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Materials Reliability Program (MRP) Initiatives Related to PWSCC: MRP-139

NRC Public Meeting
February 21, 2008

Greg Kammerdeiner
First Energy

MRP-139 - Topics

- Current implementation status
- Interim Guidance
- Original NRC Comments & MRP Responses
- MRP-139, Rev. 1 Changes
- Future Actions
  - Rev. 1 Review / Approval
  - Periodic Guideline Review Process - 2008
- DB Flaw OE Assessment
- Deviation Overview – Summary of plans as reported

MRP-139: Current Implementation Status

Pressurizer Nozzles

- PZR Nozzle Inspection deadline: 12-31-07
- Nine plants granted extension by NRC through Spring ‘08
- Fleet status
  - MRP-139 issued summer 2005
    - 15 units w/ no PZR A600/82/182
    - 4 units replaced PZRs
    - 278 Nozzles w/ A600/82/182
      - 100% inspected by summer 2008
      - ~90% mitigated by summer 2008

PZR issue resolved in three years

MRP-139: Current implementation status

Upcoming MRP-139, Rev. 0 Inspection Deadlines

- December 31, 2008:
  - ≤14” Locations Operating at Hot leg temperatures
- December 31, 2009:
  - > 14” Locations Operating at Hot leg temperatures
- December 31, 2010:
  - Locations Operating at Cold leg temperatures

Tabulated Domestic HL Inspections Reported

Through Spring 2007 Outage Season[4]

NSSS Design	# Locations Reported[1]	BMV	Volumetric	Mitigation[2]
B&W (7 units)	64	58	3	3
W 2-Loop (2 units)	2	0	0	2
W 3-Loop (7 units)	24	21	7	5
W 4-Loop (25 units)	100	86	56	-
CE 80 (9 units)	65	63	5	2
TOTAL (50 units)	255	228[3]	71	12

(1) Includes small and large bore locations

(2) MSIP, weld Overlays, & SG clad / inlay

(3) 422 total visual exams reported (repeats at same location)

(4) Survey responses reflect all 69 PWRs and have been reviewed for general consistency and obvious errors but have not been thoroughly verified. Counts therefore reflect trends, not exact numbers.

Tabulated Domestic CL Inspections Reported

Through Spring 2007 Outage Season[2]

NSSS Design	# Locations	BMV	Volumetric
B&W (7 units)	135	121	5
W 2-Loop (3 units)	6	6	2
W 3-Loop (7 units)	24	24	6
W 4-Loop (25 units)	100	86	56
CE 80 (11 units)	168	142	7
TOTAL (53 units)	433	379[1]	76

(1) 615 total visual exams reported (repeats at same location)

(2) Survey responses reflect all 69 PWRs and have been reviewed for general consistency and obvious errors but have not been thoroughly verified. Counts therefore reflect trends, not exact numbers.

Note: A separate survey category "Less than Cold Leg Temperature" was also reported although the actual scope is unclear. This group of ~116 nozzles are not included here pending further clarification.

MRP-139: Interim Guidance

Schedule Deviations

– MRP 2006-018, Issued August 11, 2006

- *"Upon receipt of this letter, it is mandatory that any plant that does not meet the implementation dates stated in Section 1.2 of MRP-139 shall process the inability to meet the date as a deviation under the guidance of NEI-03-08."*

MRP-139: Interim Guidance

<4” Volumetric Requirements & Deadline

– MRP 2007-038, Issued Nov. 1, 2007

- *“By 12-31-2010, Alloy 82/182 butt welds that are greater than or equal to 2” NPS but less than 4” NPS, not explicitly included in implementation items 2 or 3 of MRP-139, Section 1.2, and are either exposed to temperatures equivalent to the hot leg or serve an ECCS function (e.g., B&W HPI nozzles), will be volumetrically inspected per this guideline. Specific compliance with the configuration data collection deadline in MRP-139 of 12-31-07 is waived only for these newly added locations.*
- *Locations meeting these criteria but exposed to pressurizer temperatures (safety nozzles at two plants) shall be inspected by 12-31-07.”* *(Historical – Complete)*

MRP-139: Interim Guidance

<4” BMV Requirement & Deadline

– MRP 2007-039, Issued Nov. 1, 2007

- *“For those locations ≥1” NPS and <4” NPS within the scope of this document but without an explicit requirement for volumetric examination, the initial MRP-139 visual exam shall be performed no later than the first refueling outage which begins after July 1, 2008. Subsequent BMV exams shall follow the schedule as specified in Table 6-2. The most recently conducted visual exam meeting the requirements of Section 5.2 may be credited as the initial MRP-139 visual exam.”*

MRP-139: Responses to NRC Comments

- NRC comments provided October 2005
- Multiple meetings and conference calls held to clarify and resolve comments
- Last meeting held October 25, 2006
  - MRP position on all comments presented
    - Specific text changes provided (proprietary)
  - Additional NRC input was welcomed
  - MRP-139, Rev. 1 was planned for early 2007
    - Wolf Creek issue diverted resources
    - ~ 1 year slip in schedule occurred

MRP-139: Responses to NRC Comments

Review of NRC Meeting held October 25, 2006

Summary

- Oct. 20, 2005 letter comment resolution categories from May 2006 meeting summary
  - Comments agreed to with no discussion needed
    - 6, 10, 12, 13, 14, 20, 21
  - Comments accepted with clarification
    - 1, 5, 7, 17, 18, 22, 23, 25
  - Comments needing clarification
    - 3, 4, 8, 9, 11, 15, 19, 24, 26
  - Comments requiring further discussion
    - 2, 16

