Overview of DG-1119
Guidelines for Evaluating EMI/RFI in Safety-Related I&C Systems

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Presented to
Advisory Committee on Reactor Safeguards
Rockville, Maryland
March 6, 2003

Outline of Presentation

- Overview of DG-1119
- Technical Basis for Electromagnetic Compatibility at Nuclear Power Plants
- Summary of DG-1119 Benefits and Value

DG-1119 Endorses Current Electromagnetic Compatibility (EMC) Standards for Safety-Related I&C Systems

- Describes design, installation, and implementation practices to evaluate and minimize the impact of EMI/RFI and power surges on I&C systems
  - Scope covers analog, digital and hybrid equipment
  - Addresses emissions, susceptibility, and surge withstand testing
  - Describes grounding and shielding practices
- Applies to new or modified safety-related I&C equipment in existing and future nuclear power plants
- Endorsement of the guidance in IEC 61000 is introduced
- Technical basis is well documented
  - Enhanced basis for update given in NUREG/CRs 5609 and 6782
  - Basis for existing guide given in NUREG/CRs , 5941, 6431, and 6436

Why is DG-1119 Needed?

- DG-1119 Updates Regulatory Guide 1.180
- Responds to NRR User Need Request 2002-017
- US military standard for EMC has been revised (MIL-STD 461E)
- Alternate testing practices are available through international EMC standard (IEC 61000)
- Guidance to address additional EMC issues is needed
  - Conducted susceptibility along interconnecting signal leads
  - Susceptibility and emissions testing in frequency range above 1 GHz
- Industry has asked for relaxation in EMC testing criteria (e.g., operating envelopes) where technically justified

Resolution of Public Comments

- Four correspondents submitted comments on DG-1119
- Public comments can be grouped into general categories
  - Operating envelopes
  - Testing above 1 GHz
  - Surge testing for signal lines
  - Relation to previous guidance
  - Test methods and exemptions
- DG-1119, Rev. 1, reflects resolution of comments

Technical Basis For Electromagnetic Compatibility Guidance

DG-1119 Employs U.S. Military and Industrial Experiences to Establish a Systematic Approach for EMC and Offers Option for International Standard

- Endorses commercial standards for design and installation practices
  - Grounding and shielding of I&C equipment (IEEE Std 1050)
- Endorses well-established testing standards
  - Power surge withstand (IEEE Stds C62.41 and C62.45 and IEC 61000)
  - Electromagnetic emission and susceptibility requirements for the control of EMI/RFI and test methods to demonstrate compliance (MIL-STD 461 and IEC 61000)
  - Tailored test limits (operating envelopes) to conditions found in nuclear power plants and industrial sites
  - Allows exemption of some test criteria under certain conditions based on technical considerations

DG-1119 Revises the Existing Guidance Provided in RG-1.180

- Updates endorsement of MIL-STD test methods to latest version (MIL-STD 461E)
- Introduces alternate testing options using IEC 61000 test methods
- Permits use of FCC or CISPR certification under specified conditions
- Includes signal line conducted susceptibility test methods
- Extends frequency range for radiated emissions and susceptibility testing above 1 GHz
- Provides enhanced surge withstand capability operating envelopes

Position 1 Outlines the Elements of a Systematic Electromagnetic Compatibility Program for Safety-Related I&C Systems

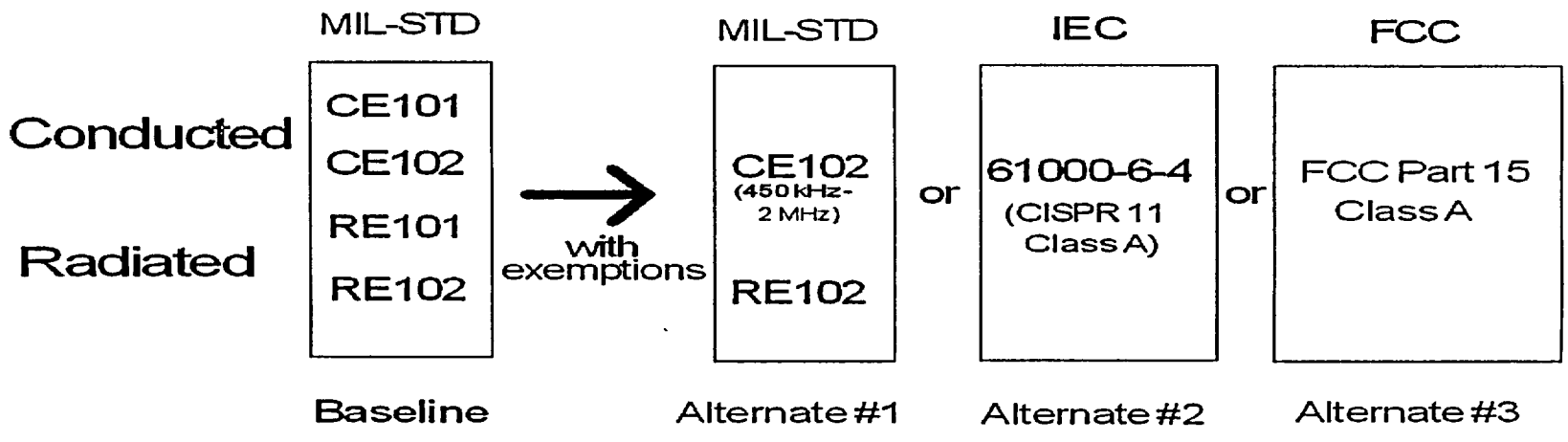
- Design and installation practices to limit the impact of electromagnetic effects
- Testing practices to assess the emissions of equipment and their susceptibility to EMI/RFI
- Testing practices to evaluate the power surge withstand capability of equipment
- Operating envelopes characteristic of the electromagnetic environment in nuclear power plants

Position 2 Endorses Design and Installation Practices in IEEE Std 1050-1996 With One Exception

- Provides guidance on engineering practices needed to minimize the potential impact on safety-related I&C systems exposed to EMI/RFI and power surges
- Addresses grounding and noise-minimization techniques in a generating station environment
- Exception taken to Section 4.3.7.4 on radiative coupling concerning field strength attenuation with distance

IEEE Std 1050-1996 is presently under revision and exception is being submitted for review

Position 3 Endorses EMI/RFI Emissions Tests from MIL-STD 461E, IEC 61000-6, and FCC Part 15, Along With Associated Operating Envelopes



- CE101 exemption is allowed if power quality control is employed
- RE101 exemption is allowed for equipment not intended to be installed in the proximity of magnetic field emitters

Position 4 Endorses EMI/RFI Susceptibility Tests from MIL-STD 461E and IEC 61000-4, Along With Associated Operating Envelopes

	Baseline MIL-STD		Alternate IEC	
	Power	Signal	Power	Signal
Conducted	CS101 CS114	CS114 CS115 CS116	61000-4-6 61000-4-13 61000-4-16	61000-4-6 61000-4-16 61000-4-4 61000-4-5 61000-4-12
Radiated	RS101(*) RS103		61000-4-8(*) 61000-4-9(*) 61000-4-10(*) 61000-4-3	

(*) Exemption based on proximity to magnetic field emitters

Position 5 Endorses IEEE Std C62.41 and IEC 61000-4 Power Surge Withstand Tests, Along With Their Associated Operating Envelopes

- IEEE Std C62.41 Ring Wave or IEC 61000-4-12
  - Simulates high-frequency oscillatory surges
- IEEE Std C62.41 Combination Wave or IEC 61000-4-5
  - Two exponential waveforms
    - open-circuit voltage
    - short-circuit current
  - Represents direct lightning discharges, fuse operation, or capacitor switching
- IEEE Std C62.41 Electrically-Fast Transients or IEC 61000-4-4
  - Emulates local load switching

Power Surge Withstand Capability Operating Envelopes

Table 22 Surge Withstand Levels for Power Lines

Surge Waveform	Category B Low Exposure	Category B Medium Exposure	Category C Exterior
Ring Wave	2 kV	4 kV	N/A
Combination Wave	2 kV / 1 kA	4 kV / 2 kA	6 kV / 3 kA
EFT	2 kV	4 kV	N/A

Position 6 Endorses MIL-STD 461E Testing Above 1 GHz

- RE102 test is applicable above 1 GHz for up to 10 times the highest intentionally generated frequency within the equipment under test
- RS103 test is applicable in the frequency range 1 GHz to 10 GHz, covering the unlicensed frequency bands where much of the high-frequency communications activity is taking place (2.45 GHz and 5.7 GHz)

Position 7 Provides Documentation Guidance for EMC

- Documentation should provide evidence that
  - Safety-related I&C systems are compatible with the electromagnetic environment
  - Acceptable installation practices are followed
  - Administrative emissions controls are in place

