals component items contained in Tables 4-1 and 4-2 of MRP-189, Revision 1 are compared against the D-B RV internals component items within the scope of license renewal in Table 3-1 (component items) and Table 3-2 (welds) of this document. Component items contained in the MRP-189 tables that are not in the D-B RV internals scope of license renewal are not listed. These component items are outside the scope of this document as well as the description of the applicable licensee/applicant action item (specific action item wording is given in Section 1.0).

3.1.2.1 *Vent Valves*

As described in the SER for MRP-227, the vent valve disc, disc shaft, and hinge pin were determined to be active components. As described in Section 3.1, components that perform an intended function with a change in configuration are not subject to AMR. Therefore, these components are excluded from Table 3-1 below.

3.1.2.2 *RV Internals Welds*

Table 3-2 below details the comparison of the D-B RV internals welds to the MRP-189, Revision 1 Table 4-2 items. The D-B AMR document does not explicitly identify all welds used to fabricate the internals (as detailed in Table 4-2 of MRP-189, Revision 1). Therefore, the following process was used to identify the specific D-B welds for comparison. First, any specific weld described in the D-B AMR document was identified in Table 3-2 adjacent to the equivalent MRP-189, Revision 1 weld. Next, an assumption was made that specific assembly descriptions in the D-B AMR document included the relevant fabrication welds. For example, the D-B AMR document identifies the "plenum cylinder assembly" as a component within the scope of license renewal and subject to AMR. This document assumes that this line item includes all relevant fabrication welds for the plenum cylinder assembly (WC-34, WC-37, WC-66, WC-131, and WC-132). Finally, a fabrication records search of the D-B reactor vessel internals was completed in 2006 for use during the preparation of MRP-189, Revision 1. The search reviewed D-B internals fabrication records including weld data sheets, quality assurance data packages, and fabrication process travelers. The results of that fabrication records search were used to identify the D-B specific welds during the comparison to MRP-189, Revision 1 Table 4-2.

3.1.2.3 *RV Internals Bolting*

In response to industry and site experience, D-B has replaced the majority of the precipitation hardenable (PH) stainless steel (SS) (Alloy A-286) bolts for the reactor vessel internals. All the lower thermal shield (LTS) bolts were replaced with Alloy X-750 bolts in the hot-rolled, high temperature annealed and aged condition (HTH). Most of the original surveillance specimen holder tube (SSHT) bolts (68 of 72 bolts) were replaced with Alloy X-750 HTH bolts (with stainless steel locking devices). The remaining four original SSHT bolt locations no longer have a functional bolt. For the upper and lower core barrel bolts, only partial replacements with the Alloy X-750 HTH bolts were completed (117 of 120 upper core barrel (UCB) and 60 of 108 lower core barrel (LCB) bolts). It should be noted that, while three original UCB bolts remain, their original locking devices were replaced and are no longer in service. The original locking devices for the 48 remaining LCB bolts remain in service.

In addition, each replacement bolt (for the UCB, LCB, LTS, and SSHT) utilized a nickel-based alloy (Alloy X-750) cylindrical compression collar in the bolt design. This compression collar served to maintain the bolt pre-load during service to account for differences in thermal expansion coefficients between the Alloy X-750 bolt material and the stainless steel RV internals components. While these compression collars are not explicitly included in Table 4-1 of MRP-189, Revision 1, for the comparison below these items are assumed to be included with the Alloy X-750 bolting itself.

The D-B AMR document lists "locking clip" as part of the Lower Grid Assembly. Following the replacement of the LTS bolts along with the associated locking devices (as discussed above), locking clips are no longer used as part of the Lower Grid Assembly. Therefore, "locking clips" are not included in the Lower Grid Assembly section of Table 3-1. (Note: the original LCB bolt locking clips are included in the Core Barrel Assembly section of Table 3-1.)

3.1.2.4 *Surveillance Specimen Holder Tubes*

As stated in Section 3.3 of MRP-189, Revision 1, the SSHT assemblies were specifically excluded from the screening performed in MRP-189, Revision 1 due to the plant-specific changes to the assemblies. The SSHT assemblies are in service at D-B; however, as described in Section 2.3.1.2 of the D-B License Renewal Application, the SSHT assemblies were determined to not perform a safety function (as described in Section 3.1.1 of this document) and, therefore, are not subject to AMR [5]. The NRC concluded that D-B appropriately identified all reactor vessel internals components within the scope of license renewal in Section 2.3.1.2.3 of their SER [1]. Therefore, the SSHT components are not subject to AMR and are not screened further in this document.

3.1.2.5 *Plenum Cylinder Reinforcement Casting*

In Section 2.3.2 and Table 3-2 of MRP-189, Revision 1, the plenum cylinder reinforcing plates are described as thick stainless steel (ASTM A 240, Type 304) plates welded to the inner surface of the plenum cylinder with a set of small round bars or lugs welded to the plate outer surface to ensure an acceptable coolant flowpath during design basis transients. As described in the D-B AMR document, the D-B plenum cylinder reinforcement plate is a different material than the reinforcement plates in the other B&W designed units as described in MRP-189,

Revision 1. For D-B, a stainless steel casting (ASTM A 351, Grade CF-8) with the lugs integrally cast with the plate is welded directly into the plenum cylinder. Therefore, the specific D-B material type for this component is not consistent with material type defined for this component in MRP-189, Revision 1. However, this component had been previously screened, and it was determined that the delta ferrite content of these castings is less than 13%, which is below the 20% delta ferrite screening value in MRP-175 for thermal aging embrittlement. Therefore, this would result in the component being placed with the Category "A" items during the screening process in MRP-189. As such, no additional evaluations are required. This is consistent with Item 14 in Table 3-1 below.

3.1.2.6 *Lower Grid Guide Blocks*

The original attachment method for the guide blocks to the lower grid was with a washer and bolt assembly that were welded to each other and the guide block and an Alloy X-750 dowel that was similarly welded to the guide block. This design is reflected in MRP-189, Revision 1. However, subsequent to original hot functional testing, D-B modified the guide block attachment on the lower grid assembly. The bolts, washers, and dowels (along with the welds) were removed, and the dowels were replaced with Alloy A-286 dowels that were welded to the guide blocks. The guide block was welded to the lower grid with a continuous fillet weld. Therefore, Table 3-1 below reflects that the guide block bolting has been removed from service and the actual dowel in service is fabricated of stainless steel material. Table 3-2 reflects that the bolting welds and the nickel-alloy weld to the Alloy X-750 dowel have been removed from service. The additional welds on the modified D-B guide blocks and on the dowel are included in Table 3-2.

Table 3-1: Comparison of D-B RV Internals License Renewal Scope to MRP-189 Revision 1 Component Items

Item	D-B RV Internals Component Item	Reference	MRP-190 Identifier	MRP-189 Component Item (MRP-189 Table 4-1) [3]
Plenum Cover Assembly				
1	Weldment Rib	D-B AMR Document	P.1.1	Weldment Ribs
2	Rib Pad	D-B AMR Document	P.1.2	Weldment Rib Pads
3	Bottom Flange	D-B AMR Document	P.1.3	Bottom Flange
4	Support Flange	D-B AMR Document	P.1.4	Support Flange
5	Support Ring	D-B AMR Document	P.1.5	Support Ring
6	Plate	D-B AMR Document	P.1.6	Cover Plate
7	Lifting Lug	D-B AMR Document	P.1.7	Lifting Lugs
8	Block	D-B AMR Document	P.1.8	Base Block for Lifting Lugs
9	Lifting Lug to Base Block Bolts	D-B AMR Document	P.1.9	Lifting Lug to Base Block Bolts
10	Locking Cup	D-B AMR Document	P.1.10	Locking Cups

Item	D-B RV Internals Component Item	Reference	MRP-190 Identifier	MRP-189 Component Item (MRP-189 Table 4-1) [3]
Plenum Cylinder Assembly				
11	Cylinder	D-B AMR Document	P.2.1	Cylinder
12	Top Flange	D-B AMR Document	P.2.2	Top Flange
13	Bottom Flange	D-B AMR Document	P.2.3	Bottom Flange
14	Reinforcing Plate Refer to Section 3.1.2.5	D-B AMR Document	P.2.4	Reinforcing Plates
15	Top Flange to Cover Bolts	D-B AMR Document	P.2.6	Top Flange to Cover Bolts
16	Locking Cup	D-B AMR Document	P.2.7	Locking Cups
17	Bottom Flange to Upper Grid Screw	D-B AMR Document	P.2.8	Bottom Flange to Upper Grid Bolts
18	Locking Cup	D-B AMR Document	P.2.9	Locking Cups
Upper Grid Assembly				
19	Rib Section	D-B AMR Document	P.3.1	Rib Section
20	Fuel Assembly Support Pad	D-B AMR Document	P.3.5	Fuel Assembly Support Pads
21	Dowel	D-B AMR Document	P.3.6	Dowels
22	Cap Screw	D-B AMR Document	P.3.7	Cap Screws