Comments were discussed on 10-25-06 in the above order

MRP-139: Responses to NRC Comments

Review of NRC Meeting held October 25, 2006

Comments Generally Agreed To prior to 10-25-06 meeting

#	Topic	MRP Position	Proposed Status 10-25-06
6	"Should" statement included within a "shall" statement appears to be inconsistent.	This inconsistency will be corrected – the "should" will be changed to "shall" and the text of 5.1.7 will be re-written to more clearly communicate the intent.	Close
10	Clarify that NRC-approved inspection coverage relief requests pre-MRP-139 may not be automatically applied under MRP-139.	This was addressed in the MRP-139 transmittal letter but will be incorporated as an explicit statement in the text.	Close
12	Clearly identify the ASME B&PV Code, Sect XI, App VIII exam requirements.	This will be incorporated into Section 5.1.1.	Close
13	Table 6-1, third column has some "dashes" that appear to be inappropriate.	These dashes will be changed to "yes".	Close
14	Delete "or Surface" from the title of second page of Table 6-1.	Incorporated	Close
20	Category G welds (SI mitigated) should be volumetrically inspected prior to return to service.	Incorporated.	Close
21	Support Codification of flaw evaluation methodologies from Section 7 and App. C.	MRP will continue to support this activity.	Close

MRP-139: Responses to NRC Comments

Review of NRC Meeting held October 25, 2006

Comments Accepted with Clarification from discussions prior to 10-25-06

- Industry considered its proposed resolution to the following comments to have been in accordance with the intent of the NRC's original comment based on previous discussions.
- Confirmation was considered necessary

MRP-139: Responses to NRC Comments

Review of NRC Meeting held October 25, 2006

Comments Accepted by MRP with Clarification from discussions prior to 10-25-06

#	Topic	MRP Position	Proposed Status 10-25-06
1	Implementation schedule – cold leg future adjustment example statement.	Delete the paragraph – it is redundant to a more clearly worded prior paragraph.	Close
5	Mandatory status of baseline visual exams is unclear due to content of transmittal letter vs. MRP-139 text.	Text will be revised to incorporate clear requirements into MRP-139.	Close
7	Chemical mitigation seems to be offered as an option when none have been determined acceptable yet.	In order to prevent confusion, the reference to the three broad categories of mitigation will be deleted and the reader will simply be directed to Section 3 for more information.	Close
17	Text seems to indicate that the MRP-139 inspection volume is less than that under ASME.	The subject statement did not effectively communicate the intent so the words will be revised to make the intent clear.	Close
18	Clarify when ASME Code provisions apply and when they do not.	Section 5.0 and Table 6-1, Note 2 will be revised to clearly address ASME Code applicability.	Close
22	Add greater detail to flaw evaluation guidance	Not appropriate for this document – this is the proper domain of the ASME Code.	Close
23	Seems to limit concern for other cyclic loads to only fatigue.	The subject words will be revised to more clearly communicate that all appropriate loads must be considered.	Close
25	Use of an “approved alternative” to define the inspection frequency in Categories C and G could allow RI-ISI to eliminate re-inspection of these locations.	Future treatment under RI-ISI is driven by PWSCC susceptibility review and SI is considered an acceptable mitigative method. “Approved Alternative” will be clarified to be NRC-approved.	Close

MRP-139: Responses to NRC Comments

Review of NRC Meeting held October 25, 2006

Comments Presented on 10-25-06 as Needing Clarification

- Industry considered its proposed resolution to the following comments to be in accordance with the intent of the original NRC comments based on previous discussions.
- Specifics of the responses may have been new to the NRC
- Confirmation was therefore considered necessary

MRP-139: Responses to NRC Comments

Review of NRC Meeting held October 25, 2006

Comments Presented on 10-25-06 as Needing Clarification

#	Topic	MRP Position	Proposed Status 10-25-06
3	Baseline inspections shall be completed per the specified deadlines even if modification is necessary.	Implementation expectation has been clarified w/ interim guidance letter – failure to meet dates must be processed as NEI-03-08 Deviation. MRP-139 revision will incorporate this and 5.1.7 will be re-written to clarify intent.	Close
4	Incorporate NRC notification if the implementation schedule will not be met.	Industry position and approach relative to sharing deviation information with the NRC is being developed outside of MRP. Deviations to MRP-139 will be expected to adhere to this guidance once issued. (Revised words 2-18-08)	Close
8	Add a description of how pre-SI UT will prevent improper categorization.	Although true mis-categorization is considered unlikely, the risk is addressed in Category C by a 50% re-inspection requirement.	Close
9	Axial flaws can have circ aspects yet there are no additional measures required for <90% axial coverage.	Consistent with the safety assessment conclusion that axial cracks can leak but will not lead to pipe failure, additional measures are not warranted. Re-inspection requirements are adequate to address circ aspects of axial flaws.	Close

MRP-139: Responses to NRC Comments

Review of NRC Meeting held October 25, 2006

Comments Presented on 10-25-06 as Needing Clarification – cont.