Summary of DG-1119 Benefits and Value

Benefits of DG-1119

- Comprehensive guidance on an acceptable method for electromagnetic compatibility of safety-related I&C systems
- Endorsement of current national and international EMC standards
- Specific guidance to address previously unresolved issues
  - Conducted susceptibility along interconnecting signal leads
  - Emissions and susceptibility testing for very high frequency phenomena (> 1 GHz)
- Relaxation of test criteria where technically justified
  - Operating envelopes
  - Opportunity to invoke FCC or CISPR emissions certification

Public Comments Were Addressed In Revised Draft Regulatory Guide

- Identification of IEC test limits was clarified (i.e., use of standard testing levels noted)
- Illustration of alternate test options added for clarity
- Surge operating envelope guidance enhanced to address additional locations and surge environments
- Emissions testing above 1 GHz added

Final Effective Guide Will Support NRC Mission

- Contributes to Achieving NRC Goals
  - Maintaining Safety by providing an enhanced approach for establishing electromagnetic compatibility for safety-related I&C systems in nuclear power plants
  - Reducing Regulatory Burden by providing alternate testing suites and relaxing selected test criteria where technically justified
  - Improving Regulatory Effectiveness by giving comprehensive guidance on acceptable practices for electromagnetic compatibility that utilize current standards

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Peach Bottom Atomic Power Station
Plant License Renewal

Presentation to
Advisory Committee on Reactor Safeguards

Bill Bohlke
Fred Polaski
March 6, 2003

Exelon SM

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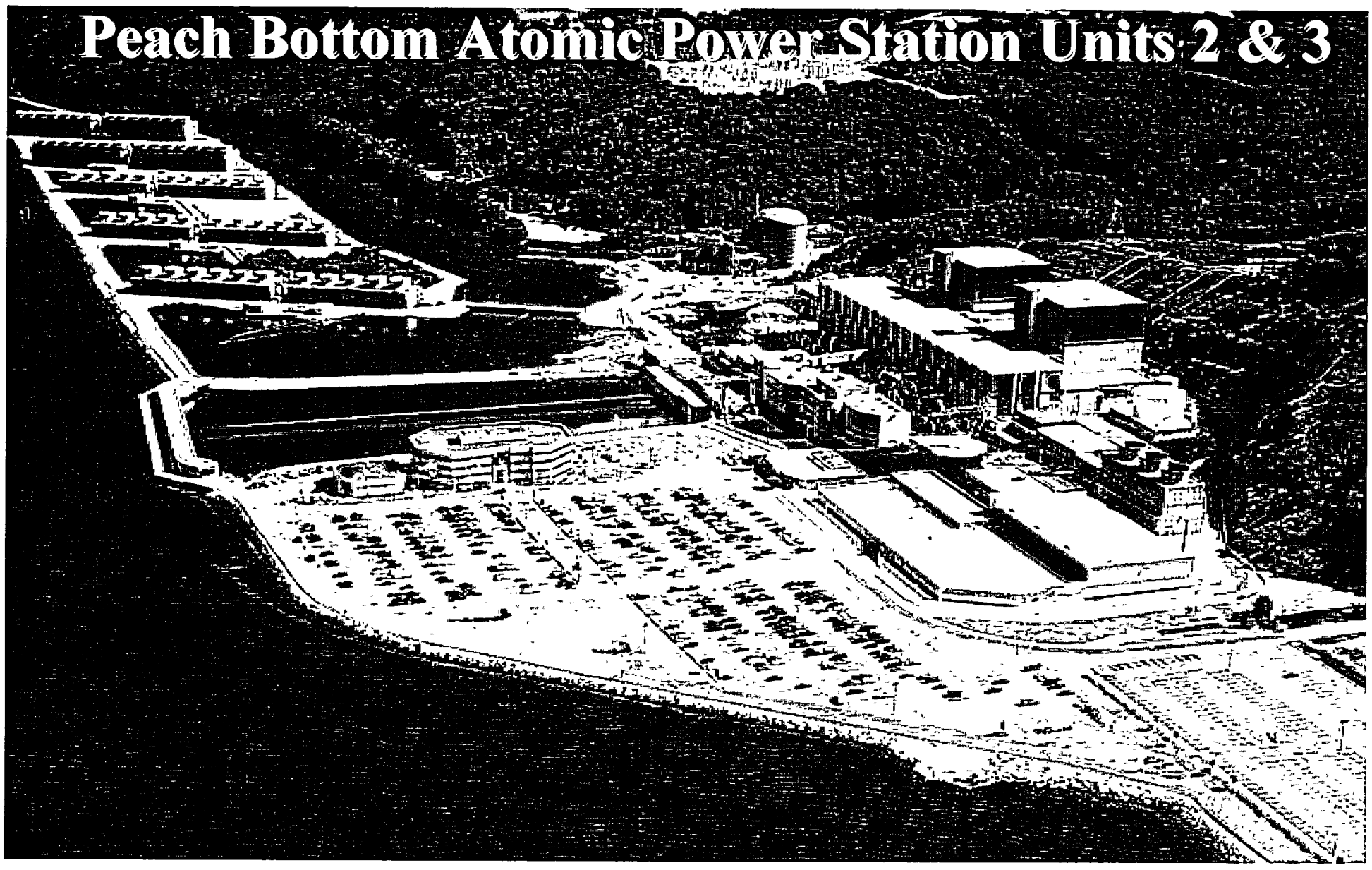
Peach Bottom Atomic Power Station Units 2 & 3



Plant Description

- PBAPS Units 2 & 3 are General Electric BWR4's with Mark I containment
- ~2340 Mwe total generating capacity
- Initial licenses expire in 2013 and 2014

Agenda

- Application Background
- Post License Look-ahead

Application Background

- July 2001 – Application submitted
- December 2002 – Supplemental Environmental Impact Statement issued
- February 2003 – Safety Evaluation Report issued
- February 2003 – Regional Administrator letter issued

Post License Look-Ahead

- UFSAR supplement will be implemented in the next update
- Aging Management Activity commitments as defined in UFSAR supplement will be completed
- Plant changes will be evaluated to ensure commitments are maintained

Implementing Commitments

- All commitments are documented in the Exelon commitment tracking system
- Commitment tracking numbers have been created for each Aging Management Activity
- Implementing procedures have been annotated for on-going commitments
- Future actions have been identified on commitment tracking evaluations

App A	EXISTING AGING MANAGEMENT ACTIVITIES	Commitment Tracking No.	Future Action**
1 1	Flow Accelerated Corrosion Program	T04338	
1 2	Reactor Coolant System Chemistry	T04336	
1 3	Closed Cooling Water Chemistry	T04336	
1 4	Demineralized Water and Condensate Storage Tank Chemistry Activities	T04336	
1 5	Torus Water Chemistry Activities	T04336	
1 6	Fuel Pool Chemistry Activities	T04336	
1 7	High Pressure Service Water Radioactivity Monitoring Activities	T04341	
1 8	Inservice Inspection (ISI) Program	T04343	E19
1 9	Primary Containment Inservice Inspection Program	T04345	
1.10	Primary Containment Leakage Rate Testing Program	T04325	
1 11	Inservice Testing (IST) Program	T04335	
1 12	Reactor Materials Surveillance Program	T04346	E08
1 13	Corrective Action Program	T04473	
1 14	Crane Inspection Activities	T04328	
1 15	Conowingo Hydroelectric Plant (Dam) Aging Mgmt Program		
1 16	Maintenance Rule Structural Monitoring Program	T04344	E20, E21
1 17	Electrical Cables not subject to 10 CFR 50 49 Environmental Qualification Requirement used in Instrumentation circuits	T04476	E14
	ENHANCED AGING MANAGEMENT ACTIVITIES		
2 1	Lubricating and Fuel Oil Quality Testing Activities	T04326, T04327	
2 2	Boraflex Management Activities	T04330	
2 3	Ventilation System Inspection and Testing Activities	T04324	
2 4	Emergency Diesel Generator Inspection Activities	T04332	
2 5	Outdoor, Buried, and Submerged Component Insp Activities	T04329	E23
2 6	Door Inspection Activities	T04331	E24
2 7	Reactor Pressure Vessel and Internals ISI Program	T04347	E15, E18
2 8	Generic Letter 89-13 Activities	T04333	E25
2 9	Fire Protection Activities	**T04342**	E05, E06, E22
2 10	HPCI and RCIC Turbine Inspection Activities	T04340	
2 11	Susquehanna Substation Wooden Pole Inspection Activity	T04348	E17
2 12	Heat Exchanger Inspection Activities	T04339	

App A	NEW AGING MANAGEMENT ACTIVITIES	Commitment Tracking No.	Future Action**
3 1	Torus Piping Inspection Activities	T04349	E07
3 2	FSSD Cable Inspection Activity	T04337	E16
3 3	Non-EQ Accessible Cable Aging Management Activity	T04475	E11
3 4	One-time Piping Inspection Activities	T04474	E26, E27, E28
3 5	Inaccessible Medium-Voltage Cables not subject to 10 CFR 50 49 Environmental Qualification Requirements	T04477	E12
3 6	Fuse Holder Aging Management Activity	T04478	E13
	TIME-LIMITED AGING ANALYSES ACTIVITIES		
4 1	Environmental Qualification Activities	T04412	
4 2	Fatigue Management Activities	T04411	E09, E29

