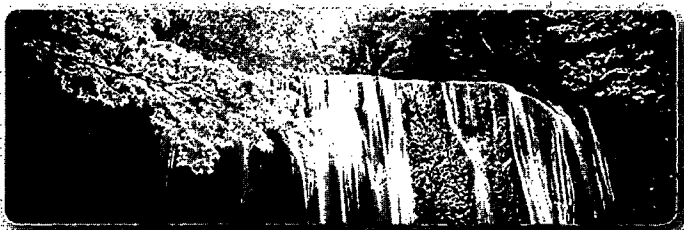
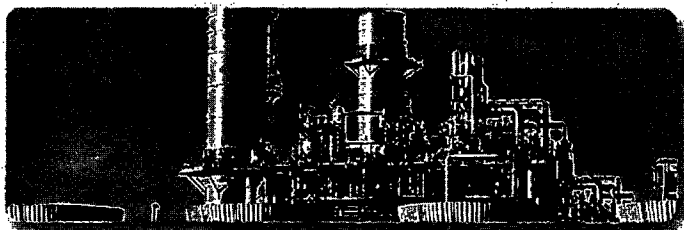
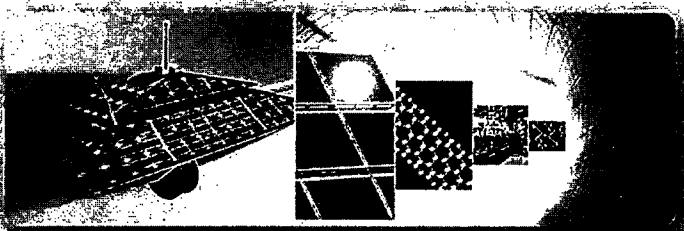


Materials Reliability Program



David Czufin, Exelon
MRP Executive Sponsor



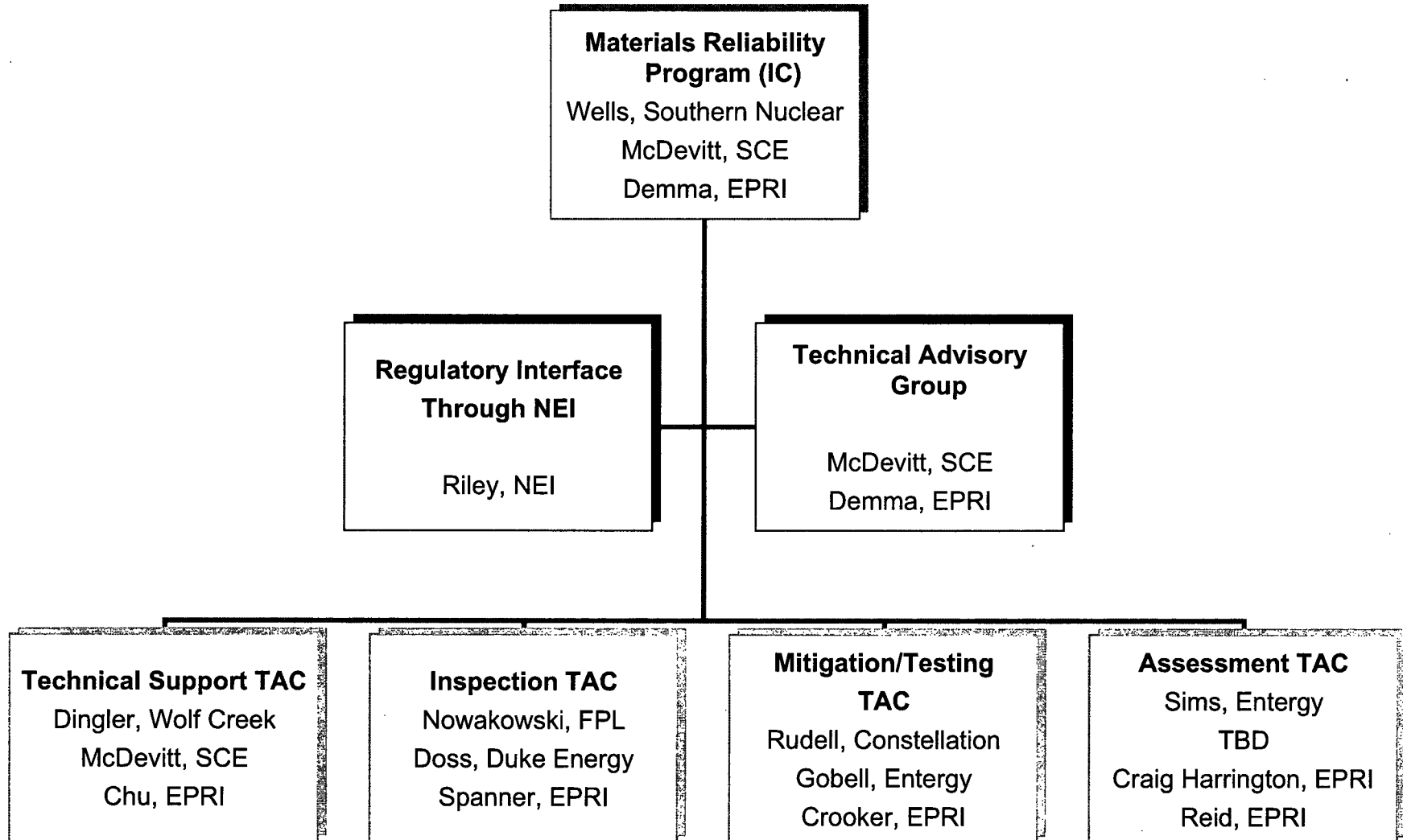
**Industry/NRC Executive Meeting on
Materials Program**