Item	D-B RV Internals Component Item	Reference	MRP-190 Identifier	MRP-189 Component Item (MRP-189 Table 4-1) [3]
23	Ring Forging	D-B AMR Document	P.3.2	Ring Forging
24	Rib to Ring Screw	D-B AMR Document	P.3.3	Rib to Ring Cap Screws
25	Lock Pin	D-B AMR Document	P.3.4	Locking Pins
Control Rod Guide Tube (CRGT) Assembly				
26	CRGT Pipe	D-B AMR Document	P.4.1	Pipe
27	CRGT Flange	D-B AMR Document	P.4.2	Flange
28	Flange to Upper Grid Screw	D-B AMR Document	P.4.3	Flange to Upper Grid Cap Screws
29	Dowel	D-B AMR Document	P.4.4	Flange Dowels
30	CRGT Spacer Casting	D-B AMR Document	P.4.5	Spacer Castings
31	Spacer Casting Screw	D-B AMR Document	P.4.6	Spacer Casting Cap Screws
32	Spacer Casting Washer	D-B AMR Document	P.4.7	Spacer Casting Washers
33	CRGT Rod Guide Tube	D-B AMR Document	P.4.8	Rod Guide Tubes
34	CRGT Rod Guide Sector	D-B AMR Document	P.4.9	Rod Guide Sectors

Item	D-B RV Internals Component Item	Reference	MRP-190 Identifier	MRP-189 Component Item (MRP-189 Table 4-1) [3]
Core Support Shield (CSS) Assembly				
35	Core Support Shield Cylinder	D-B AMR Document	S.1	Cylinder
36	Top Flange	D-B AMR Document	S.2	Top Flange
37	Bottom Flange	D-B AMR Document	S.3	Bottom Flange
38	Upper Core Barrel Bolts (original)	D-B AMR Document	S.4a	UCB: Original A-286 CSS to Core Barrel Bolts
39	Core Support Shield to Core Barrel (UCB) Bolts – Replacement	D-B AMR Document	S.4d	UCB: Replacement X-750 CSS to Core Barrel Bolts
40	Not in service Refer to Section 3.1.2.3		S.5a	Locking Clips (Locking Devices for Original UCB Bolts)
41	UCB Bolts Locking Devices (Replacement)	D-B AMR Document	S.5b	Locking Cups and Washers
42	UCB Bolts Locking Devices (Replacement)	D-B AMR Document	S.5c	Tie Plates
43	Outlet Nozzle	D-B AMR Document	S.6b	Cast Outlet Nozzles
44	CSS Mounting Rings	D-B AMR Document	S.7	Vent Valve Nozzles
45	Vent Valve Guide Block	D-B AMR Document	S.8	Vent Valve Nozzles Guide Blocks
46	Vent Valve Assembly	D-B AMR Document	S.9	Vent Valve Body

Item	D-B RV Internals Component Item	Reference	MRP-190 Identifier	MRP-189 Component Item (MRP-189 Table 4-1) [3]
47	Vent Valve Top Retaining Ring	D-B AMR Document	S.10	Vent Valve Top Retaining Ring
48	Vent Valve Bottom Retaining Ring	D-B AMR Document	S.10	Vent Valve Bottom Retaining Ring
49	Vent Valve Assembly	D-B AMR Document	S.11	Vent Valve Jack Screws
50	Vent Valve Assembly	D-B AMR Document	S.13	Disc Bushing
51	Vent Valve Assembly (Original Vent Valve Miscellaneous Locking Device Parts)	D-B AMR Document		No corresponding component items included in MRP-189, Revision 1 for D-B
52	Round Bar	D-B AMR Document	S.15	Round Bars
53	Flow Deflector	D-B AMR Document	S.16	Flow Deflectors
54	Lifting Lug	D-B AMR Document	S.17	Lifting Lugs
Core Barrel Assembly				
55	Core Barrel Cylinder	D-B AMR Document	B.1	Core Barrel Cylinder
56	Top Flange	D-B AMR Document	B.2	Top Flange
57	Bottom Flange	D-B AMR Document	B.3	Bottom Flange
58	Lower internals assembly to core barrel (LCB) bolts – original	D-B AMR Document	B.4a	LCB: Original A-286 Lower Grid Assembly to Core Barrel Bolts

Item	D-B RV Internals Component Item	Reference	MRP-190 Identifier	MRP-189 Component Item (MRP-189 Table 4-1) [3]
59	Lower internals assembly to core barrel (LCB) bolts – replacement	D-B AMR Document	B.4d	LCB: Replacement X-750 Lower Grid Assembly to Core Barrel Bolts
60	LCB Bolts (Original) Locking Devices (Locking Clip)	D-B AMR Document	B.5a	Locking Clips
61	LCB Bolts (Replacement) Locking Devices (Locking Cup)	D-B AMR Document	B.5b	Tie Plates
62	LCB Bolts (Replacement) Locking Devices (Tie Plate)	D-B AMR Document	B.5b	Locking Cups
63	Core barrel to thermal shield (UTS) bolts	D-B AMR Document	B.6a	UTS: A-286 Thermal Shield to Core Barrel Bolts
64	UTS Bolts Locking Devices (Locking Clips)	D-B AMR Document	B.7	Locking Clips
65	SSHT Bolts (Replacement)	D-B AMR Document	B.8b	X-750 Replacement SSHT to Thermal Shield Bolts
66	SSHT Replacement Bolts Locking Devices (Locking Cup and Tie Plate)	D-B AMR Document	B.9	Replacement SSHT to Thermal Shield Bolts Locking Cups and Tie Plates
67	Thermal Shield	D-B AMR Document	B.10	Thermal Shield Cylinder
68	Thermal Shield Upper Restraint "A" and "B"	D-B AMR Document	B.11	Thermal Shield Upper Restraint "A" and "B" Blocks
69	Thermal Shield Upper Restraint Shims	AREVA Drawing	B.12	Thermal Shield Upper Restraint Shims
70	Hardfacing	AREVA Drawing	B.13	Thermal Shield Upper Restraint Hardfacing ("A" and "B" Blocks)
71	Plug	AREVA Drawing	B.14	Thermal Shield Upper Restraint Upper Plugs

Item	D-B RV Internals Component Item	Reference	MRP-190 Identifier	MRP-189 Component Item (MRP-189 Table 4-1) [3]
72	Thermal Shield Restraint Dowel	D-B AMR Document	B.15	Thermal Shield Upper Restraint Dowels (not exposed)
73	Thermal Shield Upper Restraint Cap Screw	D-B AMR Document	B.16	Thermal Shield Upper Restraint Cap Screws (not exposed)
74	Baffle Plate	D-B AMR Document	B.17	Baffle Plates
75	Formers	D-B AMR Document	B.18	Former Plates
76	Barrel to Former Bolts	D-B AMR Document	B.19	Core Barrel to Former Plate Cap Screws
77	Locking Pin	D-B AMR Document	B.20	Locking Pins
78	Alloy X-750 Core Barrel-to-Former Plate Dowel	D-B AMR Document	B.21	Core Barrel to Former Plate Dowels
79	Baffle to Former Bolts	D-B AMR Document	B.22	Baffle to Former Hex head Bolts (except F4)
80	Locking Pin	D-B AMR Document	B.23	Locking Pins
81	Baffle to Former Shoulder Screws	D-B AMR Document	B.24	Baffle to Former Shoulder Screws (F4)
82	Locking Dowel	D-B AMR Document	B.25	Locking Dowels
83	Baffle to Baffle Bolts	D-B AMR Document	B.26	Baffle to Baffle 12 Pt Bolts
84	Locking Ring	D-B AMR Document	B.27	Locking Rings

Item	D-B RV Internals Component Item	Reference	MRP-190 Identifier	MRP-189 Component Item (MRP-189 Table 4-1) [3]
Lower Grid Assembly				
85	Lower Grid Rib Section	D-B AMR Document	L.1.1	Lower Grid Rib Section
86	Fuel Assembly Support Pad	D-B AMR Document	L.1.2	Lower Grid Fuel Assembly Support Pad
87	Dowel	D-B AMR Document	L.1.3	Dowels
88	Cap Screw	D-B AMR Document	L.1.4	Cap Screws
89	Cap Screw	D-B AMR Document	L.1.5	Rib to Shell Forging Cap Screws
90	Locking Pin	D-B AMR Document	L.1.6	Locking Pins
91	Lower Grid Flow Distributor Plate	D-B AMR Document	L.1.7	Lower Grid Flow Distributor Plate
92	Orifice Plug	D-B AMR Document	L.1.8	Orifice Plugs
93	Lower Grid Forging	D-B AMR Document	L.1.9a	Lower Grid Forging
94	Lower Grid Flange	D-B AMR Document	L.1.10	Lower Grid Shell Forging
95	Lower Internals Assembly to Thermal Shield (LTS) Bolts	D-B AMR Document	L.1.11c	LTS: Replacement X-750 Lower Grid Assembly to Thermal Shield Bolts
96	LTS Replacement Bolt Locking Device (Locking Cup)	D-B AMR Document	L.1.12	Locking Cups