** All future actions are tracked on commitment tracking evaluations on Action Request A1329928

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*** PLANT COMMITMENT ***

COMMITMENT NBR: T04342
TYPE : CT
UNIT NUMBER : PB
COMMITMENT SATISFIED: NO STATUS: INIT
TOPIC: PBLR FIRE PROTECTION ACTIVITIES

PRINT DATE: 11/26/02
LAST UPDATE: 01/11/02
STATUS DATE: 06/01/01
REV #: 0000

1. Document Information.

	TITLE	SECTION	DOCUMENT DATE	REV	CODE	NUMBER
SOURCE:	LICENSE RENEWAL APPL.					NLTN 010702
SOURCE:						
SOURCE:						
SOURCE:						

CM ESSENTIAL ELEMENT NBR: PBLR

2. System/Component Information.
CLASS: MODE:
SYSTEM/TOPIC:

3. Statement of Commitment/Essential Element.
THE PEACH BOTTOM LICENSE RENEWAL APPLICATION (LRA), APPENDIX A AND B, IDENTIFIED THE ACTIVITIES THAT ARE CREDITED FOR COMPLIANCE WITH THE LICENSE RENEWAL RULE FOR AGING MANAGEMENT OF PASSIVE, LONG-LIVED COMPONENTS AND STRUCTURES WITHIN THE SCOPE OF LICENSE RENEWAL. AGING MANAGEMENT REVIEWS (AMRS) DEVELOPED IN SUPPORT OF THE PBAPS LRA PROVIDED FURTHER DETAIL REGARDING THE AGING MANAGEMENT ACTIVITIES IDENTIFIED IN THE LRA APPENDICES.
****
STATEMENT OF COMMITMENT:
THE FOLLOWING ACTIVITIES ARE CREDITED FOR AGING MANAGEMENT:
LRA APP. A, SECTION A.2.9 AND APP. B, SECTION B.2.9 CREDIT FIRE PROTECTION ACTIVITIES FOR MANAGING AGING EFFECTS IN THE FIRE PROTECTION SYSTEMS.
EXISTING FIRE PROTECTION ACTIVITIES PROVIDE FOR INSPECTIONS, SYSTEM MONITORING, AND/OR SYSTEM PERFORMANCE TESTS OF:
- FP SYSTEM PUMPS, PIPING, SPRINKLERS, AND VALVES,
- DIESEL DRIVEN FIRE PUMP FUEL OIL SYSTEM PUMPS, VALVES, PIPING AND TUBING
- BURIED FIRE MAIN PIPING AND VALVES,
- OUTDOOR FIRE HYDRANTS, HOSE CONNECTIONS, AND HOSE STATION BLOCK VALVES, AND
- FIRE BARRIER PENETRATION SEALS, FIRE BARRIER DOORS, AND FIRE WRAPS EXPOSED TO SHELTERED AND OUTDOOR ENVIRONMENTS.

THE SCOPE OF FP ACTIVITIES WILL BE ENHANCED TO:
- REQUIRE ADDITIONAL INSPECTION REQUIREMENTS FOR DELUGE VALVES IN THE POWER BLOCK SPRINKLER SYSTEMS
- PERFORM FUNCTIONAL TESTS OF SPRINKLER HEADS THAT HAVE BEEN IN SERVICE FOR 50 YEARS
- INSPECT DIESEL DRIVEN FIRE PUMP EXHAUST SYSTEMS,
- INSPECT DIESEL DRIVEN FIRE PUMP FUEL OIL SYSTEM FLEXIBLE HOSES, AND
- ADD SPECIFICITY FOR DETECTION OF LOSS OF MATERIAL IN REQUIREMENTS FOR INSPECTION OF FIRE DOORS.
- A ONE TIME TEST OF CAST IRON FIRE PROT. COMPONENT TO DETECT LOSS OF MATERIAL DUE TO SELECTIVE LEACHING

PERFORMANCE TESTING OF FIRE PROTECTION SYSTEMS AND COMPONENTS ARE BASED ON NFPA 24 STANDARDS.

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THE FOLLOWING AGING EFFECTS ARE MANAGED:
- FP SYSTEM PIPING, SPRINKLERS, AND VALVES - VISUAL INSPECTIONS TO DETECT LOSS OF MATERIAL, CRACKING, AND FLOW BLOCKAGE
- FIRE PUMPS - VISUAL INSPECTIONS DURING CORRECTIVE MAINTENANCE ACTIVITIES TO DETECT LOSS OF MATERIAL AND FLOW BLOCKAGE
- DIESEL DRIVEN FIRE PUMP FUEL OIL SYSTEM PUMPS, VALVES, PIPING, AND TUBING - VISUAL INSPECTIONS TO DETECT LOSS OF MATERIAL AND CRACKING
- BURIED FIRE MAIN PIPING AND VALVES - CONTINUOUS MONITORING OF SYSTEM PRESSURE FOR LEAKAGE DETECTION
- BURIED MAIN PIPING AND VALVES, OUTDOOR FIRE HYDRANTS, HOSE CONNECTIONS, AND HOSE STATION BLOCK VALVES - FLOW TESTS TO DETECT BLOCKAGE AND COMPONENT DEGRADATION
- FIRE BARRIER PENETRATION SEALS, FIRE BARRIER DOORS, AND FIRE WRAPS - VISUAL INSPECTIONS TO DETECT CHANGE IN MATERIAL PROPERTIES, CRACKING, DELAMINATION, SEPARATION, AND LOSS OF MATERIAL. THIS WILL CONSIST OF INSPECTING SPECIFIED SAMPLE QUANTITIES OF PENETRATION SEALS EVERY 24 MONTHS WITH THE ENTIRE POPULATION BEING INSPECTED EVERY 16 YEARS.
- POWER BLOCK DELUGE VALVES - VISUAL INSPECTIONS TO DETECT LOSS OF MATERIAL, CRACKING, AND FLOW BLOCKAGE
- SPRINKLER HEADS IN SERVICE FOR 50 YEARS - FUNCTIONAL TESTING TO DETECT FLOW BLOCKAGE. THIS WILL CONSIST OF FUNCTIONAL TEST OF A REPRESENTATIVE SAMPLE
- DIESEL DRIVEN FIRE PUMP EXHAUST SYSTEM - VISUAL INSPECTIONS TO DETECT LOSS OF MATERIAL
- DIESEL DRIVEN FIRE PUMP FUEL OIL SYSTEM FLEXIBLE HOSES - VISUAL INSPECTIONS TO DETECT CHANGE IN MATERIAL PROPERTIES
- FIRE DOORS - VISUAL INSPECTIONS FOR LOSS OF MATERIAL
- CAST IRON FIRE PROT COMPONENTS - TESTED FOR LOSS OF MATERIAL DUE TO SELECTIVE LEACHING.
****
REFERENCES:
AMR-M01, GAS ENVIRONMENTS
AMR-M03, OIL/FUEL OIL ENVIRONMENT
AMR-M04, RAW WATER
AMR-M08, EXTERNAL ENVIRONMENTS
AMR-S06, HAZARDS BARRIERS AND ELASTOMERS

4. Implementing Activities.

___ 001 DOCUMENT CODE: M 037-001 SECTION: ____
DOC. DATE: ____ REV NUMBER: ____
ANNOTATED: Y IMPLMNT ORGN: P COMPLT: ____
ACTIVITY: CHECK VALVE MAINT MK 249

___ 002 DOCUMENT CODE: M 037-002 SECTION: ____
DOC. DATE: ____ REV NUMBER: ____
ANNOTATED: Y IMPLMNT ORGN: P COMPLT: ____
ACTIVITY: DIESEL FIRE PUMP MAINT.

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*** PLANT COMMITMENT ***

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TOPIC: PBLR FIRE PROTECTION ACTIVITIES

PRINT DATE: 11/26/02
LAST UPDATE: 01/11/02
STATUS DATE: 06/01/01
REV #: 0000

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4. Implementing Activities.

093 DOCUMENT CODE: ST O-37B-362-2 SECTION:
DOC. DATE: REV NUMBER:
ANNOTATED: Y IMPLMNT ORGN: P COMPLT:
ACTIVITY: SBGT FILTER TRAIN B DELUGE SYS FUNC.