#	Topic	MRP Position	Proposed Status 10-25-06
11	Treatment of locations operating at cold leg temperature should be clarified to require they be made inspectable.	The lower temperature threshold for MRP-139 applicability will be clarified and Section 5.1.7 will be re-written to make intent clear.	Close
15	Limit use of “additional margins” to only allow a flaw to remain in service for one outage.	A note will be added to Table 6-1 for Cat. G requiring four successive exams to fully enter Cat. G	Close
19	Mitigation measures may introduce additional NDE considerations – please clarify.	Words to clarify the intent and direct the user of the document will be added.	Close
24	Clarify the intent of the flaw evaluation guidance requiring any flaw be assumed through wall.	This is simply a conservative approach to flaw evaluation and is similar to that applied to BWR Shroud flaws. No change is required.	Close
26	NRC Notification of plans to mitigate.	ASME Code already imposes notification obligations on licensees when modifying the RCS pressure boundary.	Close

MRP-139: Responses to NRC Comments

Review of NRC Meeting held October 25, 2006

Comments Presented on 10-25-06 as Requiring Further Discussion

- Industry considered its proposed resolution to the following comments to have been in accordance with the intent of the NRC's comment based on previous discussions
- Specifics of the responses may have been new to the NRC
- Confirmation was therefore considered necessary

MRP-139: Responses to NRC Comments

Review of NRC Meeting held October 25, 2006

Comments Requiring Further Discussion

#	Topic	MRP Position	Proposed Status 10-25-06
2	Treatment of LBB lines relative to inspection frequency and mitigation	Baseline timing is aggressive and appropriate. Requiring mitigation is beyond the proper role of MRP since management by inspection is effective.	Close
16	Reconsider the inspection requirements for lines less than 4” NPS (visual and volumetric).	Inspect DM butt welds greater than or equal to 2” NPS: • At pressurizer temperatures • At hot leg temperatures • Serve an ECCS function See MRP 2007-038	Close

MRP-139: Rev. 1 (draft) - Changes

Changes incorporated to address:

- NRC Comments as outlined in MRP responses (10-25-06)
- MRP Interim Guidance
- MRP-139 Inquiries – (similar to Code Interpretations – cannot change intent)
- Implementation Lessons Learned
- Clarifications
- Editorial items
- MRP-169 linkage
- Cast Austenitic Stainless Steel (pending)

MRP-139: Rev. 1 (draft) - Changes

Page #	Change Bases
i & ii	•Title & Disclaimer Pages: Administrative changes
iii	•Citations: Admin and to reflect major contributors
iv	•Report Summary: Revised to reflect recent OE (Wolf Creek, etc.)
v	•Administrative
1-1	•Administrative & editorial
1-2	•Administrative & editorial •Inquiry MRP139-11, #1 •Interim Guidance MRP 2007-038 - <4" Volumetric •Reinforced requirements for ASME Code compliance are unchanged
1-3	•NRC Comment #3, Inquiry MRP139-09 & Interim Guidance MRP 2006-018; •NRC Comment 1 – future adjustments w/ example •NRC Comment 6 (Should vs. shall) •Interim Guidance MRP 2007-038 - <4" Volumetric •Inquiry MRP139-04 – clarify applicable size ranges •Reflect revised intent for Section 5.1.7 (deviation) •General editorial for clarification
1-4	•Interim Guidance MRP 2007-038 - <4" Volumetric •Inquiry MRP139-03 "A" – basis for B&W special cases •Inquiry MRP139-04 – clarify applicable size ranges •NRC Comment #2 – delete LBB statements •NRC Comment #5 – Visual exam transition requirements from MRP-139 transmittal letter •Interim Guidance MRP 2007-039 - <4" Visual – "start the clock" date & Inquiry MRP139-13 •NRC Comment #25 – RI-ISI from transmittal letter •General editorial for clarification

MRP-139: Rev. 1 (draft) - Changes

2-1	•Inquiry MRP139-10 – Joint Design
2-2	•Inquiry MRP139-05 – Typical, other locations could exist
2-3	•Inquiry MRP139-07 - Other examples of A600 safe-ends
2-8	•Editorial to reflect certain statements were accurate at the time Rev. 0 was issued and have not been updated in order to maintain a consistent context for that section of the report.
2-11	•Editorial
3-1	•Clarify technical basis for overlays (not just FSWOL) being a SI method
3-2	•Editorial – Inspection doesn't make SI "effective"
3-3	•Editorial – Inspection doesn't make SI "effective" •Reflect categorization for OWOL (plant implementation can't proceed w/o MRP-169 SER)
4-5	•Added section and minor edits to address recent inspection experience (Wolf Creek, etc.)

MRP-139: Rev. 1 (draft) - Changes

5-1	•General editorial for clarification •NRC Comment #18 – Clarify applicability of ASME Requirements
5-2	•General editorial for clarification •Inquiry MRP139-17 – Wetted surface coverage requirement •Inquiry MRP139-14 – Clarify intent for wetted ID susceptible material
5-3	•Editorial – Nozzle to safe-end weld is generally shop not field
5-4	•General editorial for clarification •NRC Comment #17 – Sounded like required less than ASME so improved words •NRC Comment #12 – Refer to App. VIII Supplements 10 & 11
5-5	•General editorial for clarification
5-6	•General editorial for clarification of intent (should be no change of intent) •Reflect revised intent of Section 5.1.7 (deviation)
5-7	•Complete rewrite – similar to original intent but reflects significant changes – now directs utility to prepare a deviation and suggests compensatory measures •NRC Comment #7 – approved mitigation methods •NRC Comment #10 – NRC-approved Relief Requests •NRC Comment #11 – Scope includes cold leg and above •Inquiry MRP139-09 – Earliest Possible RFO clarification
5-8	•Completion of changes on page 5-7
-	•Replaced Figure 5-1 w/ minor editorial changes to better match text •NRC Comment #9 – Box 7 incorrectly includes “See Note 1”