June 21, 2011

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- MRP Organization and Membership
- MRP Strategic Plan, Current Issues and Leveraging
- MRP Guidelines Status
- Reactor Internals Guidelines (MRP-227) Status
- Byron 1 OE Summary & TCold Upper Head Action Plan
- Coordinated Reactor Vessel Surveillance Program
- Surface Stress Mitigation Techniques
- 2012 International BWR/PWR Conference

MRP Organization



MRP Membership



- 31 Organizations representing 169 PWR's
 - International 100 PWR's
 - USA 69 PWR's



Taiwan power company

Hokkaido Electric Power Co., Inc.

MRP Strategic Plan

- Develop fundamental understanding of degradation mechanisms and identify materials (and locations) of high susceptibility
- Conduct generic operability and safety assessments for susceptible locations
- Develop Inspection and Evaluation (I&E) guidelines for identified locations
- Evaluate available mitigation options and, if necessary develop additional options.
- Evaluate repair/replace options, where necessary
- Monitor, evaluate and feedback plant Operating Experience
- Develop technical bases for regulatory review and support licensees on plant-specific applications

MRP Current Issues/Activities

- Stress Corrosion Cracking (SCC) of nickel-based alloys
 - Reactor Internals Degradation Management
 - Testing for Irradiation Assisted Degradation of Reactor Internals
 - I&E guidelines (e.g. Thermal Fatigue, Reactor Internals)
 - SCC of stainless steel including CASS
 - Low Alloy Steel corrosion (upper and bottom RPV Heads)
 - Non-Destructive Examination (NDE) qualifications (e.g. CRDM, RI standards)
 - Fatigue degradation management including Environmental Fatigue
 - Reactor Pressure Vessel Integrity
 - Extremely Low Probability of Rupture (xLPR)
-
- More than 50 tasks defined and funded for 2011