094 DOCUMENT CODE: ST O-37B-381-2 SECTION:
DOC. DATE: REV NUMBER:
ANNOTATED: Y IMPLMNT ORGN: P COMPLT:
ACTIVITY: UNDERGROUND FIRE MAIN FLOW TEST

095 DOCUMENT CODE: ST O-37C-330-2 SECTION:
DOC. DATE: REV NUMBER:
ANNOTATED: Y IMPLMNT ORGN: P COMPLT:
ACTIVITY: MOTOR DRIVE FIRE PP FLOW RATE

096 DOCUMENT CODE: ST O-37D-340-2 SECTION:
DOC. DATE: REV NUMBER:
ANNOTATED: Y IMPLMNT ORGN: P COMPLT:
ACTIVITY: DIESEL DRIVEN FIRE PP FLOW RATE

097 DOCUMENT CODE: ST O-37D-370-2 SECTION:
DOC. DATE: REV NUMBER:
ANNOTATED: Y IMPLMNT ORGN: P COMPLT:
ACTIVITY: DIESEL DRIVEN FIRE PP OPERABILITY TEST

098 DOCUMENT CODE: ST S-037-350-2 SECTION:
DOC. DATE: REV NUMBER:
ANNOTATED: Y IMPLMNT ORGN: P COMPLT:
ACTIVITY: SAFETY RELATED FIRE BRRIER DOOR INSP.

099 DOCUMENT CODE: RT PLACE KEEPER SECTION: A1329928 E06
DOC. DATE: 06/15/12 REV NUMBER:
ANNOTATED: N IMPLMNT ORGN: PEPB COMPLT:
ACTIVITY: SPRINKLER HEADS IN SERVICE FOR 50 YEARS INSPECTION

100 DOCUMENT CODE: RT PLACE KEEPER SECTION: A1329928 E05
DOC. DATE: 01/05/08 REV NUMBER:
ANNOTATED: N IMPLMNT ORGN: PEPB COMPLT:
ACTIVITY: FIRE PROT. COMP. SELECTIVE LEACHING TESTING

========== END OF COMMITMENT ==========

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5.2.2 Visually **EXAMINE** the following components for damage, excessive wear, cracks, corrosion, pitting, erosion, evidence of Asiatic Clams or other abnormalities. **RECORD** As Found in CREM. **CM-1**

- Cover
- Hanger
- Hanger pin
- Hanger plugs
- Disc
- Valve body including seat ring
- All bolting material

_____ WV

5.2.3 Using 0.003" Feeler Gauge, **CHECK** disc to valve body seat to verify 360° contact. **RECORD** results in CREM.

SAT ___ UNSAT ___ _____ WV

NOTE: If lapping is performed, valve body and internals shall be vacuumed and thoroughly cleaned.

5.2.4 If required, **LAP** disc seat to in-body seat ring.

Lapping performed: YES___ NO___ _____ WV

1. Using 0.003" Feeler Gauge, **CHECK** disc to valve body seat to verify adequate contact. **CONTINUE** lapping if required. **RECORD** results in CREM.

   _____ WV

2. IF 360° contact CANNOT be obtained, THEN **CONTACT** Maintenance Supervision.

   _____ _____
   Person Contacted WV

5.2.5 **REPLACE** valve body seat ring as follows:

1. **UNTHREAD** seat ring (13) AND **REMOVE** from valve body (1).
2. **APPLY** Never Seez to threads AND **INSTALL** new seat ring (13) into valve body (1).

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5.3.8 **INSTALL** valve cover gasket (5) onto valve body (1).

5.3.9 **INSTALL** valve cover (4) onto valve body (1).

5.3.10 **LUBRICATE** threads with Never Seez AND **INSTALL** valve cover studs (3) and nuts (2).

DOUBLE VERIFICATION

5.3.11 **TORQUE** studs to 160 (150 to 170) ft-lbs.

_____ WV _____ DV

5.3.12 **INITIAL** AND **DATE** indicating subsection complete._____ WV

6.0 RETURN TO NORMAL

6.1 **ENSURE** the following:

- Tools and equipment are returned to designated storage location and work area is clean.
- M&TE numbers and date used are recorded in WO.
- Name and initials of each person who initialed procedure steps are entered on last page of this procedure.
- Procedure is complete and attached to WO.

_____ WV

7.0 REFERENCES

7.1 Plant Procedures/Drawings

7.1.1 A-C-33, Process for Verification of Quality

7.1.2 MAG-CG-301, Control of Bolting/Torquing/Tensioning

7.1.3 M-112-15, Walworth Company, 12" 175# I.B.B.M. Swing Check Valve

7.1.4 M-318, Sheet 3, P & I Diagram, Fire Protection System

7.2 Commitments

7.2.1 CM-1, Peach Bottom License Renewal Fire Protection Activities (T04342) 14

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*** ACTION REQUEST ***

PAGE: 01

A/R TYPE : AT CTAI
REQUEST ORG : SL
REQUEST DATE: 01AUG01
REQUESTED BY: MOYER KL

A/R NUMBER : A1329928
A/R STATUS : PLNNED
STATUS DATE: 07SEP01
LAST UPDATE: 12FEB03
PRINT DATE : 19FEB03

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EVALUATION NBR: 06
EVALUATING ORG: PEPB
EVAL ASIGND TO: STURNIOLO (LRA) *T
EVAL REQUEST ORG: SEL
EVAL REQUESTOR: LAKE, FD
EVAL RETURNED BY:

ORIG DATE ASSIGNED:
EVAL DUE DATE: 15JUN12
DATE ASSIGNED: 21AUG01
EVAL STATUS : ACCEPT

IMPORTANCE CODE: 1 OEAP: SCHEDULE CODE: DATE FIXED: T

EVAL DESC: TESTING OF SPRINKLER HEADS IN SERVICE > 50 YEARS
THE PB LICENSE RENEWAL APPLICATION (LRA), APPENDIX A & B, FDL2 21AUG01
IDENTIFIED THE ACTIVITIES CREDITED FOR COMPLIANCE WITH FDL2 21AUG01
THE LICENSE RENEWAL RULE FOR AGING MANAGEMENT OF PASSIVE FDL2 21AUG01
LONG-LIVED COMPONENTS AND STRUCTURES WITHIN THE SCOPE OF FDL2 21AUG01
LICENSE RENEWAL. AGING MANAGEMENT REPORTS (AMR) DEVELOPED FDL2 21AUG01
IN SUPPORT OF THE LRA PROVIDED FURTHER DETAIL REGARDING FDL2 21AUG01
AGING MANAGEMENT ACTIVITIES IDENTIFIED IN THE LRA APPEND. FDL2 21AUG01
THE FOLLOWING ACTIVITY IS CREDITED FOR AGING MANAGEMENT: FDL2 21AUG01
LRA APPENDIX A, SECTION A.2.9, AND APPENDIX B, SECTION FDL2 21AUG01
B.2.9, COMMITTED TO PERFORMING FUNCTIONAL TESTING FOR FDL2 21AUG01
FLOW BLOCKAGE OF SPRINKLER HEADS IN SERVICE FOR 50 YEARS. FDL2 21AUG01
TESTING OF SPRINKLER HEADS WITH LONG SERVICES LIVES WILL FDL2 21AUG01
BE REQUIRED DURING THE EXTENDED PERIOD OF PLANT SERVICE FDL2 21AUG01
TO MEET THE REQUIREMENTS OF NFPA 25, SECTION 2-3.1.1. FDL2 21AUG01
. FDL2 21AUG01
A REPRESENTATIVE SAMPLE OF SPRINKLER HEADS THAT HAVE BEEN FDL2 21AUG01
IN SERVICE FOR 50 YEARS ARE REQUIRED TO BE FUNCTIONALLY FDL2 21AUG01
TESTED FOR FLOW BLOCKAGE AND VERIFICATION OF PROPER OPER- FDL2 21AUG01
ATION. FDL2 21AUG01
. FDL2 21AUG01
THIS PROGRAM MUST BE IMPLEMENTED PRIOR TO ANY SPRINKLER FDL2 21AUG01
HEADS ACHIEVING 50 YEARS OF SERVICE LIFE. FDL2 21AUG01
THIS COMMITMENT IS CONTAINED IN T04342, PBLR FIRE PROTECT FDL2 21AUG01
ION ACTIVITIES. ONCE THE PROGRAM IS DEVELOPED AS REQUIRE FDL2 21AUG01
BY THIS A/R EVAL, THE T04342 COMMITMENT MUST BE UPDATED FDL2 21AUG01
TO REFLECT THE NEW PROCEDURE/PM NUMBER. THE COMMITMENT FDL2 21AUG01
CAN ONLY BE DELETED OR CHANGED BY FOLLOWING THE GUIDANCE FDL2 21AUG01
IN LS-AA-110, COMMITMENT MANAGEMENT. FDL2 21AUG01
REFERENCE: AMR M04, RAW WATER FDL2 21AUG01

==========END OF ACTION REQUEST==========

Evaluating Plant Changes

- Configuration change control procedures will be updated to address license renewal requirements
  - Included will be physical plant modifications, operational changes, and changes to CLB
- UFSAR update process will address 10 CFR 54.37(b) requirements