MRP-139: Rev. 1 (draft) - Changes

6-1	•General editorial for clarification •LBB Report (Ref 21) was deleted before Rev. 0 was issued •Should to shall in reference to 5.1.7 Alternative Methods •Added new text to clarify the scope of the document as well as how welds are categorized in Section 6
6-2	•Added new text to clarify the scope of the document as well as how welds are categorized in Section 6 •NRC Comment #11 – Cold leg temperature and above •Inquiry MRP139-01 – Joint Nominal Size •Inquiry MRP139-10 – Joint Design •Inquiry MRP139-11 – Materials of Construction •Inquiry MRP139-15 – Nominal Operating Temperature at the Joint Location
6-3	•Added new text to clarify the scope of the document as well as how welds are categorized in Section 6 •Inquiry MRP139-06 – Clarify “no known cracks” can’t be assumed, must be shown through inspection •Inquiry MRP139-11 – Prior Inspection Results
6-4	•Inquiry MRP139-08 – MRP-139 visuals don’t apply to Cat A •Text added to address OWOLs (plant implementation can’t proceed w/o MRP-169 SER)
6-5	•NRC Comment #19 – NDE for New mitigation methods •Text added to address OWOLs (plant implementation can’t proceed w/o MRP-169 SER)
6-6	•Interim Guidance MRP 2007-038 - <4” Volumetric
6-7	•Interim Guidance MRP 2007-038 - <4” Volumetric
6-9	•Text added to address OWOLs (plant implementation can’t proceed w/o MRP-169 SER)

MRP-139: Rev. 1 (draft) - Changes

6-10	•NRC Comment #20 – Copy “return to service inspection” sentence from 6.3.2 •Editorial for clarification
6-11	•Editorial to reflect changes to section 5.1.7
6-12	•Interim Guidance MRP 2007-038 - <4” Volumetric •Editorial for clarification and to reflect changes to section 5.1.7
6-13	•Interim Guidance MRP 2007-038 - <4” Volumetric •Inquiry MRP139-12 – Applicable to other cold leg locations •Editorial for clarification
6-15	•Interim Guidance MRP 2007-038 - <4” Volumetric •Inquiry MRP139-06 – No known cracks – added Note 7 •NRC Comment #13 – Add “yes” to Inspected? Column for D and E •NRC Comment #18 – Note 2 – Sample Expansion •NRC Comment #25 – Note 6 on Approved Alternative •Reflect OWOL categorization in PWSCC Categories B & F
6-16, 17	•NRC Comment #15 – Cat. G additional inspections (Note 5) •NRC Comment #25 – Note 6 on Approved Alternative •Inquiry MRP139-11 (#3 & #4) – limitation to similar joints in Note 2 •OWOL Inspection volume added as Note 8 •Editorial
6-18	•Inquiry MRP139-12 – Applicable to other cold leg locations

MRP-139: Rev. 1 (draft) - Changes

7-2	•Editorial – no Figure 2.4
7-3	•NRC Comment #23 – Other loads •Weld overlay Code Cases updated and reference to MRP-169 added addressing OWOL design
C-1	•Editorial

MRP-139: Rev. 1 (draft) - Changes

Section 1.2 – Mandatory Requirement Statement

- ***"Per the implementation protocol of the Nuclear Energy Institute (NEI) 03-08 initiative, this section (Section 1.2) and Sections 5 and 6 of this I&E guideline are mandatory requirements for PWR owners. Owners must implement the initial exam schedules listed in this section and the subsequent inspections/frequencies listed in Tables 6-1 and 6-2 for all weld locations meeting the detailed scope definition contained in section 6.0. If owners determine that certain weldments are not inspectable per section 5.1.5 of this guideline, they shall take those actions necessary to make the weldment inspectable by the required implementation date (stated below). Any plant that cannot meet the implementation dates stated below shall process the inability as a deviation under the guidance of NEI 03-08 and applicable MRP Administrative Procedures. Section 5.1.7 contains recommended compensatory actions for such weld locations that should be considered in any such deviation. The remainder of this guideline is provided for information and is not meant to carry any implementation requirements under NEI 03-08."***

MRP-139: Rev. 1 (draft) - Changes

5.1.7 Requirements If Inspections Will Not be Completed as Required

- *"If either of the following conditions apply for a particular weld, then a timely deviation documenting this condition and any compensatory actions being taken is required (Section 1.2). This deviation and any specific compensatory measures it imposes shall be maintained until full compliance with the inspection and schedule requirements of this document can be attained for the subject weld or until the weld has been mitigated.*
  - *An inability to obtain 90% coverage of the required volume for circumferential flaws AND an inability to improve the examination coverage by modifying the weld (Figure 5-1 Item 9), or*
  - *A required baseline exam will not be completed per the implementation schedule of Section 1.2.*
- *Note: If an owner obtains NRC approval of a relief request for not being able to obtain 90% coverage of the volume of interest subsequent to the July 14, 2005 initial release of this Guideline, the owner may meet the conditions of the NRC-approved relief request in lieu of applicable requirements of this guideline. Relief requests for reduced coverage approved by NRC prior to issuance of this guideline shall be re-evaluated by the utility considering the intent of the MRP-139 requirements."*