Item	D-B RV Internals Component Item	Reference	MRP-190 Identifier	MRP-189 Component Item (MRP-189 Table 4-1) [3]
97	LTS Replacement Bolt Locking Device (Tie Plate)	D-B AMR Document	L.1.12	Tie Plates
98	Guide Block	D-B AMR Document	L.1.13	Guide Blocks (mating with Guide Lugs on RV)
99	Not in service Refer to Section 3.1.2.6		L.1.14a, L.1.14b, L.1.15	Guide Block Bolts, Washers, and Dowels
100	Dowel Cap	D-B AMR Document		No corresponding component items included in MRP-189, Revision 1 for D-B
101	Guide Block Replacement Dowel	D-B AMR Document		No corresponding component items included in MRP-189, Revision 1 for D-B
102	Shock Pad	D-B AMR Document	L.1.16a&b	Shock Pads
103	Shock Pad Bolt	D-B AMR Document	L.1.17a	Bolts
104	Support Post Pipe	D-B AMR Document	L.1.18	Support Post Pipes
105	Bolting Plug	D-B AMR Document	L.1.19	Bolting Plugs
106	Support Post Cap Screw	D-B AMR Document	L.1.20	Cap Screws
107	Locking Pin	D-B AMR Document	L.1.21	Locking Pins
Flow Distributor Assembly				
108	Flow Distributor Head	D-B AMR Document	L.2.1	Flow Distributor Head

Item	D-B RV Internals Component Item	Reference	MRP-190 Identifier	MRP-189 Component Item (MRP-189 Table 4-1) [3]
109	Flow Distributor Flange	D-B AMR Document	L.2.2	Flow Distributor Flange
110	Shell Forging to Flow Distributor Bolts	D-B AMR Document	L.2.3a	FD: A-286 Flow Distributor to Lower Grid Shell Forging Bolts
111	Locking Clip	D-B AMR Document	L.2.4	Locking Clips
112	Incore Guide Support Plate	D-B AMR Document	L.2.5	IMI Guide Support Plate
113	Clamping Ring	D-B AMR Document	L.2.6	IMI Guide Support Plate Clamping Ring
114	Dowel	D-B AMR Document	L.2.7	IMI Guide Support Plate Dowel
Incore Monitoring Instrumentation (IMI) Guide Tube Assembly				
115	Incore Guide Tube	D-B AMR Document	L.3.1	IMI Guide Tubes
116	Gusset	D-B AMR Document	L.3.2	IMI Guide Tube Gussets
117	Guide Tube Washer	D-B AMR Document	L.3.3	IMI Guide Tube Washers
118	Guide Tube Nut	D-B AMR Document	L.3.4	IMI Guide Tube Nuts
119	Locking Clip	D-B AMR Document	L.3.5	Locking Clips
120	Spider	D-B AMR Document	L.3.6	IMI Guide Tube Spider Castings

Table 3-2: Comparison of D-B RV Internals License Renewal Scope to MRP-189 Revision 1 Welds

Item	D-B RV Internals Weld Item	Reference	Weld ID	MRP-189 Weld Description (MRP-189 Table 4-2) [3]	MRP-190 Component IDs
Core Barrel Assembly					
1	Core barrel cylinder (including vertical and circumferential seam welds)	D-B AMR Document	WC-11	Top and bottom core barrel cylinders to top and bottom core barrel flanges circumferential seam weld	B.1, B.2, and B.3
2	Thermal shield assembly	D-B AMR Document	WC-12	Top and bottom thermal shield cylinder vertical seam weld	B.10
3	Thermal shield assembly	D-B AMR Document	WC-13	Top thermal shield cylinder to bottom thermal shield cylinder circumferential seam weld	B.10
4	Inaccessible locking device and locking weld (CBF bolts)	D-B AMR Document	WC-15	Core barrel-to-former plate cap screw locking pin to core barrel cylinder weld	B.19 and B.1
5	Accessible locking device and locking weld (FB bolts)	D-B AMR Document	WC-15	Baffle-to-former bolt locking pin to baffle plate weld	B.23 and B.17
6	Accessible locking device and locking weld (internal and external BB bolts)	D-B AMR Document	WC-16	Baffle-to-baffle bolt locking ring to baffle plate weld	B.27 and B.17
7	Core barrel cylinder (including vertical and circumferential seam welds)	D-B AMR Document	WC-20	Core barrel top and bottom cylinder vertical seam weld	B.1
8	Core barrel cylinder (including vertical and circumferential seam welds)	D-B AMR Document	WC-21	Core barrel top cylinder to core barrel bottom cylinder circumferential seam weld	B.1
9	Core barrel assembly	D-B AMR Document	WC-94	Plug weld locking dowel flush with special flat head baffle-to-former shoulder screw	B.24 and B.25
10	Alloy X-750 dowel-to-core barrel cylinder fillet welds	D-B AMR Document	WC-130	X-750 dowel to top and bottom core barrel cylinders fillet weld	B.1

Item	D-B RV Internals Weld Item	Reference	Weld ID	MRP-189 Weld Description (MRP-189 Table 4-2) [3]	MRP-190 Component IDs
11	Lower core barrel (LCB) bolts (original) and their locking devices (locking clip weld)	D-B AMR Document	WC-141	Locking clip (for original LCB bolt) to lower grid shell forging weld	B.6a and L.1.10
12	Alloy X-750 dowel to core barrel cylinder fillet welds	D-B AMR Document	WC-164	X-750 dowel to core barrel cylinder weld (both ends)	B.1
13	Thermal shield assembly	D-B AMR Document	WCF-220	Plug dowel to thermal shield upper restraint "A" weld	B.15 and B.11
Core Support Shield Assembly					
14	Thermal shield assembly	D-B AMR Document	WCF-176	Locking clip (for original UTS bolts) to thermal shield upper restraint "A" weld	S.5a and B.11
15	Core support shield cylinder	D-B AMR Document	WC-43	Core support shield cylinder to top and bottom flange circumferential seam weld	S.1, S.2, and S.3
16	Core support shield cylinder	D-B AMR Document	WC-44	Core support shield cylinder to vent valve nozzle weld	S.1 and S.7
17	Core support shield cylinder	D-B AMR Document	WC-45	Core support shield cylinder to vent valve nozzle weld (opposite WC-44)	S.1 and S.7
18	Core support shield cylinder	D-B AMR Document	WC-46	Core support shield cylinder to outlet nozzle weld	S.1 and S.6a&b
19	Core support shield cylinder	D-B AMR Document	WC-47	Core support shield cylinder to outlet nozzle fillet weld (opposite WC-46)	S.1 and S.6a&b
20	Flow deflector	D-B AMR Document	WC-48	Flow deflector (U-baffle) segments weld	S.16
21	Core support shield cylinder	D-B AMR Document	WC-49	Core support shield lifting lug to top flange weld	S.17 and S.2
22	Core support shield cylinder	D-B AMR Document	WC-50	Core support shield lifting lug to top flange weld (opposite WC-49)	S.17 and S.2

Item	D-B RV Internals Weld Item	Reference	Weld ID	MRP-189 Weld Description (MRP-189 Table 4-2) [3]	MRP-190 Component IDs
23	Core support shield cylinder	D-B AMR Document	WC-51	Core support shield cylinder vertical seam weld	S.1
24	Core support shield cylinder	D-B AMR Document	WC-52	Round (LOCA) bars to core support shield cylinder ID surface weld	S.15 and S.1
25	Core support shield assembly	D-B AMR Document	WC-53	Flow deflector (U-baffle) to core support shield cylinder weld	S.16 and S.1
26	Core support shield assembly	D-B AMR Document	WC-105	Guide block to core support shield vent nozzle fillet weld	S.8 and S.7
27	Core support shield assembly	D-B AMR Document	WCF-264	Locking clip (for original UCB A-286 bolts) to core support shield bottom flange weld	S.5a and S.3
28	Core support shield assembly	D-B AMR Document	WCF-265	Locking clip (for original UCB A-286 bolts) to core support shield bottom flange weld	S.5a and S.3
CRGT Assembly					
29	Control rod guide tube assembly	D-B AMR Document	WC-40	Washer to CRGT pipe and spacer bolt weld (WC-64 for top spacer)	P.4.7 and P.4.1
30	Control rod guide tube assembly	D-B AMR Document	WC-41	CRGT flange to CRGT pipe weld (all around except at the 4 scallops)	P.4.2 and P.4.1
31	Control rod guide tube assembly	D-B AMR Document	WC-42	Type 304 dowel to CRGT flange weld	P.4.4 and P.4.2
32	Control rod guide tube assembly	D-B AMR Document	WC-64	Washer to CRGT pipe and spacer bolt weld (also see WC-40)	P.4.7 and P.4.1
33	Control rod guide tube assembly	D-B AMR Document	WC-65	CRGT pipe to plenum cover plate weld	P.4.1 and P.1.6
34	Control rod guide tube assembly	D-B AMR Document	WC-67	CRGT flange cap screw (joining upper grid rib section) to CRGT flange weld	P.4.3 and P.4.2