Maintaining Records

- Exelon Records Management system will retain documents, drawings, and aging management reviews that support the Peach Bottom license renewal application
- Future self-assessments and NRC inspections will validate commitment management

ACRS Full Committee Meeting
The Reactor Oversight Process

March 6, 2003

Cynthia Carpenter
Mark Satorius
Ronald Frahm

Staff Understanding of Committee Concerns

- Risk-Informed and Performance-Based Elements Are Not Quantifiably Equitable
- PI and SDP Thresholds are not Fully Consistent and Transparent
- Yellow-Red Thresholds for the Scram Indicators are not Meaningful
- Cross-Cutting Issues are not Adequately Addressed in Current ROP

Risk-Informed and Performance-Based Differences

- Acknowledge Differences Between Risk-Informed and Performance-Based Aspects of the ROP
- ROP Uses Performance-Based Thresholds Linked to Appropriate Regulatory Response, Incorporating Risk Insights If Available
- Meet Competing ROP Objectives to Remain Predictable, Understandable, Risk-Informed, and Objective, and the 4 Strategic Performance Goals
- Staff Believes the ROP Appropriately Addresses Risk-Informed and Performance-Based Issues

Consistency and Transparency of PI and SDP Thresholds

- Recognized Concern and Developed ROP Basis Document to Consolidate More Transparent Basis for PIs and SDPs
- Thresholds Developed By Expert Judgment with Significant Stakeholder Input and Buy-In
- Continue to Adjust PI and SDP Thresholds to Ensure a Consistent Regulatory Response
- Seek Continued Improvements Through the ROP Self-Assessment and Feedback Processes and Interactions with Other Stakeholders

Yellow-Red Thresholds for the Scram Indicators

- Recognize that Highly Unlikely Any Plant Would Cross These Yellow-Red Thresholds
- Existing Thresholds Provide a Gauge of the Relative Risk and Demonstrate the Safety Margin
- Plan to Maintain Current Thresholds and Consider Adjusting the Thresholds for the Scram PIs Along With Ongoing Changes to the PI Program

Addressing Cross-Cutting Issues in ROP

- Recognized Concern and are Developing Prescribed Response to Substantive Cross-Cutting Issues
- Incorporated into SDP Improvement Initiative Based on Recommendation from the SDP Task Group
- Response May Include Redirection of Resources, Management Meetings, and/or Docketed Licensee Response

Staff Conclusions

- Current ROP is Working, Plants Are Receiving Appropriate Level of Oversight
- Continued Improvements are Warranted and Anticipated Based on Lessons Learned
- No Current Plans to Revise Fundamental Basis of ROP Regarding Handling of Risk-Informed and Performance-Based Elements
- ROP Must Remain Transparent and Consistently Maintained Via the ROP Basis Document

MRP Alloy 600 ITG Reactor Vessel Head WG Status Report

Advisory Committee on Reactor Safeguards

Vessel Head Penetration Cracking and RPV Head Degradation

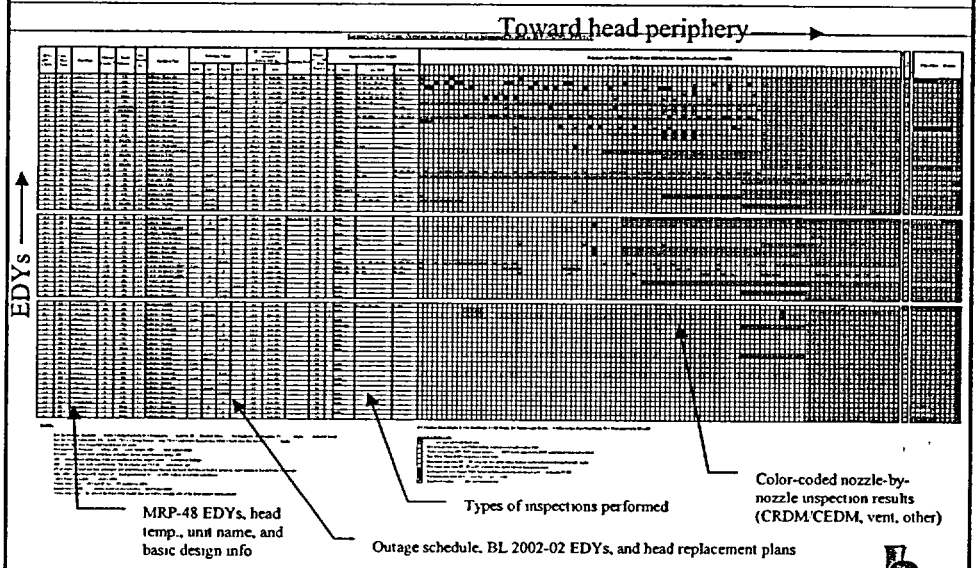
March 6, 2003

Larry Mathews, SNOC
MRP Alloy 600/82/182
Issue Task Group Chairman

Topics

- Overview Table of Inspection Results by Plant
  - Detected Circumferential Cracks
  - Summary Statistics
- Inspection Plans for Spring 2003 Outages

Overview Table of Inspection Results



Overview Table of Inspection Results

- The overview table graphically shows:
  - The extent to which the fleet has been inspected
  - The extent of detected cracking, leakage, and wastage correlated with effective degradation time (EDYs) and position on the head
  - Key operating and design data
  - Refueling outage schedule and current head replacement plans
- The overview table complements more detailed outage-specific and defect-specific inspection results tables that are used to generate statistical (i.e., Weibull) fits
- The MRP plans to release a revision to the table at the end of each outage season

Results for Inspections that Detected Cracking

No	Unit	NSSS Supplier	Approx EDYs at Inspection	Date	Number of Nozzles on Head				Nozzles Inspected by Non-Visual		No. Leaking Nozzles/ Welds		No. Cracked Nozzles/ Welds		No. Nozzles with Base Metal Cracks	No. Nozzles with Weld Metal Cracks	No. Nozzles with Axial Cracks	No. Nozzles with Circ Cracks
					CRDM	CEDM	ICI	Total	Total	Total %	Leaking	% of Total Inspected	Cracked	% of Total Inspected				
1	ANO 1	B&W	19 6	Mar 2001	69			69	1	1 4%	1	100 0%	1	100 0%	1	0	1	1
2	ANO 1	B&W	21 1	Oct 2002	69			69	69	100 0%	1	1 4%	8	11 6%	8	8	8	0
3	Cook 2	W	13 9	Jan-2002	78			78	78	100 0%	0	0 0%	2	2.6%	2	0	2	0
4	Crystal River 3	B&W	16.2	Oct-2001	69			69	9	13 0%	1	11 1%	1	11 1%	1	1	1	1
5	Davis-Besse	B&W	19 2	Apr-2002	69			69	69	100 0%	3	4 3%	5	7.2%	5	0	5	1
6	Millstone 2	CE	11 2	Feb-2002		69	8	77	77	100 0%	0	0 0%	3	3 9%	3	1	3	2
7	North Anna 1	W	20 0	Oct 2001	65			65	30	46 2%	0	0 0%	6	20.0%	6	0	6	0
8	North Anna 2	W	19 0	Nov-2001	65			65	3	4 6%	3	100 0%	3	100 0%	3	3	3	0
9	North Anna 2	W	19 7	Sep 2002	65			65	65	100 0%	6	9 2%	42	64 6%	7	42	1	6
10	Oconee 1	B&W	21 8	Nov-2000	69			69	18	26 1%	1	5 6%	1	5 6%	1	1	1	0
11	Oconee 1	B&W	23.2	Mar-2002	69			69	5	7 2%	1	20 0%	3	60 0%	3	1	3	0
12	Oconee 2	B&W	22.2	Apr-2001	69			69	4	5 8%	4	100 0%	4	100.0%	4	4	4	1
13	Oconee 2	B&W	23 7	Oct-2002	69			69	69	100 0%	7	10 1%	15	21 7%	15	5	10	0
14	Oconee 3	B&W	21 7	Feb 2001	69			69	18	26.1%	9	50 0%	10	55 6%	10	0	10	5
15	Oconee 3	B&W	22 5	Nov-2001	69			69	52	75 4%	5	9 6%	7	13.5%	7	2	7	2
16	Surry 1	W	19 1	Oct 2001	65			65	16	24 6%	2	12.5%	6	37.5%	0	6	0	0
17	TMI 1	B&W	18 1	Oct 2001	69			69	12	17 4%	5	41 7%	7	58 3%	7	4	7	0
	Totals for Inspections Since First U.S Leakage (11/2000)				3871	1090	94	5055	1462	28 9%	47	3.2%	120	8.2%	82	75	71	19

NOTE The table does not reflect the small-diameter thermocouple nozzles found to be cracked and leaking at Oconee 1 and TMI 1 (These are the only two plants that have this type of nozzle)