Note: Inspection limitations at certain cold leg locations may preclude compliance with coverage requirements - resolution options are still being considered

MRP-139: Rev. 1 (draft) - Changes

5.1.7 Requirements If Inspections Will Not be Completed as Required

- *"Recommended Compensatory Measures*
  - *The following compensatory measures are not mandatory but should be considered where appropriate and applicable when preparing a deviation in accordance with the requirement above:*
    - *… visual exam . . .*
    - *… best effort volumetric . . .*
    - *… degradation assessment . . .*
    - *. . . etc."*

MRP-139: Rev. 1 (draft) - Changes

Section 6.0 - Guideline Scope and Categorization Criteria

- *"The applicability and categorization of the requirements of this document are a function of the following primary weld joint attributes: operating environment; joint design; materials of construction; nominal size; nominal operating temperature at the joint location; and mitigation status. The relevant applicability criteria associated with each of these attributes are stated below.* ***Weld locations included within the scope of this document and to which the requirements herein apply are those where the operating environment, joint design, materials of construction, size, and operating temperature have all been determined to be applicable.*** *Operating temperature, size, materials of construction, mitigation attributes, and prior inspection results are then individually relevant to categorization of a given weld joint within the set of PWSCC Categories defined in the following sections."*

MRP-139: Rev. 1 (draft) - Changes

Section 6.0 - Guideline Scope and Categorization Criteria – cont.

- *"Operating Environment - [Scope]*
- *This document is applicable to locations exposed to PWR reactor coolant.*
- *Joint Design - [Scope]*
- *This document is applicable to dissimilar metal butt weld joints generally of the design defined as ASME categories B-F and B-J. Only this joint design has been evaluated in the analyses supporting this guideline document. However, the dissimilar metal welds joining the nickel alloy RV closure head penetrations to various attachment fittings or appurtenances (e.g., CRDM, CEDM, ICI, vent, etc.), are excluded from the scope of this document as are RV bottom head instrument nozzles and core flood tank applications that operate at temperatures below the plant cold leg temperature.*
- *Materials of Construction - [Scope & Categorization]*
- *This document is applicable to dissimilar metal welds as defined by the ASME B&PV Code Section IWA-9000, Glossary. Only those weld joints originally fabricated from non-resistant nickel-based alloys require additional actions. For the purposes of this document, Alloys 82, 182, and 132 are generally considered materials susceptible to PWSCC (non-resistant). High chrome, nickel alloys including Alloys 52 and 152, and austenitic stainless steels, cast stainless steels, and low-alloy steels are generally considered to be resistant materials. However, if the bulk joint consists of non-resistant material that has been completely and effectively isolated from the operating environment with resistant material, the joint may be considered "resistant"."*

MRP-139: Rev. 1 (draft) - Changes

Section 6.0 - Guideline Scope and Categorization Criteria – cont.

- *"Joint Nominal Size - [Scope & Categorization]*
- *This document is applicable to joints where the relevant nominal pipe size (NPS) associated with the subject joint is one-inch (1") NPS or greater. Weld size is also a relevant attribute in determining specific inspection requirements. In most instances, categorization by size (NPS) is unequivocal; but in marginal situations (e.g., large nozzles joined to small diameter pipe), the final determination shall be made conservatively and in a technically defensible manner. Note that 1" to <4" weldments are included; however, they are not all treated with equal volumetric nondestructive evaluation (NDE) rigor.*
- *Nominal Operating Temperature at the Joint Location - [Scope & Categorization]*
- *This document is applicable to joint locations where the nominal operating temperature is greater than or equal to cold leg temperature. Due to the range of cold and hot leg temperatures across the fleet of PWRs, this document intentionally does not define specific thresholds for these designations. However, 570ºF is a practical working boundary between hot and cold leg temperatures that may be applied with appropriately conservative discretion. Locations determined to operate below cold leg temperature are outside the scope of this document. However, in making such a determination, both the relative temperature below the plant-specific cold leg temperature and the absolute temperature relative to the range of cold leg temperatures across the PWR fleet should be considered. Additionally, as the delta below some nominal cold leg temperature diminishes, it may be appropriate to evaluate the subject location(s) using methods similar to those employed in defining MRP-139 inspection requirements."*

MRP-139: Rev. 1 (draft) - Changes

Section 6.0 - Guideline Scope and Categorization Criteria – cont.

- *"Joint Mitigation Status - [Categorization]*
- *This document is applicable to joint locations following application of a PWSCC mitigation process that has been qualified per the guidance contained in Section 3. Mitigation allows the subject joint location to be re-classified to a category as defined in this section (Section 6) generally with less restrictive inspection requirements to reflect the reduction in PWSCC susceptibility.*
- *Prior Inspection Results - [Categorization]*
- *Prior inspections that meet the requirements of Section 5 of this document provide categorization input for the "Inspected?" and "Cracked?" attributes. If the requirements, including inspection methods, coverage, and personnel qualification, have been met for the most recently required inspection of the subject weld joint, then the joint has been "Inspected" and the findings (i.e., cracks vs. no known cracks) determine the "Cracked" attribute. An unmitigated joint may only be designated "Uncracked" based on inspection results meeting all applicable coverage requirements of the ID-connected inspection volume defined in Section 5. Otherwise a flaw must be assumed and the joint is conservatively designated "Cracked". If a flaw is identified and attributed to PWSCC, the location is "Cracked" and MRP-139 requirements and actions apply; however, if the indication is not attributed to PWSCC, then the requirements of ASME Section XI take precedence and the joint may be designated "Uncracked" for the purposes of compliance with this document. If the flaw is analyzed to be left in service for longer than one cycle, the Section 7 evaluation will dictate future required actions (i.e. repair or inspection). Classification following mitigation shall be based on guidance established for the specific mitigation applied."*