Item	D-B RV Internals Weld Item	Reference	Weld ID	MRP-189 Weld Description (MRP-189 Table 4-2) [3]	MRP-190 Component IDs
Flow Distributor Assembly					
35	Flow distributor assembly	D-B AMR Document	WC-57	Flow distributor flange to flow distributor head circumferential seam weld	L.2.2 and L.2.1
36	Alloy X-750 dowel to flow distributor flange welds	D-B AMR Document	WC-58	X-750 dowel to flow distributor flange weld	L.2.2
37	Flow distributor assembly	D-B AMR Document	WC-60	Flow distributor (FD) bolt locking clip to flow distributor flange weld	L.2.4 and L.2.2
38	Clamping ring	D-B AMR Document	WC-157	IMI guide support plate clamping ring vertical seam weld	L.2.6
39	Flow distributor assembly	D-B AMR Document	WC-161	Dowel (for clamping ring) to flow distributor flange weld	L.2.7 and L.2.2
IMI Guide Tube Assembly					
40	Flow distributor assembly	D-B AMR Document	WC-158	Incore instrument guide tubes (center) to flow distributor head weld	L.3.1 and L.2.1
41	Incore guide tube assembly	D-B AMR Document	WC-158	Incore instrument guide tubes (peripheral) to flow distributor head weld	L.3.1 and L.2.1
42	Incore guide tube assembly	D-B AMR Document	WC-159	Incore instrument guide tubes (center) to flow distributor head and gusset weld	L.3.1, L.2.1, and L.3.2
43	IMI guide tube spider to lower grid rib section welds	D-B AMR Document	WC-160	Spider to lower grid rib section weld	L.3.6 and L.1.1
44	Incore guide tube assembly	D-B AMR Document	WC-187	Nut locking clip to incore instrument guide tube nut weld	L.3.5 and L.3.4
45	Incore guide tube assembly	D-B AMR Document	WC-188	Nut locking clip to incore instrument guide tube weld	L.3.5 and L.3.1

Item	D-B RV Internals Weld Item	Reference	Weld ID	MRP-189 Weld Description (MRP-189 Table 4-2) [3]	MRP-190 Component IDs
Lower Grid Assembly					
46	Alloy X-750 dowel to lower grid shell forging welds	D-B AMR Document	WC-4	X-750 dowel to lower grid shell forging weld	L.1.10
47	Lower grid assembly	D-B AMR Document	WC-5	Support post to lower grid forging weld	L.1.18 and L.1.10
48	Lower grid assembly	D-B AMR Document	WC-8	Lower grid forging (or weldment) to lower grid shell forging weld	L.1.9a&b and L.1.10
49	Lower grid assembly	D-B AMR Document	WC-26	Flow distributor plate to lower grid shell forging weld	L.1.7 and L.1.10
50	Lower grid assembly	D-B AMR Document	WC-27	Support post to flow distributor plate weld	L.1.18 and L.1.7
51	Lower fuel assembly support pads: cap screw and associated locking weld	D-B AMR Document	WC-59	Cap screw to lower fuel assembly pad weld	L.1.4 and L.1.2
52	Lower grid assembly	D-B AMR Document	WC-97	Bolting plug to support post weld	L.1.19 and L.1.18
53	Alloy X-750 dowel to lower grid rib section weld	D-B AMR Document	WC-98	X-750 dowel to lower grid rib section weld	L.1.3 and L.1.1
54	Lower grid assembly	D-B AMR Document	WC-99	Locking pin (for lower grid rib section cap screw) to lower grid rib section weld	L.1.6 and L.1.1
55	Lower grid assembly	D-B AMR Document	WC-100	Locking pin (for lower grid support post cap screw) to lower grid rib section weld	L.1.21 and L.1.1
56	Lower grid assembly	D-B AMR Document	WC-101	Shock pad bolt to shock pad fillet weld	L.1.17a and L.1.16a&b

Item	D-B RV Internals Weld Item	Reference	Weld ID	MRP-189 Weld Description (MRP-189 Table 4-2) [3]	MRP-190 Component IDs
57	Lower grid guide block to lower grid assembly weld (See Section 3.1.2.6)	D-B AMR Document		No corresponding component items included in MRP-189, Revision 1 for D-B	
58	Lower grid assembly	D-B AMR Document	WC-142	Lower grid forging (or weldment) to lower grid shell forging weld	L.1.9a & b and L.1.10
59	Lower grid assembly	D-B AMR Document	WC-142	Support post to flow distributor plate weld	L.1.18 and L.1.7
60	Lower grid assembly	D-B AMR Document	WC-142	Flow distributor plate to lower grid shell forging weld	L.1.7 and L.1.10
61	Lower fuel assembly support pads: pad to rib section weld	D-B AMR Document	WC-173	Fuel grid pad to lower grid rib section weld	L.1.2 and L.1.1
62	Lower grid flow distributor plate	D-B AMR Document	WC-240	Orifice plugs to flow distributor plate weld	L.1.8 and L.1.7
63	Not in service Refer to Section 3.1.2.6	D-B AMR Document	WCF-103 WCF-104	Guide block bolt washer to guide block weld X-750 dowel to guide block weld	L.1.14b, L.1.15, and L.1.13
64	Lower grid assembly: Alloy A-286 dowel to guide block welds (See Section 3.1.2.6)	D-B AMR Document		No corresponding component items included in MRP-189, Revision 1 for D-B	
65	Lower grid assembly: Alloy X-750 dowel-to-lower fuel assembly support pad welds	D-B AMR Document	WC-3	X-750 dowel to lower fuel assembly pad weld	L.1.2 and L.1.3
Plenum Cover Assembly					
66	Plenum cover assembly	D-B AMR Document	WC-18	Two plenum cover support ring segments to form a complete plenum cover support ring weld	P.1.5
67	Plenum cover assembly	D-B AMR Document	WC-19	Plenum cover support ring to plenum cover support flange weld	P.1.5 and P.1.4

Item	D-B RV Internals Weld Item	Reference	Weld ID	MRP-189 Weld Description (MRP-189 Table 4-2) [3]	MRP-190 Component IDs
68	Plenum cover assembly	D-B AMR Document	WC-28	Plenum cover weldment ribs to each other weld	P.1.1
69	Plenum cover assembly	D-B AMR Document	WC-29	Plenum cover weldment ribs to support ring and support flange weld	P.1.1, P.1.4, and P.1.5
70	Plenum cover assembly	D-B AMR Document	WC-30	Plenum cover bottom flange to plenum cover weldment ribs weld	P.1.3 and P.1.1
71	Plenum cover assembly	D-B AMR Document	WC-31	Plenum cover plate to plenum cover weldment ribs weld	P.1.6 and P.1.1
72	Alloy X-750 dowels to plenum cover bottom flange welds	D-B AMR Document	WC-33	X-750 dowels to plenum cover bottom flange weld	P.1.3
73	Plenum cover assembly	D-B AMR Document	WC-75	Locking cup (for plenum cover lifting lug bolt) to lifting lug base block weld	P.1.10 and P.1.8
74	Plenum cover assembly	D-B AMR Document	WC-124	Plenum cover support ring to plenum cover support flange (WC-124 on the ID side, WC-19 on the OD side) weld	P.1.5 and P.1.4
75	Plenum cover assembly	D-B AMR Document	WC-126	Plenum cover support flange to the bottom of plenum cover weldment ribs weld	P.1.4 and P.1.1
76	Plenum cover assembly	D-B AMR Document	WC-127	Plenum cover lifting lug base block between 2 plenum cover weldment ribs weld	P.1.8 and P.1.1
77	Plenum cover assembly	D-B AMR Document	WC-128	Plenum cover lifting lug base block between 2 plenum cover weldment ribs weld	P.1.8 and P.1.1
78	Plenum cover assembly	D-B AMR Document	WC-129	Plenum cover lifting lug base block between 2 plenum cover weldment ribs weld	P.1.8 and P.1.1
79	Plenum cover assembly	D-B AMR Document	WC-133	Plenum cover rib pads to plenum cover weldment rib weld	P.1.2 and P.1.1

Item	D-B RV Internals Weld Item	Reference	Weld ID	MRP-189 Weld Description (MRP-189 Table 4-2) [3]	MRP-190 Component IDs
80	Plenum cover assembly	D-B AMR Document	WC-142	Plenum cover plate to the top of plenum cover weldment rib weld	P.1.6 and P.1.1
81	Plenum cover assembly	D-B AMR Document	WC-142	Plenum cover weldment rib to the other weldment rib weld	P.1.1
82	Plenum cover assembly	D-B AMR Document	WC-142	Plenum cover rib pads to plenum cover support ring weld	P.1.2 and P.1.5
Plenum Cylinder Assembly					
83	Plenum cylinder assembly	D-B AMR Document	WC-34	Plenum cylinder to top and bottom plenum cylinder flanges circumferential seam weld	P.2.1, P.2.2, and P.2.3
84	Plenum cylinder assembly	D-B AMR Document	WC-34	Plenum cylinder bottom flange to reinforcement weld	P.2.3 and P.2.4
85	Plenum cylinder assembly	D-B AMR Document	WC-37	Plenum cylinder vertical seam weld	P.2.1
86	Plenum cylinder assembly	D-B AMR Document	WC-66	Locking cup (for bolts joining plenum cylinder top flange to plenum cover bottom flange) to plenum cylinder top flange weld	P.2.7 and P.2.2
87	Plenum cylinder assembly	D-B AMR Document	WC-66	Locking cup (for bolts joining plenum cylinder bottom flange to upper grid ring forging) to plenum cylinder bottom flange weld	P.2.9 and P.2.3
88	Plenum cylinder assembly	D-B AMR Document	WC-131	Plenum cylinder reinforcement to plenum cylinder weld	P.2.4 and P.2.1
89	Plenum cylinder assembly	D-B AMR Document	WC-132	Plenum cylinder reinforcement to plenum cylinder weld (opposite WC-131 weld)	P.2.4 and P.2.1