Nozzle Circ Cracks At or Above the J-groove Weld

Unit	NSSS Design	Nozzle ID	Nozzle Angle (°)	Inspection Results						
				Date	Approx. EDYs	OD/ ID	Axial Location	Circ Angle (°)	Depth (in)	TW Depth (%)
Crystal River 3	B&W	32	26 2	Oct-01	16 2	OD	above weld	91	0.29	47%
Davis-Besse	B&W	2	8 0	Mar-02	19 2	OD	above weld	34	0.31	50%
North Anna 2	W	15	19 8	Sep-02	19 7	OD	≥1 12" below root	5	0.23	36%
		41	33 1			OD	≥0 52" below root	46	0 10	16%
		54	38 6			OD	≥0 04" below root	79	0.23	36%
						OD	≥0.28" below root	32	0 16	25%
		59	40 0			OD	≥0 31" below root	76	0 15	24%
						OD	≥0 32" below root	50	0 15	24%
		65	42 6			OD	≥0.32" below root	72	0 15	24%
						OD	≥0.20" below root	30	0 08	12%
		67	42 6			OD	≥0 80" below root	44	0 09	15%
Oconee 2	B&W	18	18 2	Apr-01	22.2	OD	above weld	36	0 07	11%
Oconee 3	B&W	11	16 2	Feb-01	21.7	OD	over weld	153	0 36	57%
						OD	over weld	113	0.25	40%
		23	23 2			OD	above weld	66	0.22	35%
		50	35 1			OD	above weld	165	0 62	pin holes
		56	35 1			OD	above weld	165	0 62	100%
		2	8 0	Nov-01	22 5	OD	above weld	48	0 18	29%
		26	24 7			OD	over weld	44	0 07	11%

Summary of Inspection Results Statistics

- The total RVH nozzle population includes 3871 CRDM nozzles, 1090 CEDM nozzles, and 94 ICI nozzles at 69 units
- Bare-metal visual (BMV) and/or non-visual NDE inspections have now been performed on about 81% of the RVH nozzles
  - About 47 nozzles have been found to be leaking
- Almost 8% of the nozzles in B&W plants have leaked, but leakage in non-B&W plants is limited to North Anna 2 and Surry 1 leakage, which is primarily due to weld cracking
- Non-visual examinations have been performed on:
  - About half of the ">12 EDY" nozzles and a third of the "8-12 EDY" nozzles
  - About two-thirds of the nozzles in B&W plants and 25% of the nozzles in non-B&W plants

Summary of Inspection Results Statistics (cont'd)

- About 19% of the inspected B&W plant nozzles show base metal cracking
- Base metal cracking in non-B&W plants is limited to Millstone 2 (3 nozzles) and Cook 2 (1 nozzle), although North Anna 1 and 2 may have experienced some base-metal initiated cracking (Sandvik material)
- About 8% of the J-groove welds have been examined by ET or PT
- Weld experience ranges from no indications in a relatively high EDY plant (Robinson) to relatively extensive weld cracking in another high EDY plant (North Anna 2)
- To date, weld cracking has been limited to vessels fabricated by Rotterdam Dockyards and B&W-designed units

Inspection Plans for Spring 2003

- 20 units have refueling outages this spring:
  - Oconee 3, North Anna 1, and Surry 1 will replace their heads with new heads having Alloy 690 material
  - All 17 other units will perform 100% BMV and/or non-visual inspections
  - All the plants having greater than 12 EDYs will have performed a non-visual baseline examination by the end of the spring outage season
- The spring 2003 outage season mainly concludes the initial set of inspections following Bulletin 2001-01. After this spring:
  - All but two units (< 2 EDYs) will have completed 100% BMV and/or non-visual inspections (97% of the total nozzle population)
  - 20 of the 28 units with > 12 EDYs (as of February 2001) will have completed baseline non-visual examinations or head replacement

Inspection Plans for Spring 2003 (cont'd)

- After fall 2003, it is expected that:
  - All 69 units will have completed 100% BMV and/or non-visuals (or head replacement)
  - 27 of the 28 units with > 12 EDYs (as of February 2001) will have completed baseline non-visual examinations or head replacement (28th unit plans such an inspection at its next RFO in spring 2004)
- Upon the conclusion of the spring outage season, the MRP will again look for correlations between cracking and factors such as EDYs, tubing material supplier, and vessel head fabricator

Process for Revising the MRP Inspection Plan

Advisory Committee on Reactor Safeguards

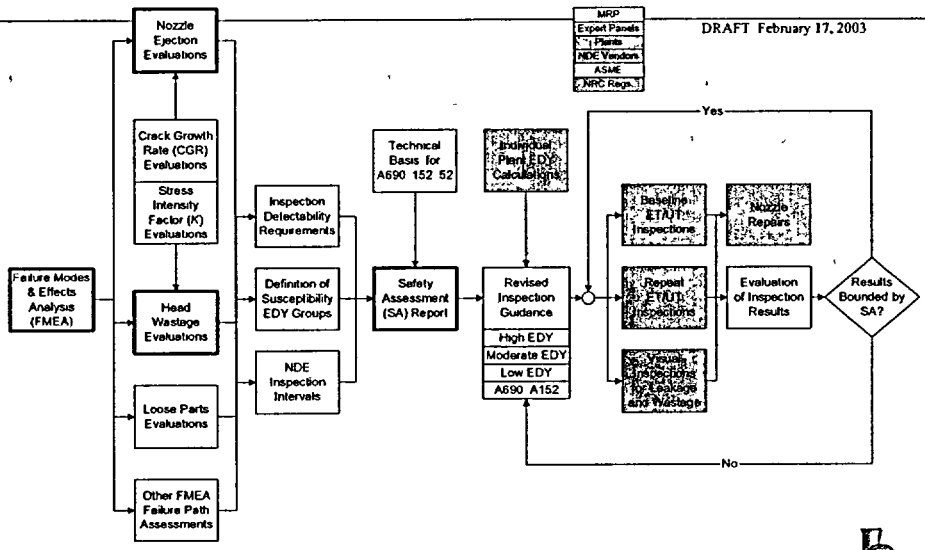
Vessel Head Penetration Cracking and RPV Head Degradation

Craig Harrington, TXU
MRP Alloy 600/82/182 ITG
RV Head Working Group Chairman

Topics

- Overall Safety Assessment Process
- Transition to Combination Baseline Inspections with Inspection Intervals Chosen to Ensure Safety
- Failure Modes and Effects Analysis
- Schedule for Issuing Revised Inspection Plan and Safety Assessment Report

Overall Process Flowchart



Safety Assessment Process: Key Points

- The MRP approach is transitioning to ensuring safety through "combination" baseline inspections at all plants with:
  - The timing for the baseline inspection and the re-inspection interval based on the technical evaluations and
  - More frequent bare metal visual (BMV) inspections providing backup to the program of periodic combination inspections
- The revised MRP inspection plan will be formed on the basis of a comprehensive safety assessment (SA) report
- The SA report:
  - Begins with a failure modes and effects analysis (FMEA) to anticipate the possibility of failure modes that have not been observed in the field and
  - Includes the analysis tools previously developed and described in MRP-75

Safety Assessment Process: Key Points (cont'd)

- The results of the FMEA are used to establish the required technical evaluations and ultimately the inspection detectability requirements
- Existing calculations show that non-visual inspections do not have to be performed every refueling outage to ensure safety
  - Extremely low probability of nozzle ejection and significant wastage
  - Extremely small consequential increase in core damage frequency, consistent with NRC Reg. Guide 1.174

Combination Baseline Inspections

- Subsequent to the release of the MRP-75 inspection plan and technical bases and in light of the most recent inspections results, the MRP has released a letter to the industry recommending a transition to combination baseline inspections
- Three types of combinations inspections:
  - (UT/BMV) UT of the base metal from the tube ID and bare-metal visual (BMV)
  - (UT/ET) UT of the base metal from the tube ID and ET/PT of the weld surface
  - (ET/ET) ET of the base metal ID and OD and ET/PT of the weld surface
- The timing of the baseline inspection and the inspection interval will be based on the technical evaluations to ensure safety

Combination Baseline Inspections (cont'd)

- Time at temperature (EDYs) will continue to form the basis for the susceptibility groups
- It is expected that high susceptibility plants will perform the combination baseline inspection by the next refueling outage
- It is expected that moderate susceptibility plants will perform the baseline inspection by approximately 2005 at the latest
- It is expected that low susceptibility plants will perform the baseline inspection by approximately 2007 at the latest