MRP-139: Future Actions

- MRP-139, Rev. 1
  - Technical review nearing completion
  - Submit for MRP membership Approval in early March
  - Issue following Executive Committee approval

- Guidelines are subject to review ~every two years
  - MRP-139 due in 2008
  - Rev. 1 intended as “cleanup” revision
  - Broader review will be conducted this year to determine if additional revision is warranted

MRP-139: DB Flaw OE Assessment

Issued to utility contacts as letter MRP 2008-07

- ***Plant Name:*** Davis Besse
- ***Event description:*** Discovery during implementation of mitigation (SWOL) of an axial, near-through wall flaw in an A82/182 weld under the jurisdiction of MRP-139 and operating at hot leg temperature
- ***Event Date:*** January 4, 2008
- ***Evaluation Date:*** January 18, 2008
  - *Have similar indications been found previously in this generic location?*
    - Yes in a limited number of cases
  - *Have the likely or presumed degradation mechanisms been previously associated with this generic location?*
    - Yes – PWSCC is a known degradation mechanism for these locations

MRP-139: DB Flaw OE Assessment – cont.

- ***Are the critical characteristics of the indication(s) consistent with previous operating plant experiences relative to:***
  - *Indication location*
    - Yes – indications and flaws have been identified in various hot leg DM weld joints. The flaw(s) identified at TMI in the HL-PZR Surge nozzle and V. C. Summer HL are examples.
  - *Indication length*
    - Yes – flaws of this basic length and aspect ratio have been previously seen – VC Summer is an example
  - *Indication depth*
    - Yes – a limited number of through wall flaws have occurred (this is the third deep flaw we've seen – the Summer hot leg and Tsuruga pzr nozzle were leaking during operation)
  - *Indication orientation*
    - Yes – axial flaws have clearly been the most prevalent orientation and to date only axial flaws have been identified as through wall based on physical evidence via destructive testing and/or in place verification.
  - *Number of such indications in similar locations*
    - Yes – a single axial flaw or indication is not uncommon.
  - *Number of such indications in this specific location*
    - This specific location (Decay Heat nozzle) is common to the B&W fleet and this is the first such flaw identified in these nozzles. However, in a general sense this location is not remarkably different from other US PWR hot leg DM weld locations in terms of size, function, or temperature.
  - *Extenuating Circumstances at this specific location (+ or -)*
    - This plant-specific location reportedly does not incorporate a safe end in the joint configuration, instead involving only a thick A82/182 butter layer applied in the shop and an A82/182 field weld between the butter and the SS pipe. This field weld did involve repairs in several areas but there is no indication that they were remarkably different from repairs reported for many other welds under the jurisdiction of MRP-139.

MRP-139: DB Flaw OE Assessment – cont.

- *Is there an industry-issued management plan in place that is capable of ensuring continued safe operation of any plant by the timely identification of this class of indications in this generic location?*
  - Yes – MRP-139 is in place and was the source of the initiating requirement to mitigate / inspect this location at this time.
- *Was this indication identified as a direct result of implementing requirements of a site-specific or industry mandated management program for this generic location?*
  - Yes – see above
- *Is this indication or set of indications clearly bounded in a robust manner by existing site-specific or generic industry analyses?*
  - Yes – MRP-139 and its technical basis documents clearly identify axial as the most likely flaw orientation based on extensive stress analysis results and as borne out by most field experience. These documents also clearly state that the flaw will arrest upon encountering the base metal on both sides of the weld (LAS and SS) so the length of the flaw is physically limited. The conditions reported by the utility for the subject flaw are entirely consistent with these expectations.
  - It should be noted though that MRP-139 is based on an assumption of circumferential flaws since such flaws could not be analytically ruled out, are the more limiting nuclear safety condition, and have been identified at several plants. (Note that confirmatory destructive analysis has been limited to that conducted at V. C. Summer which revealed the small circ component of the through wall axial flaw)

MRP-139: DB Flaw OE Assessment – cont.

- *Is there anything about this indication that would suggest it appropriate to re-evaluate any program requirements, previous inspection results, or upcoming inspection plans?*
  - No – considered in the context of past OE and analytical expectations, this particular flaw as reported does not exhibit any uniquely noteworthy characteristics. Therefore, no changes to MRP-139 and no new plant actions are recommended as a result of this OE. However, the fact that flaws continue to be found while we implement this series of baseline exams of DM welds reinforces the importance to the fleet of the timely completion of this phase of MRP-139 implementation. As a reminder to licensees, during evaluation of mitigation processes and outage planning, the Technical Specification operability requirements of the line involved and the potential for impacts to its operability during all phases of the mitigation activity must be carefully assessed.