Item	D-B RV Internals Weld Item	Reference	Weld ID	MRP-189 Weld Description (MRP-189 Table 4-2) [3]	MRP-190 Component IDs
Upper Grid Assembly					
90	Upper grid assembly	D-B AMR Document	WC-23	Cap screw to upper grid fuel assembly support pad weld	P.3.7 and P.3.5
91	Upper grid assembly	D-B AMR Document	WC-95	Locking pin (for cap screw to joining upper grid rib section to upper grid ring forging) to upper grid rib section weld	P.3.4 and P.3.1
92	Upper grid assembly	D-B AMR Document	WC-173	Fuel assembly support pad to upper grid rib section weld	P.3.5 and P.3.1
93	Alloy X-750 dowel to upper grid rib section bottom flange welds	D-B AMR Document	WC-96	X-750 dowel (for alignment) to upper grid rib section weld	P.3.1

3.2 *Component Item Comparison*

As illustrated in Table 3-1, the component items that are included in the scope of license renewal and subject to AMR for D-B, but are not included in MRP-189, Revision 1, are the vent valve miscellaneous locking device parts (Table 3-1, Item 51) and the items (Table 3-1, Items 100 and 101) and welds (Table 3-2, Items 57 and 64) associated with the lower grid guide block attachment replacement. Note that even though the lower grid guide blocks (Table 3-1, Item 98) were screened as part of MRP-189, Revision 1, these guide blocks were modified in that they were welded to the lower grid and, therefore, need to re-screened.

3.2.1 *Vent Valve Locking Device*

D-B has four vent valves installed in the core support shield (CSS) cylinder to a vent valve mounting ring (also called vent valve nozzle) that is welded into the CSS cylinder (refer to Figure 3-1, Figure 3-2, and Figure 3-3). To accommodate the vent valves, the inner surfaces of the rings have lips and flanges. Each vent valve consists of a hinged disc, a valve body with sealing surfaces, a split-retaining ring and fasteners (that retain and seal the perimeter of the valve assembly), and an alignment device (to maintain the correct orientation). Refer to Figure 3-4 for an illustration of the miscellaneous locking devices that secure the split-retaining ring into the vent valve nozzle. Vent valve component parts, including the disc, are designed to minimize the possibility of lost parts to the reactor coolant system, and therefore, all operating fasteners include a positive locking device. The hinged-disc includes a device for remote testing and verification of proper disc function. The external side of the disc is contoured to absorb the impact load of the disc on the reactor vessel inside wall without transmitting excessive impact loads to the hinge parts as a result of a loss of coolant accident. The hinge assembly consists of a shaft (hidden by cover plates), two valve body journal receptacles, two valve disc journal receptacles, and four flanged shaft journals (bushings). The valve disc journal contains integral exercise lugs for remote operation of the disc with the valve installed in the CSS.

The swing check vent valves are meant to relieve pressure in the interior of the core support shield assembly during a large break loss of coolant accident (LOCA), preventing backpressure from reversing coolant flow through the core and limiting emergency core cooling flow into the core. For all normal operating conditions, the vent valve is closed. In the event of a rupture of

the reactor vessel inlet pipe, the valve will open to vent steam generated in the core directly to the break, thus permitting the core to be flooded and adequately cooled after emergency core coolant has been supplied to the reactor vessel. Therefore, the vent valves are passive devices that have no function during normal operation. However, degradation of the vent valve locking device parts may either prevent the vent valve from fully closing under normal operating conditions (causing increased bypass flow) or from fully opening under the required accident conditions.

Past operational issues have been identified related to the vent valve jackscrew bushing and locking devices in the B&W-designed units. These issues resulted in modifications to and redesigns of the locking devices on several of the units. It is relevant to note that the D-B four RV internals vent valves are not located near the outlet nozzles. Proximity to the outlet nozzles has been identified as a driving factor in the initiator of the component wear due to flow induced vibrations. In addition, a review of the D-B site Spring 2010 outage vent valve video indicates that all four of the D-B vent valves have the original locking devices and that no repair or replacement was completed on these components.

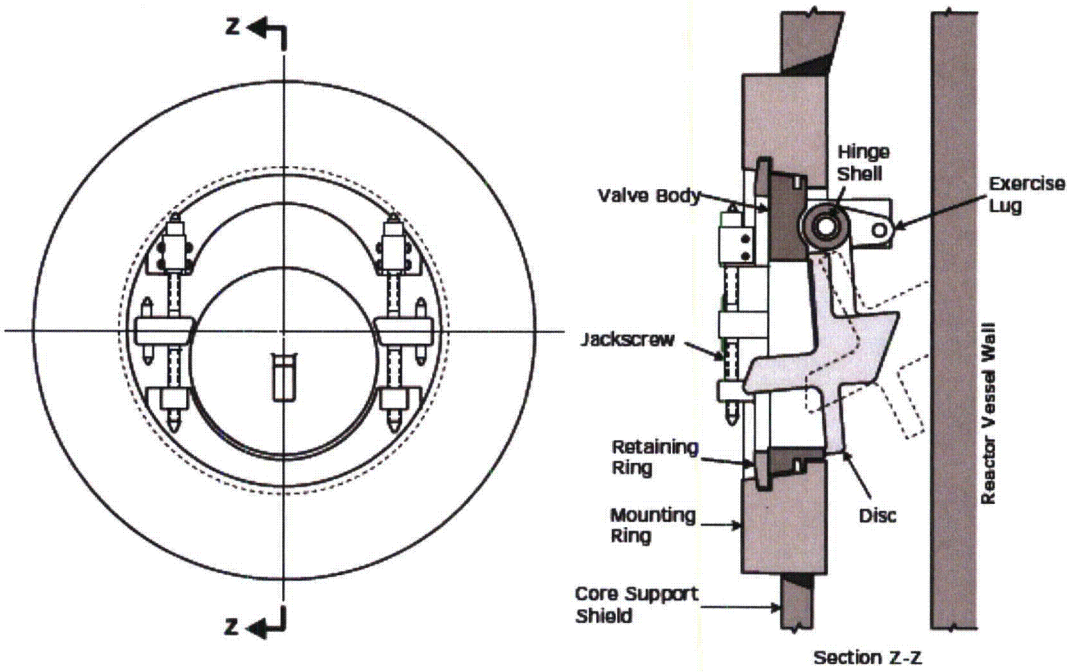


Figure 3-1: Vent Valve Assembly

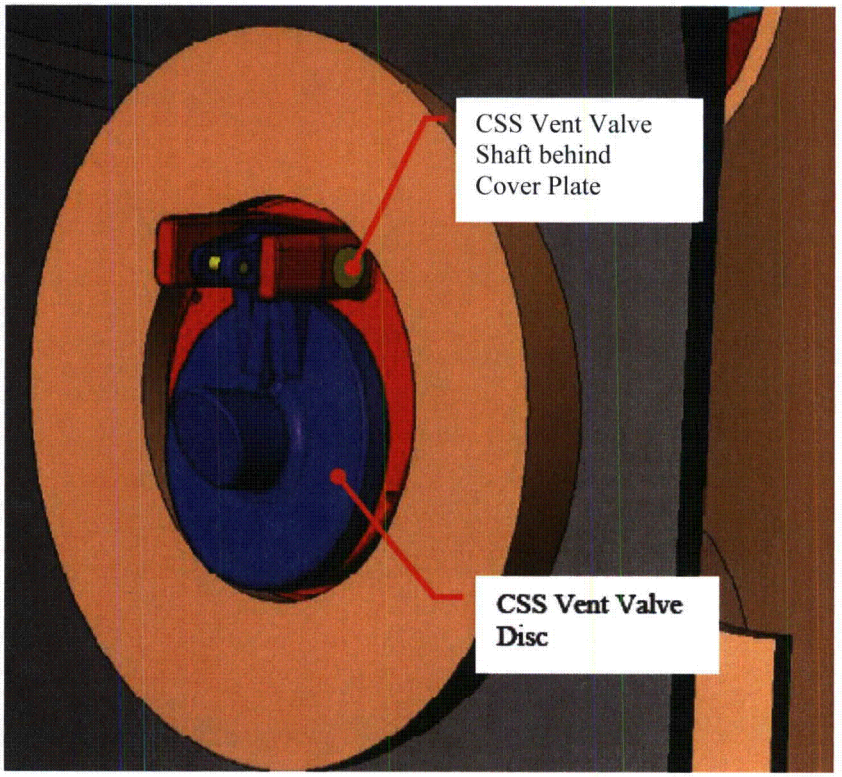


Figure 3-2: Typical Vent Valve (External Core Support Shield View)