Failure Modes and Effects Analysis: Introduction

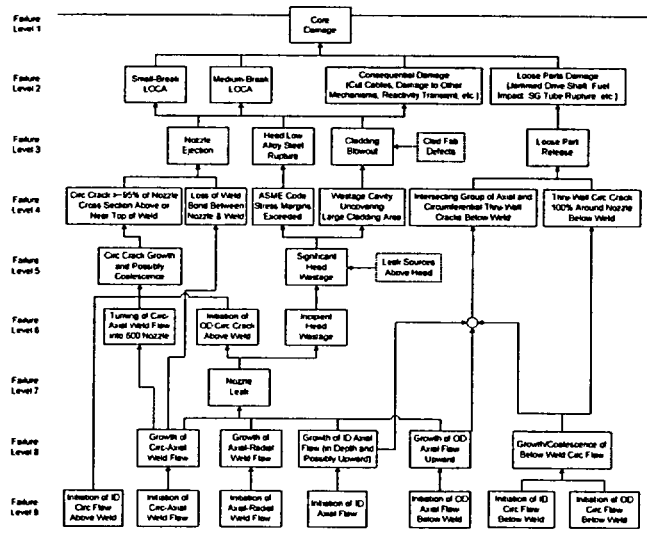
- FMEA is a technique of TQM (Total Quality Management) to ensure product reliability
- Typically, a table of the following characteristics of the possible failure modes is prepared:
  - Cause
  - Effect (consequence)
  - Detectability
  - Frequency of Occurrence
- Relationships among the failure modes are illustrated using a block diagram
- FMEA is a tool that helps anticipate new failure modes

Failure Modes and Effects Analysis: Application to RVH Nozzles

- For RVH penetrations, there are three principal failure modes:
  - Nozzle Ejection Due to Net Section Collapse
  - Cladding Blowout Due to Wastage
  - RCS Damage Due to Loose Parts Generation
- There are several levels in the failure process for these modes:
  - PWSCC initiation (nozzle ID, nozzle OD below weld, weld surface)
  - PWSCC growth (axial and circ in nozzle, axial-radial and circ-axial in weld; weld to nozzle and nozzle to weld; turn from axial to circ)
  - Leakage to annulus (new crack initiation and low-alloy steel wastage)
  - Growth to allowable size / wastage until code allowable stresses are reached
  - Growth to net section collapse or loose parts release / wastage to cladding blowout
  - Small/medium LOCA and possible consequential damage / loose parts damage
  - Effect on core damage frequency (CDF)

Failure Modes and Effects Analysis: Simplified Block Diagram

PRELIMINARY



Failure Modes and Effects Analysis: Classification of Failure Conditions

- Each failure condition will be classified as:
  - Not credible,
  - Not actionable, or
  - Actionable
- A classification as "not credible" will require a strong technical argument and thorough documentation with a high threshold
- A classification as "not actionable" requires that adequate protection be provided at a higher level in the failure process
- Conditions classified as "actionable" will be inputs to the probabilistic and deterministic evaluations and will ultimately shape the detectability requirements specified in the inspection plan

Failure Modes and Effects Analysis: Additional Higher Order Factors

- Additional factors being considered in the FMEA include:
  - Environmental fatigue
  - Fabrication practices such as nozzle straightening or nickel plating
  - Surface and imbedded flaws produced during fabrications such as welding lack of fusion and hot cracking
  - The condition of the inside surface cladding
  - Primary water chemistry factors such as resin intrusions
  - Leaks from sources above the head
  - Plant-specific differences in the air flow across the head top surface

Failure Modes and Effects Analysis: Frequency of Occurrence

- Weibull reference curves based on the latest inspection results
  - Plant experience may support different curves for different nozzle material suppliers and different weld fabricators
- Crack growth rates based on MRP-55 and stress intensity factor calculations
- Existing small- and medium-break LOCA analyses
- Consequential damage assessments
- Loose parts damage assessments

Deliverables and Schedule

- A comprehensive safety assessment (SA) report will form the basis for a revised MRP inspection plan
- As appropriate, the SA report will reference other reports (e.g., the MRP report on crack growth rates of Alloy 600—MRP-55)
- Some calculations remain to be revised and extended, but much of the material to be incorporated into the SA report has already been completed in support of MRP-75
- Data developed subsequent to the initial release of the SA report will be evaluated for consistency with the SA evaluations once such data become available
- The MRP expects to be prepared to discuss the contents of the SA and the revised inspection plan summer 2003
- In the meantime, technical discussions with the NRC staff will continue

Status of Reactor Vessel Head Penetration Inspection Activities

Tom Alley, Duke Energy
Chair, Alloy 600 Inspection WG

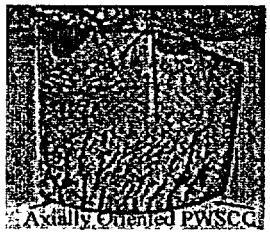
Presentation Outline

- CRDM Issue Background
- Top-of-head Visual Exam Guidance
- MRP Approach to NDE Demonstration
- 2001 Demonstration Process & Results
- 2002 Demonstration Process & Results
- Future Demonstration Activities
- Other Future Inspection Committee Activities
- Summary

CRDM Head Penetration NDE Background

- Original (97-01) demonstrations addressed cracks initiating on the inside surface of the penetration only
- Discovery of tube OD and weld cracking identified the need to modify the NDE demonstration program
  - Inspection technology required rapid development, deployment and field adaptation of existing inspection equipment
- Visual evidence of leakage vastly different from originally postulated
- First phase of MRP demonstrations was available to support fall 2001 inspections
  - Detection of "safety-significant" flaws in the tube
- Second phase performed to support fall 2002 inspections
  - J-groove weld flaws
  - More base metal flaws to evaluate depth sizing

2001 Demo Mock-ups - Oconee Specimens



- Specimen #56
  - OD-initiated PWSCC
    - Range of sizes & locations
  - Off-axis flaws (~45 degrees) are representative of circumferential flaw in outermost penetration
- Specimen #50
  - ID-initiated PWSCC

2002 Mockups – Tiger Team Goals

- Blind Mock-up
- Demonstrate sizing capabilities
- Full Scale Mock-up
- Establish Inspection Thresholds
- No POD
- Practice Blocks and Blind Blocks
- Include Effects of Crazed Cracking

MRP Demonstration Process

- All CRDM Head Penetration NDE demonstrations had the following characteristics:
  - Blind
    - supported by non-blind preparation phases
  - Procedure demonstration
    - No acceptance criteria
    - Demonstration best available techniques
      - ASME code will probably develop technique/personnel qualifications
  - Measurements of flaw detection capability and limits
    - No acceptance (pass-fail) criteria

MRP Demonstration Process

- Demonstration protocol
  - Vendor collects data on mockups & reports findings
    - evaluates measured vs. true values
    - Detection (# detected/total flaws)
    - Location with respect to pressure boundary
    - Sizing results documented
    - False call performance
  - NDE Center documents procedure essential variables
    - Allows verification that the techniques used are the same techniques that were demonstrated
  - Analysis process used in the demonstration and must be captured in the procedure
  - Results are provided to utilities

MRP Demonstration Process - Overview

- Complicated examination volume
- Vendor UT inspection procedures include <u>many</u> technique options and probe combinations, examples:
  - Open-tube probes
  - Blade probes
    - Probes are designed to accomplish specific objectives:
      - Specific volumes
      - Flaw orientations, e g , circumferential or axial flaws
      - Detection technique, e g , corner trap or tip diffraction
      - Sizing technique
- MRP Demonstrations document performance of individual probes/scans
  - More than one probe may be required to examine the specified inspection volume to detect/size specified flaw locations and orientations

2002 Demonstrations – Summary

- **Blade-Probe UT of penetration tube**
  - Flaws ranging ~ 15 to 100% TWE detected when flaws are oriented perpendicular to beam direction
  - Flaws ranging ~15 to 100% TWE detected when flaws are oriented parallel to beam direction
- **Open-tube "Rotating" probe of penetration tube**
  - Flaws ranging ~ 10 to 100% TWE detected when oriented perpendicular
  - Flaws ranging ~15 to 100% TWE detected when flaws are oriented parallel to beam direction
- **Open-tube "Rotating" probe of tube/weld interface**
  - Tube/weld interface flaw detected when flaw length extended to triple-point
  - Weld metal flaws that did not extend to the triple point were not detected.