MRP-139: Deviation Survey
69 of 69 Plants Responded

1. By 12/31/08 - welds ≥ 4” NPS and ≤ 14” NPS and exposed to temperatures equivalent to the hot leg
   - 44 will comply, 24 have no welds in this category, 1 deviation: coverage
2. By 12/31/09 - welds > 14” NPS and exposed to temperatures equivalent to the hot leg
   - 56 will comply, 13 have no welds in this category, 0 deviations
3. By 12/31/10 - welds exposed to temperatures equivalent to the cold leg (including smaller-diameter HPI welds)
   - 60 will comply, 4 have no welds in this category, 5 deviations
   - 1 Schedule Deviation
   - 4 Coverage Deviations
4. By 12/31/10 - welds > 2” NPS and < 4” NPS and exposed to temperatures equivalent to the hot leg or serve an ECCS function
   - 39 will comply, 30 have no welds in this category, 0 deviations
5. By 12/31/10 - welds > 1” NPS and < 4” NPS without a requirement for UT exam the initial visual exam is due no later than the first RFO after July 1, 2008
   - 47 will comply, 22 have no welds in this category, 0 deviations

MRP-139: Scope for Reported Deviation Plans

- Coverage (5)
  - Hot leg <14” NPS nozzle (1): Performed inspection but failed to attain required coverage due to joint configuration – planning to inspect during an upcoming maintenance outage
  - Cold leg nozzles (4): Cannot meet current MRP-139 coverage requirements due to presence of Cast Austenitic Stainless Steel component in joint

- Schedule (1)
  - Cold leg nozzles inaccessible without core barrel removal (infrequent, high dose, high risk evolution)
  - Delay one cycle to align with 10-yr vessel ISI

MRP-139: CASS Inspection Issue

- DM weld joints to CASS material cannot meet the current MRP-139 volumetric examination zone coverage requirements
  - Required exam zone currently includes base material on both sides of the weld / butter material
  - The grain structure of CASS materials precludes effective UT interrogation of the material itself or of adjacent materials through the CASS
  - CASS can be an MRP-139 inspection issue where:
    - CS main loop piping is joined to CASS RCP casing
    - CASS safe-ends were welded to CS pipe or components
  - PDI qualified single-sided exams may alleviate this
    - MRP-139 Interim Guidance for single-sided exam inspection volume is under review
  - Joint geometry may create a second inspection limitation
  - Similar challenge exists under ASME Section XI

- Allowance in MRP-139 for removal of CASS from required exam volume is under review; PDI procedures already allow single-side exam

Bottom Mounted Nozzles

Industry Activities

Inspections

I&E Guideline Development

Bottom Mounted Nozzles: Background

- Industry activities initiated in 1998 to evaluate the consequences of degradation of bottom mounted nozzles via PWSCC
- First field event – staining (no leak) on the Davis-Besse vessel (mid-2002)
- STP discovery of boric acid crystal deposits on April 12, 2003 accelerated the concern
- EPRI MRP issued letter requesting each site to complete bare metal visual inspection of RV lower head (June 2003)
- NRC issued Generic Letter 2003-02 requesting information on site plans

BMNs: Strategic Plan

- Coordinate activities through EPRI MRP, WOG/CEOG and B&WOG
  - NDE Demonstration Program
    - MRP Alloy 600 ITG
  - BMN Assessment Plan
    - B&WOG, WOG, and MRP Alloy 600 ITG
  - Integrated Industry Inspection Plan
    - MRP and PWR Owners
  - BMN Repairs
    - MRP Alloy 600 ITG

BMNs: Previous NRC Meetings

- November 25, 2003 Meeting
  - B&WOG LOCA Evaluation Results
  - WOG Operability Assessment Results
  - MRP Visual Examination Recommendations
  - NDE Demonstration Program Status
  - Safety Assessment Plans
  - Industry Integrated Inspection Plan Status
  - BMN Repair Criteria Development
- July 19, 2004 Conference Call
  - BMN NDE Demonstration Program Status
  - BMN Safety Assessment Plan
  - Integrated Inspection Plan
  - BMN Strategic Plan Status
- Sept 29, 2005 Meeting
  - Integrated Industry Inspection Plan
  - NDE Demonstration Program
  - BMN Repair Attributes
  - Safety Assessment Results
  - BMN Management Plan Development