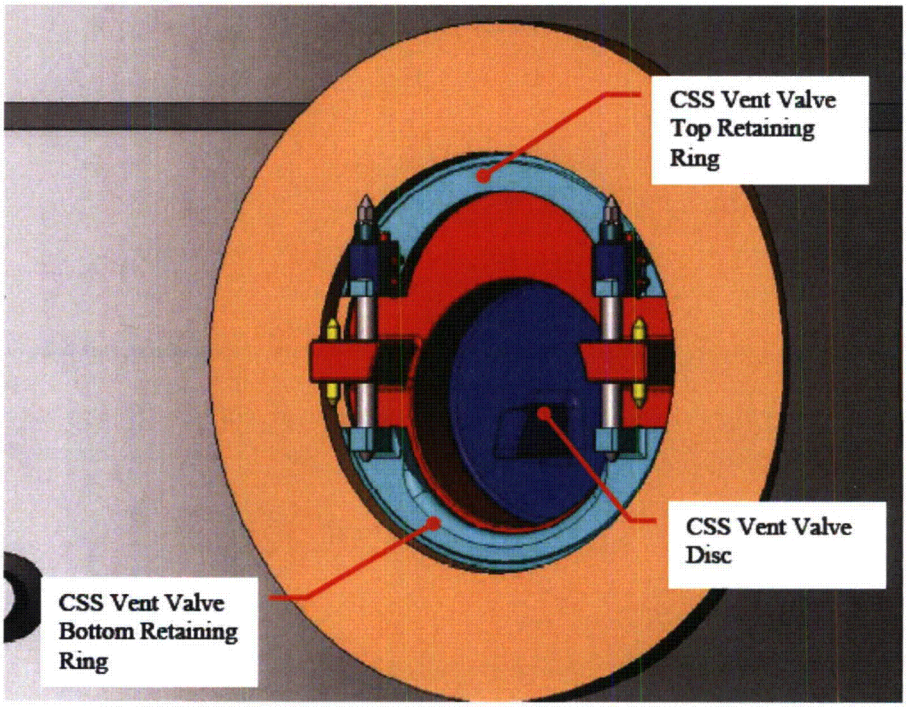


Figure 3-3: Typical Vent Valve (Inside Core Support Shield View)

[ ]

Figure 3-4: Original Vent Valve Locking Device Miscellaneous Parts

3.2.2 *Lower Grid Guide Block Attachment Replacement*

The lower grid guide assembly includes twelve sets of guide blocks located equidistant around the periphery of the outside vertical wall of the lower grid shell forging. These blocks function to provide precision clearances with the reactor vessel guide lugs that are welded to the inside wall of the reactor vessel. Refer to Figure 3-5 for an illustration of the lower grid guide block assembly. As described in Section 3.1.2.6, following hot functional testing, the D-B lower grid guide block attachment was modified after it was determined that the testing had caused guide blocks to become loose and out of position. The lower grid guide block attachment replacement was comprised of a stainless steel dowel held in place with a welded dowel cap, and a continuous fillet weld around the guide block to the lower grid forging.

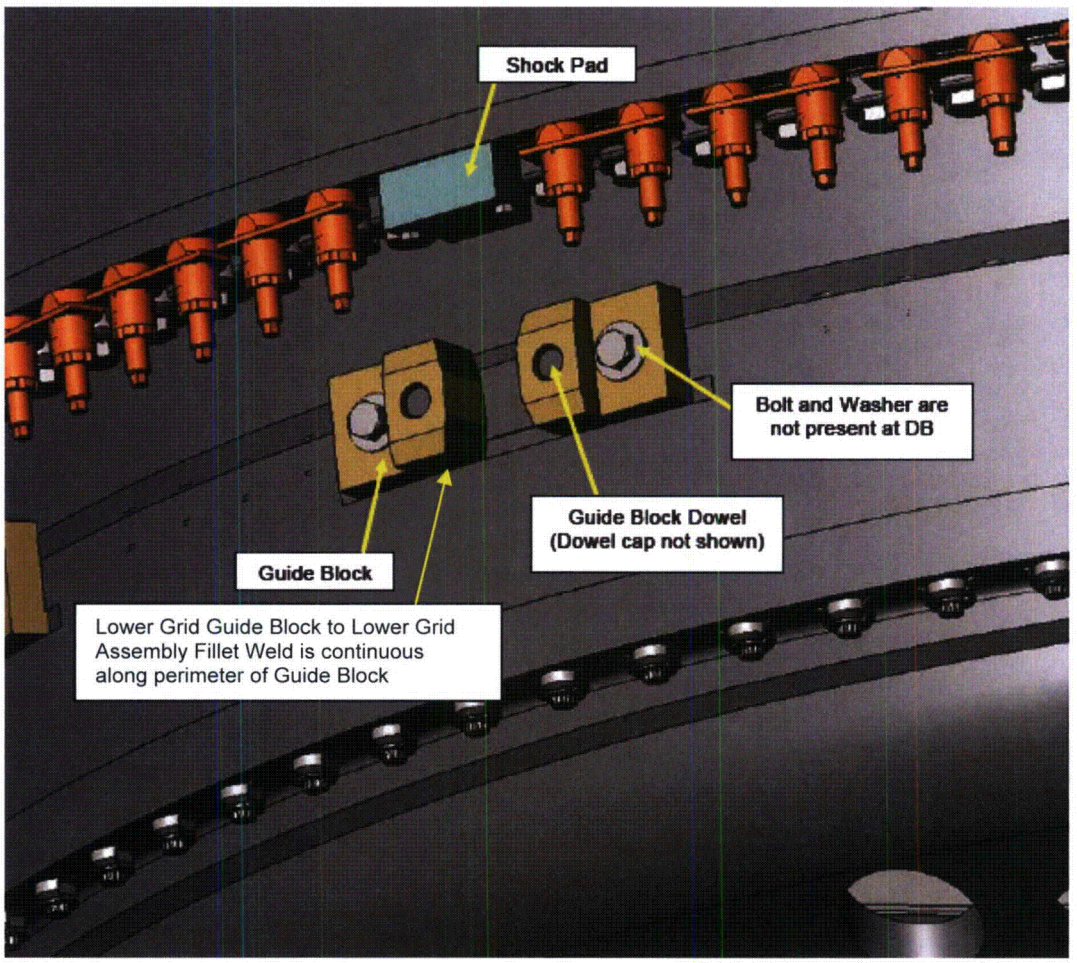


Figure 3-5: Lower Grid Guide Block Assembly

3.3 *Program Modification Assessment*

Because D-B RV internals components were identified in the preceding sections that are not included in MRP-189, Revision 1, it is necessary to consider if modifications to the program delineated in MRP-227-A are required to address the additional components. The following subsections assess whether modifications are needed.

3.3.1 *Materials of Construction*

The general materials of construction are listed in Table 3-3 for the vent valve miscellaneous locking device items and in Table 3-4 for the lower grid guide block attachment replacement items. All items are fabricated of various alloys of stainless steel.

Table 3-3: Materials of Construction for Vent Valve Miscellaneous Locking Device Items

Subcomponent or Weld Part Number	Subcomponent or Weld Part Description	Material

Table 3-4: Materials of Construction for Lower Grid Guide Block Attachment Replacement Items

Subcomponent or Weld Part Number	Subcomponent or Weld Part Description	Material

3.3.2 *Identification of Screening Parameters*

The screening parameters are listed in Table 3-5 for the vent valve miscellaneous locking device items and in Table 3-6 for the lower grid guide block attachment replacement items. The environmental parameters for the vent valve miscellaneous locking device items are the same as for the other vent valve items (see Table 3-2 of MRP-189, Revision 1, Identifiers S.7-S.14). Similarly, environmental parameters for the lower grid guide block attachment replacement items are the same as for the guide blocks (see Table 3-2 of MRP-189, Revision 1, Identifier L.1.13). Operating stresses for either the original vent valve locking device items or the lower grid guide block attachment replacement items were not located during the preparation of this task. Unless otherwise noted, the welds were not confirmed to be or not to be multi-pass welds, but due to their small size, they are assumed to not be multi-pass welds. The one exception is the guide block to lower grid weld (WCF-344), which is a multi-pass weld. The delta ferrite content for WCF-344 was required to be in the range of 5 to 20%.

Table 3-5: Original Vent Valve Miscellaneous Locking Device Parts Screening Parameters

Subcomponent Part or Weld Number	Subcomponent or Weld Part Description	Material Category	Material Spec	Material Type, Grade, or Class	Temp (°F)	Neutron Exposure (n/cm^2, E>1MeV)	Operating Stress (ksi)[1]	Cold Work ≥20%	Multi-pass Weld	Fatigue Usage Factor[2]	Bolting

[1] Operating stresses for these subcomponents were not located.
[2] Fatigue for these subcomponents is assumed to be very low (<0.1), similar to that of most reactor vessel internals items.
[3] Alloy A-286 spring wire is assumed to have surface cold work following manufacture
[4] These items are non-bolting and not crimped, thus it is unlikely that these items exceed the stress screening criteria.
[5] Due to the nature of these welds, it is assumed that the operating stress is very low and below the screening criteria.
[6] Determination of a multi-pass nature for these welds is not possible. However due to the small size of these welds, it is unlikely that this is a multi-pass weld and therefore, assumed to be a single pass weld.