Vendor A UT Detection Results

	Vendor A – UT Blade & Open Tube Probe Detection Results See Flaw Table 4 and drawing for description of flaw types "A" through "O"					
Field Used UT Techniques	A, B, & C ID Axial Flaws	G H & I ID Circumferential Flaws	D, E & F OD Axial Flaws	J K & L OD Circumferential Flaws	M N & O Weld Flaws	Cluster Flaws OD Flaws under shallow (< 3 mm deep) ID Cluster Flaws
"Axial Blade" (TOFD UT COAF) (Note 1) 3 degree scan increment	5%-86% TWE detected (Note 4) Orientation of flaws < 12 % TWE was inconsistent (Note 5)	11%-49% TWE detected Orientation of flaws < 12 % TWE was inconsistent	28% 100% TWE detected 4 flaws < 24% TWE missed 1 D type flaw 1 E type flaw, 2 EF type flaws	15% 100% TWE detected 1 K type false call @ 7% TWE (Note 6)	(Note 7)	100% detection of ID & OD
"Circ Blade" (TOFD UT AOCF) (Note 2) 3 degree scan increment	11%-86% TWE detected 1 B type flaw < 5% TWE missed Orientation of flaws < 12 % TWE was inconsistent (Note 5)	11%-49% TWE detected Orientation of flaws < 12 % TWE was inconsistent	15% 100% TWE detected 4 flaws < 15% TWE missed 2 D type flaws, 1 E type flaw 1 EF type flaw	15% 100% TWE detected 1 K type false call @ 15% TWE (Note 6)	(Note 7)	100% detection of ID & OD
"Open-Tube" (Note 3) 5 degree scan increment	5% 86% TWE detected (Note 5)	11%-49% TWE detected	15% 100% TWE detected 3 flaws < 12% TWE missed 1 D type flaw 1 E type flaw 1 EF type flaw	15% 100% TWE detected 1 K type false call @ 15% TWE (Note 6)	(Note 7)	100% detection of ID & OD
"Open-Tube" (Note 3) 3 degree scan increment	5%-86% TWE detected (Note 5)	11%-49% TWE detected	15% 100% TWE detected 3 flaws < 12% TWE missed 1 D type flaw 1 E type flaw, 1 EF type flaw	15% 100% TWE detected 1 K type false call @ 15% TWE (Note 6)	(Note 7)	100% detection of ID & OD
Notes:	(1) TOFD UT COAF (Circumferentially Oriented for Axial Flaws) used for detection and sizing of flaws. (2) TOFD UT AOCF (Axially Oriented for Circumferential Flaws) used for detection and sizing of flaws. (3) TOFD UT COAF/AOCF Pulse/Echo, and 0 degree used for detection and sizing of flaws. (4) Through-wall-extent (TWE) of flaw depth in the tube thickness. (5) Inadequate resolution to separate closely associated (approx. 3 mm spacing) flaws. (6) Appears to be a welding defect at the tube-to-weld-interface. (7) Equipment and procedure were not optimized to resolve indications extending beyond the tube-to-weld interface in the weld volume					

2002 Demonstrations ET of Attachment Weld

- Detection is sensitive to weld surface conditions
  - Ground Surface Condition
    - Detected 0.16" long, 0.00031" wide
  - Un-ground (as-welded) Surface Condition
    - Detected 0.55" long, 0.00197" wide
    - Missed; 1.42" long, 0.00591" wide
  - Continue to pursue additional/alternate techniques to improve the detection capabilities

Future Demos

- **Tecnatom**
  - ET of Attachment Weld
    - May 2003
- **Framatome**
  - ET of Attachment weld
    - February 2003
  - "Other" surface method for wetted surface of attachment weld
    - 1st quarter of 2003
- **WesDyne**
  - UT of tube/weld interface
  - ET of attachment weld
  - Thermal imaging
- **B&W Canada**
  - UT of tube/weld interface
    - 1st quarter of 2003
  - ET of attachment weld
    - 1st quarter of 2003

Future Activities

- New mock-ups under construction
  - Existing mock-ups will be made available to vendors for personnel training and technique refinement
- Replacement head inspection
  - Equivalence studies
  - Mock-up drawings
  - Pre-Service Inspection Requirements
- Bottom Head Inspection
  - Document industry (including international) inspection capabilities and experience

Summary

- MRP has organized a comprehensive approach to address recent industry events
- Considerable progress has been made in a short amount of time
- Demonstrations continuing
- Emphasis on examination of attachment weld and increased inspection efficiency

Peach Bottom License Renewal Safety Evaluation Report

Staff Presentation to ACRS

Project Manager: David L. Solorio

Office of Nuclear Reactor Regulation

March 6, 2003

Agenda

- Opening Remarks.....G. Leitch
- Staff Introduction.....P. Kuo
- Applicant Overview.....F. Polaski
- Safety Evaluation Report.....D. Solorio

Background

- July 2, 2001, Exelon submitted LRA
- Initially a 25 month review → shortened to 22 months
- September 16, 2002 issued safety evaluation report with open items
- October 30, 2002, ACRS subcommittee presentation on SER with open items
- February 6, 2003 issued safety evaluation report
- Three inspections completed and Regional Administrator letter issued February 14, 2003

Safety Evaluation Report Topics

- Scoping of housings
- Scoping of non-safety related equipment
- Status of BWRVIPs (license conditions)
- Torus inspection program
- Diesel generator fuel oil tank
- SGTS buried piping
- Fuse holders
- Top guide inspections
- Inspection program (future commitments)
- December 21, 2002, event

Chapter 2: Scoping and Screening

- Scoping of housings
  - Open Items 2.3.2.7.2-2, 2.3.3.8.2-1, 2.3.3.8.2-2
    Scoping of HVAC components (housings)
- Scoping of non-safety related components
  - Open Item 2.3.3.19.2-1

Status of BWRVIPs for Review

Component	Reference	SER Date	Accession # for SER
Reactor pressure vessel components	BWRVIP-74	10/18/01	ML012920549
Vessel shells	BWRVIP-05	03/07/00	ML003690281
Shroud support and attachments	BWRVIP-38	03/01/01	ML010600211
Shroud	BWRVIP-76	the end of 2003	N/A
Nozzle safe ends and piping	BWRVIP-75	09/15/00	ML003751105
Core support plate	BWRVIP-25	12/07/00	ML003775989
Core ΔP/SLC line and nozzle	BWRVIP-27	12/20/99	ML993630179
Core spray, jet pump riser brace, and other attachments	BWRVIP-48	01/17/01	ML010180493
Core spray lines and spargers	BWRVIP-18	12/07/00	ML003775973
Top guide	BWRVIP-26	12/07/00	ML003776119
Jet pump assemblies	BWRVIP-41	05/01/01	ML011570560
CRDH stub tubes and guide tubes, ICM housing guide tubes and penetrations	BWRVIP-47	12/07/00	ML003775765
Instrument penetrations	BWRVIP-49	03/31/02	NUDOCS
Integrated Surveillance Program Plan	BWRVIP-78	02/01/021 (40 years)	ML020380691
Intergrated Surveillance Program: Implementation Plan	BWRVIP-86	02/01/021 (40 years)	ML020380691

License Conditions

- Integrated surveillance program
  - BWRVIP resolution or propose plant specific solution
- Core shroud inspection and flaw evaluation
  - Review of BWRVIP-76 not complete
  - BWRVIP resolution or propose plant specific solution
- Incorporate UFSAR Summaries into UFSAR
  - Update in accordance with 50.71(e)
- Implementation date for future inspections
  - Prior to extended period of operation

Torus

- SER Section 3.0.3.7 credits primary containment in-service inspection program for inspecting torus (also reviewed during AMR inspection)
- Torus water chemistry activities (SER Section 3.0.3.5) also credited for aging management
- Inspections are performed in accordance with subsection IWE of ASME Section XI
- Inspections confirmed wear rate is low
- Torus condition monitored during subsequent inspection

Diesel Fuel Oil Tanks

- SER Sections 3.0.3.18 and 3.3.16
- Credit lubricating and fuel oil quality testing activities (SER Section 3.0.3.18)
- Inspect once every 10 years
- Last inspection in 1996 confirmed no wear

Standby Gas Treatment

- SER Section 3.2.7
- Aging effect for ducting not expected because ambient air inside and outside of ducting is of similar temperature
- Should not have water leakage into SGTS unit (3 locked series valves upstream of deluge nozzles)
- Carbon steel SGTS piping managed by outdoor, buried, and submerged component inspection activities (SER Section 3.0.3.13)
- Inspection reviewed SGTS condition and records
- Technical specification surveillance (filter and nozzles)

Chapter 3: AMR Results

- Fuse Holders
  - CI 3.6.2.2.2.-1
  - Applicant committed to implement resolution of interim staff guidance ISG-04

Chapter 4: Time Limited Aging Analysis

- Top guide (Open Item 4.5.2-1)
  - Top guide beams inspections performed at the same time control rod drive housing (CRDH) guide tubes inspected (in high fluence region)
  - Sample size and frequency for CRDH guide tubes is a 10% sample of the total population within 12 years; one half (5%) to be completed within six years
  - Enhanced visual examination utilized to examine for cracks
  - Implemented prior to extended period of operation

Future Inspections

- Manual Chapter 2516, Inspection Procedure 71003
  - Post-approval site inspection for license renewal
  - Verify outstanding commitments identified at the time a renewal license was granted (as documented in the plant-specific attachment to this IP) have been met
  - Prior to extended period of operation

Unit 2 Reactor Trip

- December 21, 2002, Unit 2 tripped
- Cause attributed to card failure
- Special inspection conducted
- Review of LER (02-001) did not identify any failures of passive components
- Special inspection report in preparation