Tabulated Domestic BMN Inspection Reported

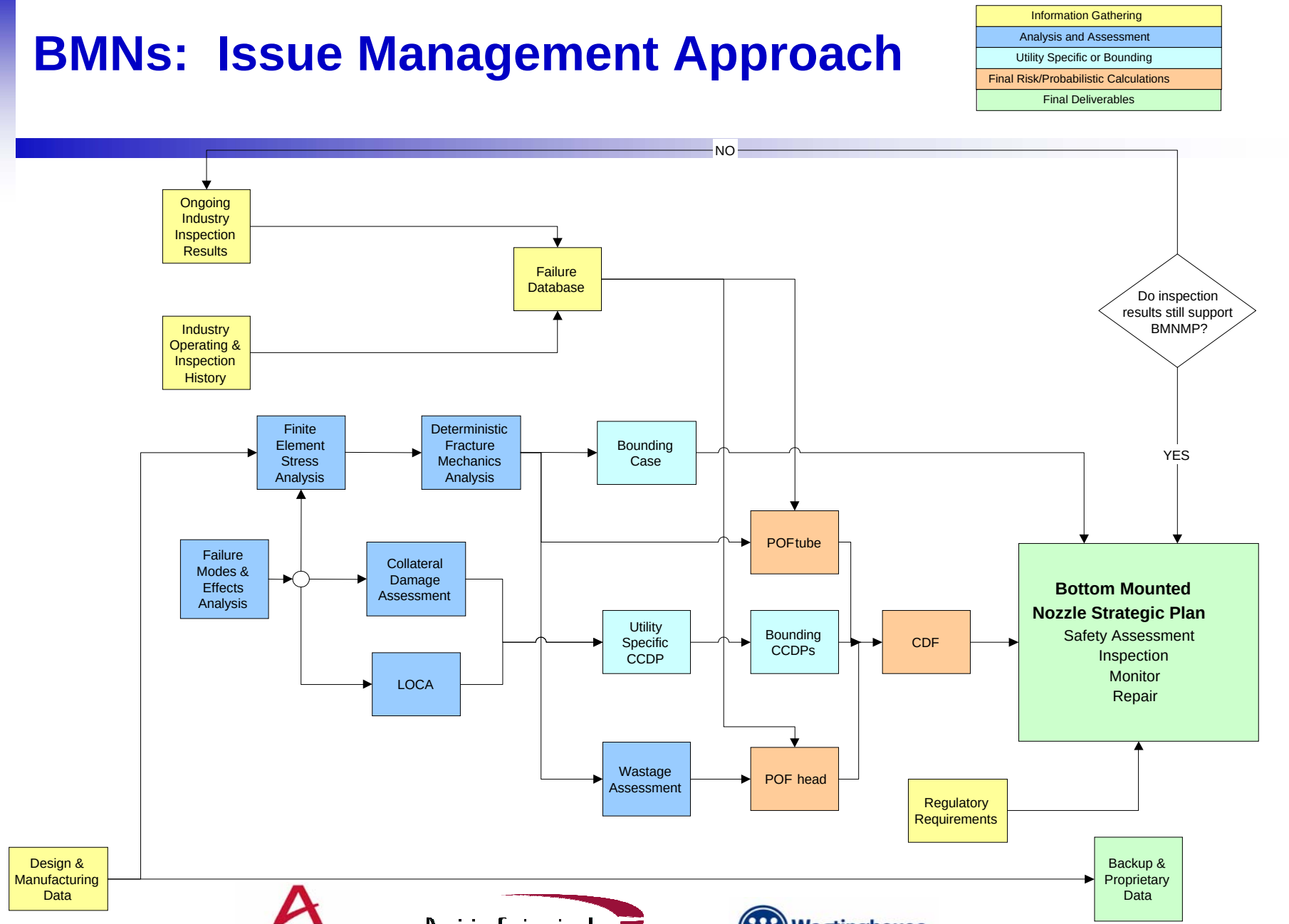
Through Spring 2007 Outage Season

NSSS Design	# BMNs	BMV	Volumetric**
B&W * (7 units)	366	366	0
W 2-Loop * (6 units)	216	216	0
W 3-Loop (13 units)	652	602	176
W 4-Loop (29 units)	1605	1605	677
CE 80 (3 units)	183	183	0
TOTAL	3022	2972	853

*Volumetric exam capability was not successfully demonstrated to the satisfaction of the utility (false positives)

** Voluntary industry initiative

BMNs: Issue Management Approach



BMNs: Safety Assessments

Presentation Outline from September 2005

- WOG & BWOG
  - Materials and Fabrication Records
  - FMEA
  - WOG/B&WOG
    - Deterministic Fracture Mechanics
    - LOCA Analysis
    - Probabilistic Risk Assessment
  - Collateral Damage Assessment
- MRP (DEI)
  - Wastage Evaluation

BMNs: Inspection Guideline

- MRP-206, Inspection Plan for Reactor Vessel Bottom Mounted Nozzles in U.S. PWR Plants
  - Inspection regimes based on
    - OG Safety Assessment documents
    - MRP Wastage Assessment
  - Initial drafts developed in 2006
    - Work delayed in 2007
  - Final document to be issued mid-2008

BMNs: Inspection Bases

Most Probable Initiating conditions

- Axial Tube wall crack
  - Deterministic crack growth calcs – NSC not credible
  - Periodic exams adequate
- Weld crack
  - Short time to through wall likely
  - Tube ejection judged not credible
  - Volumetric exam not possible or necessary
- Consequences
  - Leakage
  - Well within ECCS makeup capability thus CCDP<<1

BMNs: Inspection Bases

Least Probable Initiating conditions

- Circumferential Tube wall crack
  - Deterministic crack growth calcs – long time to NSC
  - Periodic exams adequate

- Consequences
  - Leakage
  - Single tube failure within ECCS makeup thus CCDP<1

BMNs: Inspection Bases

Impact of cracks (w/o inspection)

- Tube or weld leaks - wet annulus regardless of crack type
- Undetected leakage likely to produce wastage
- Wastage rate
  - Precise predictions not possible
  - Conservative assumptions applied
- Ultimate failure mode - (clad rupture)
  - Gross wastage undetected
  - Likely to exceed ECCS makeup capability
  - CCDP = 1

Therefore wastage dominates overall risk

BMNs: Inspection Bases

Inspection Options

- Tubes
  - Volumetric/Surface exam: currently only W-3 & W-4, System 80
- Welds
  - Volumetric exam: not available
  - ECT: unreliable due to geometry
  - PT: remote and underwater
- External Visual Exams
  - Inspecting for leakage
    - Highly effective

BMNs: Implementation

- MRP-206
  - Assuming CC N-722 becomes regulation:
    - Issue w/o mandatory requirements
    - Provide basis for relief to implement alternative inspection regimes

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