Table 3-6: Lower Grid Guide Block Attachment Replacement Parts Screening Parameters

Subcomponent or Weld Part Number	Subcomponent or Weld Part Description	Material Category	Material Spec	Material Type, Grade, or Class	Temp (°F)	Neutron Exposure (n/cm^2, E>1MeV)	Operating Stress (ksi)[7]	Cold Work ≥20%	Multi-pass Weld	Fatigue Usage Factor	Bolting

[7] Operating stresses for these subcomponents were not located.
[8] Due to the nature of this weld, it is assumed that the operating stress is very low and below the screening criteria.

3.3.3 *Characterize and Screen for Degradation*

In this section, the original vent valve locking devices and lower grid guide block attachment replacement items are screened using the process set forth in MRP-189, Revision 1. The screening criteria are defined in Table 3-1 of MRP-189, Revision 1. Using these criteria, each age-related degradation mechanism is screened for each item identified in Table 3-5 and Table 3-6. An aging mechanism is screened "in" if the screening criteria are met or exceeded for the particular item. Unless otherwise noted, for unknown characteristic values (i.e., operating stress), the value is assumed to exceed the screening criteria. The results of this initial screening are shown in Table 3-7 and Table 3-8.

Table 3-7: Original Vent Valve Miscellaneous Locking Device Parts Screening Results

Subcomponent or Weld Part Number	Subcomponent or Weld Part Description	Material Category	SCC	IASCC	Wear	Fatigue	Thermal Aging Embrittlement	Irradiation Embrittlement	Void Swelling	Irradiation Stress Relaxation and Creep
		Austenitic SS	A	A	Not A	A	A	A	A	A
		Austenitic SS	A	A	Not A	A	A	A	A	A
		Austenitic PH SS	Not A	A	Not A	A	A	A	A	A
		Austenitic SS	A	A	Not A	A	A	A	A	A
		Martensitic SS	A	A	A	A	Not A	A	A	A
		Austenitic SS	A	A	A	A	A	A	A	A
		Austenitic SS	A	A	A	A	A	A	A	A
		Martensitic SS	A	A	A	A	Not A	A	A	A
		Austenitic SS	A	A	A	A	A	A	A	A

SCC = Stress Corrosion Cracking
IASCC = Irradiation Assisted Stress Corrosion Cracking

Table 3-8: Lower Grid Guide Block Attachment Replacement Parts Screening Results

Subcomponent or Weld Part Number	Subcomponent Part or Weld Description	Material Category	SCC	IASCC	Wear	Fatigue	Thermal Aging Embrittlement	Irradiation Embrittlement	Void Swelling	Irradiation Stress Relaxation and Creep
[	]	Austenitic SS	Not A	A	Not A	A	A	A	A	A
		Austenitic SS	Not A	A	Not A	A	A	A	A	A
		Austenitic PH SS	A	A	A	A	A	A	A	A
		Austenitic SS	A	A	A	A	A	A	A	A
		Austenitic SS	A	A	A	A	A	A	A	A
	]	Austenitic SS	A	A	A	A	A	A	A	A

SCC = Stress Corrosion Cracking
IASCC = Irradiation Assisted Stress Corrosion Cracking

3.3.4 *Failure Modes and Effects Criticality Analysis (FMECA)*

The objective of the FMECA is to provide a systematic, qualitative review to identify the D-B RV internals subcomponents and age-related degradation mechanisms that potentially result in functional degradation leading to significant risk. The FMECA is used to examine the susceptibility as well as safety and economic consequences of the identified RV internals subcomponent/age-related degradation mechanism combinations. The FMECA approach uses inductive reasoning to ensure that the potential failure of each subcomponent is analyzed to determine the results or effects on the system and to classify each potential failure mode according to its severity.

Each failure mode was judged on its importance to risk, based on the susceptibility and severity of consequences. Consequences were examined from two perspectives: safety and economic. A risk matrix was developed to correlate the consequence severity of a particular age-related degradation mechanism with the susceptibility of that particular mechanism. Different risk banks were used within the matrix to categorize the level of risk of a particular component item/degradation mechanism pair, and provide guidance on the strategies that should be developed to reduce the corresponding risk and a basis for ranking and categorization. The risk matrix utilized in the development of MRP-227-A was similarly used for the relevant D-B RV internals subcomponents and welds and the results are shown in Table 3-9 and Table 3-10.

Table 3-9: Original Vent Valve Miscellaneous Locking Device Parts FMECA Results

Subcomponent or Weld Part Description	SCC						IASCC						ISR & Creep						Wear						Fatigue						TE						IE						VS						Component Item Category
	Susceptibility	Safety Consequence	Economic Consequence	Safety Risk Band	Economic Risk Band	Category	Susceptibility	Safety Consequence	Economic Consequence	Safety Risk Band	Economic Risk Band	Category	Susceptibility	Safety Consequence	Economic Consequence	Safety Risk Band	Economic Risk Band	Category	Susceptibility	Safety Consequence	Economic Consequence	Safety Risk Band	Economic Risk Band	Category	Susceptibility	Safety Consequence	Economic Consequence	Safety Risk Band	Economic Risk Band	Category	Susceptibility	Safety Consequence	Economic Consequence	Safety Risk Band	Economic Risk Band	Category	Susceptibility	Safety Consequence	Economic Consequence	Safety Risk Band	Economic Risk Band	Category	Susceptibility	Safety Consequence	Economic Consequence	Safety Risk Band	Economic Risk Band	Category	
	A					A	A					A	A					A	C	1	2	I	III	B	A					A	A					A	A					A	A					A	B
	A					A	A					A	A					A	C	1	2	I	III	B	A					A	A					A	A					A	A					A	B
	B	1	2	I	II	A	A					A	A					A	C	1	2	I	III	B	A					A	A					A	A					A	A					A	B
	A					A	A					A	A					A	C	1	2	I	III	B	A					A	A					A	A					A	A					A	B
	A					A	A					A	A					A	A					A	A					A	C	1	2	I	III	B	A					A	A					A	B
	A					A	A					A	A					A	A					A	A					A	A					A	A					A	A					A	A
	A					A	A					A	A					A	A					A	A					A	A					A	A					A	A					A	A
	A					A	A					A	A					A	A					A	A					A	C	1	2	I	III	B	A					A	A					A	B
	A					A	A					A	A					A	A					A	A					A	A					A	A					A	A					A	A

SCC = Stress Corrosion Cracking, IASCC = Irradiation Assisted Stress Corrosion Cracking, ISR = Irradiation enhanced Stress Relaxation, TE = Thermal Embrittlement, IE = Irradiation Embrittlement, VS = Void Swelling

Table 3-10: Lower Grid Guide Block Attachment Replacement Parts FMECA Results

Subcomponent or Weld Part Description	SCC						IASCC						ISR & Creep						Wear						Fatigue						TE						IE						VS						Component Item Category
	Susceptibility	Safety Consequence	Economic Consequence	Safety Risk Band	Economic Risk Band	Category	Susceptibility	Safety Consequence	Economic Consequence	Safety Risk Band	Economic Risk Band	Category	Susceptibility	Safety Consequence	Economic Consequence	Safety Risk Band	Economic Risk Band	Category	Susceptibility	Safety Consequence	Economic Consequence	Safety Risk Band	Economic Risk Band	Category	Susceptibility	Safety Consequence	Economic Consequence	Safety Risk Band	Economic Risk Band	Category	Susceptibility	Safety Consequence	Economic Consequence	Safety Risk Band	Economic Risk Band	Category	Susceptibility	Safety Consequence	Economic Consequence	Safety Risk Band	Economic Risk Band	Category	Susceptibility	Safety Consequence	Economic Consequence	Safety Risk Band	Economic Risk Band	Category	
	B	1	2	1	II	A	A					A	A					A	B	1	2	1	II	A	A					A	A					A	A					A	A					A	A
	A					A	A					A	A					A	A					A	A					A	A					A	A					A	A					A	A
	A					A	A					A	A					A	A					A	A					A	A					A	A					A	A					A	A
	A					A	A					A	A					A	A					A	A					A	A					A	A					A	A					A	A
	A					A	A					A	A					A	A					A	A					A	A					A	A					A	A					A	A

SCC = Stress Corrosion Cracking, IASCC = Irradiation Assisted Stress Corrosion Cracking, ISR = Irradiation enhanced Stress Relaxation, TE = Thermal Embrittlement, IE = Irradiation Embrittlement, VS = Void Swelling

3.3.5 *Engineering Evaluation and Assessment*

As can be seen from Table 3-9 and Table 3-10, the subcomponent parts not included in MRP-189, Revision 1 that remain as non-Category A following the FMECA include various parts of the original vent valve locking device ([

]) and no parts from the lower grid guide block attachment replacement items. The aging mechanisms that lead to these subcomponents being screened as non-Category A are thermal embrittlement and wear. Thermal embrittlement itself does not cause failure. However, this embrittlement can cause a reduction in the toughness of the material, leading to an increased susceptibility to failure.

As stated in Section 3.2.1, industry experience with the original vent valve locking devices has indicated that wear can be a concern with damage sustained on the locking devices due to flow induced vibration forces. This resulted in several of the B&W-designed units replacing the vent valves nearest to the core support shield outlet nozzles as this was determined to be the area of susceptibility and where the locking device damage was primarily located. As previously stated, D-B has four RV internals vent valves (as compared to eight for the other B&W-designed units) and these four valves are not located near the outlet nozzles. Therefore, it is unlikely that any of the D-B original vent valve locking devices will experience this wear degradation. However, wear was conservatively identified as an applicable aging mechanism [

] due to the operating history for these components.

These original vent valve locking device parts have limited accessibility for inspection (refer to Figure 3-3 and Figure 3-4). As stated in the D-B AMR document, the vent valve assemblies have a "Support" intended function. To meet this intended function, structural integrity of the vent valve assembly must be maintained to ensure the vent valve remains in the CSS nozzle and functional. The function of the vent valve jackscrew is to maintain the retaining rings position and to prevent the retaining rings from backing out of the mounting ring groove in the CSS nozzle. The function of the vent valve locking device ([

]) is to prevent the jackscrew from

turning during reactor operation. As shown in the D-B AMR document, the retaining rings are considered primary component items within the MRP-227 program at D-B. Section 4.3.1 of MRP-227-A delineates that the retaining rings are to be inspected via visual VT-3 inspection on the 10-year ASME Boiler and Pressure Vessel (B&PV) Code Section XI Inservice Inspection (ISI) interval [2]. If the function [

] were degraded during service, the visual inspection of the retaining rings in the vicinity of these subcomponent items (refer to Figure 3-3), would indicate that the jackscrew had turned and was out of design position. The observation that the jackscrew and retaining rings are in their design configuration is verification that the locking devices are fulfilling their design function.

In addition, D-B performs a visual inspection on the valve body and valve disc as well as an operability test during each refueling outage (at least once per 24 months). This inspection and operability test is required through the unit's Technical Specifications. Therefore, the

[ ] subcomponents of the original vent valve locking device are further categorized as "Existing Programs" for D-B. Note that the addition of the original vent valve miscellaneous locking device parts as an "Existing Program" is currently under industry review.

It is unlikely that thermal embrittlement or wear to these subcomponents would lead to a loss of intended function for the vent valve locking device. If this degradation were to occur, it would likely be detected (prior to loss of intended function) by the visual inspection and operability testing performed each refueling outage or the VT-3 inspection performed during the 10-year ISI intervals. The potential for thermal embrittlement and wear on the original vent valve locking devices is adequately managed by the existing plant Technical Specifications and the MRP-227-A inspection requirements invoked through the D-B ISI Program.

4.0 CONCLUSIONS

As required by Applicant/Licensee Action Item #2 for the MRP-227-A SER, this report completes the comparison between Table 4-1 and 4-2 in MRP-189, Revision 1 and the component items designated in the scope of license renewal for D-B. As described above, two component items were identified as being within the scope of license renewal and subject to AMR, but were not included in the relevant MRP-189, Revision 1 tables:

- Original Vent Valve Miscellaneous Locking Device Parts
- Lower Grid Guide Block Attachment Replacement Parts

A review of background information pertaining to the original vent valve locking devices and the lower grid guide block attachment replacement parts was completed. The appropriate subcomponent items of interest were identified. The sequence steps as described in MRP-189, Revision 1 Sections 3 and 4 were used to evaluate the aging mechanisms and resultant aging effects on the subcomponents that could result in degradation leading to significant risk. The material types as well as screening parameters such as temperature, fluence, and operating stresses were identified (or assumed with justification). These parameters were then used for comparison to the screening criteria from MRP-189, Revision 1 to perform the initial screening of these items for degradation. A FMECA was performed, and a preliminary categorization using the degradation screening results as well as the FMECA was performed. An engineering evaluation and assessment was used to categorize the subcomponent items for inspection. Finally, the results of the evaluation were reviewed for any necessary modifications to the program defined in MRP-227-A.

The results are as follows:

- Original Vent Valve Miscellaneous Locking Device Parts – Categorized as "Category A" or "Existing Programs". (Note: The addition of certain original vent valve miscellaneous locking device parts as an "Existing Program" is currently under industry review.)
- Lower Grid Guide Block Attachment Replacement Parts – Categorized as "Category A"

The potential for failure of the locking devices on the original vent valve assemblies due to thermal embrittlement and wear is adequately managed by the ASME B&PV Code Section XI

programmatic controls along with the valve testing and inspection requirements each refueling outage (as required by plant Technical Specifications).

However, it is noted that the existing program in place for the original vent valve locking device aging management at D-B is not identified as such in Table 4-7 of MRP-227-A. AREVA is working with the PWR Owners Group and EPRI to establish interim guidance to account for this discrepancy and incorporate the appropriate information into the next revision of MRP-227. In this report, D-B assumes that the visual inspections currently performed are equivalent to an Existing Program for MRP-227 implementation.

5.0 REFERENCES

1. US Nuclear Regulatory Commission, Safety Evaluation Report Related to the License Renewal of Davis-Besse Nuclear Power Station, September 2013 (Accession No. ML13248A267).

2. *Materials Reliability Program: Pressurized Water Reactor Internals Inspection and Evaluation Guidelines (MRP-227-A)*. EPRI, Palo Alto, CA: 2011. 1022863.

3. *Materials Reliability Program: Screening, Categorization, and Ranking of B&W-Designed PWR Internals Component Items (MRP-189-Rev. 1)*. EPRI, Palo Alto, CA: 2009. 1018292.

4. Code of Federal Regulations, Title 10, Part 54, "Requirements for Renewal of Operating Licenses for Nuclear Power Plants."

5. "Davis-Besse Nuclear Power Station License Renewal Application," August, 2010.

Enclosure D

Davis-Besse Nuclear Power Station, Unit No. 1 (Davis-Besse)

Letter L-15-139

AREVA NP Affidavit to
Support the Disclosure Request for the
Proprietary Assessment Report

3 pages follow

AFFIDAVIT

COMMONWEALTH OF VIRGINIA)
) ss.
CITY OF LYNCHBURG)

1. My name is Gayle Elliott. I am Manager, Product Licensing, for AREVA Inc. (AREVA) and as such I am authorized to execute this Affidavit.

2. I am familiar with the criteria applied by AREVA to determine whether certain AREVA information is proprietary. I am familiar with the policies established by AREVA to ensure the proper application of these criteria.

3. I am familiar with the AREVA information contained in the document ANP-3359P titled "Davis Besse Reactor Vessel Internals License Renewal Scope and MRP-189, Revision 1 Comparison," dated December 2014 and referred to herein as "Document." Information contained in this Document has been classified by AREVA as proprietary in accordance with the policies established by AREVA Inc. for the control and protection of proprietary and confidential information.

4. This Document contains information of a proprietary and confidential nature and is of the type customarily held in confidence by AREVA and not made available to the public. Based on my experience, I am aware that other companies regard information of the kind contained in this Document as proprietary and confidential.

5. This Document has been made available to the U.S. Nuclear Regulatory Commission in confidence with the request that the information contained in this Document be withheld from public disclosure. The request for withholding of proprietary information is made in accordance with 10 CFR 2.390. The information for which withholding from disclosure is

requested qualifies under 10 CFR 2.390(a)(4) "Trade secrets and commercial or financial information."

6. The following criteria are customarily applied by AREVA to determine whether information should be classified as proprietary:

(a) The information reveals details of AREVA's research and development plans and programs or their results.

(b) Use of the information by a competitor would permit the competitor to significantly reduce its expenditures, in time or resources, to design, produce, or market a similar product or service.

(c) The information includes test data or analytical techniques concerning a process, methodology, or component, the application of which results in a competitive advantage for AREVA.

(d) The information reveals certain distinguishing aspects of a process, methodology, or component, the exclusive use of which provides a competitive advantage for AREVA in product optimization or marketability.

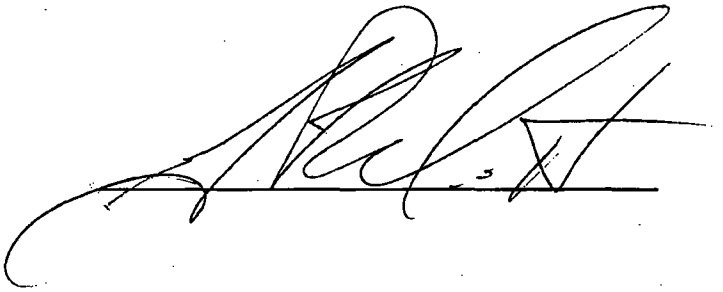
(e) The information is vital to a competitive advantage held by AREVA, would be helpful to competitors to AREVA, and would likely cause substantial harm to the competitive position of AREVA.

The information in this Document is considered proprietary for the reasons set forth in paragraphs 6(c), 6(d) and 6(e) above.

7. In accordance with AREVA's policies governing the protection and control of information, proprietary information contained in this Document has been made available, on a limited basis, to others outside AREVA only as required and under suitable agreement providing for nondisclosure and limited use of the information.

8. AREVA policy requires that proprietary information be kept in a secured file or area and distributed on a need-to-know basis.

9. The foregoing statements are true and correct to the best of my knowledge, information, and belief.



SUBSCRIBED before me this 13th

day of January, 2015.

Ella F. Carr-Payne 309873