MRP Leveraging and Collaborations

- All Reactor Internals testing projects (Zorita, Halden, Gondole)
- Stainless steel SCC research with MAI/EDF & PWROG
- Alloy A690 international collaboration for long-term leveraging on A690/52/152 research
- xLPR (with NRC RES)
- Weld residual stresses (NRC RES)
- Chemical Mitigation (PWROG, FRP, Chemistry)
- Surface stress mitigation methods with Hitachi, Toshiba and MHI
- Low K testing with Studsvik and AREVA
- Environmental Fatigue (BWRVIP, ANT, NRC RES and others)
- Inspection issues with EPRI NDE Center
- Information exchange agreement with Naval Reactors contractors

MRP Guidelines Status

Guideline Title	ITG/ TSC	NEI 03- 08 ^[ii]	MRP Rpt #	Curren t Rev #	G/L Report #	Last Pub. Date	Next G/L Review Date	Next G/L Rev Pub Date ^[iii]
Mitigation of Thermal Fatigue in Unisolable Piping Connected to PWR Reactor Coolant Systems	TSC	GP ^[iii]	29	0	1001017	Dec. 2000	2012	2012
Thermal Fatigue Monitoring Guidelines	TSC	GP ^[iv]	32	0	1001016	April 2001	-	June 2011
Computer-Based NDE Training for Thermal Fatigue Cracking	TSC	GP	36	1	1016935	Nov. 2008	-	2012
Guidelines for Addressing Fatigue Environmental Effects in a License Renewal Application	TSC	GP	47	1	1012017	Sept. 2005	-	2012
Generic Guidance for Alloy 600 Management	AST	Man.	126	0	1009561	Nov 2004	-	^[v]
Primary System Piping Butt Welds Inspection and Evaluation Guidelines	AST	Man.	139	1	1015009	Dec. 2008	-	^[vi]
Management of Thermal Fatigue in Normally Stagnant Non-Isolable Reactor Coolant System Branch Lines	TSC	Need	146	0	1011955 ^[v] ^[ii]	June 2005	-	June 2011
Management of Thermal Fatigue in Normally Stagnant Non-Isolable Reactor Coolant System Branch Lines – Supplemental Guidance	TSC	Need	146S	0	1018330	January 2009	2012	2013
Integrated Fatigue Management Guideline	TSC	GP	148	0	1012018	April 2005	-	2012
Thermal Fatigue Monitoring Guideline	TSC	GP	149	0	1011957	April 2005	2012	2013
Assessment of RHR Mixing Tee Thermal Fatigue in PWR Plants	TSC	GP	192	1 ^[viii]	1018395	Dec. 2008	-	2012
Materials Reliability Program: PWR Internals Inspection and Evaluation Guidelines	AST	Man.	227	0	1016596	Dec. 2008	-	2011
Materials Reliability Program: Inspection Standard for PWR Internals	Insp	Need	228	0	1016609	July 2009	-	2012

MRP-227 Safety Evaluation Schedule

- Draft SE Issued on 28 March
- Draft Public Comment Period from 11 April to 10 May
- Industry Comments Transmitted on 10 May
 - Included Industry-proposed changes to the SE Conditions and Action Items for Staff consideration
- Teleconference Held on 26 May to Review Comment with Staff
- Final SE to be Issued on or about 24 June
- RIS to be Issued with Final SE
 - Anticipated on or about 28 June
 - Guidance on AMP submittal/revision expectations for plants in different classifications

MRP-227-A

- MRP-227-A will Incorporate Condition in Final SE
 - Will also include changes submitted with RAI responses
- Proposed Changes to Incorporate Conditions, As Modified, Submitted with Draft SE Comments
- MRP-227-A will be Issued on or before 31 December this Year
 - *Publication will start the two-year clock on the Needed requirement to implement the tables in MRP-227-A.*
- Revision to MRP-228 (Reactor Internals Inspection Standard) will be Prepared and Issued Next Year
 - Revision for consistency with MRP-227-A and to incorporate operating experience and methodology updates

Byron 1 RV Head Inspection Summary

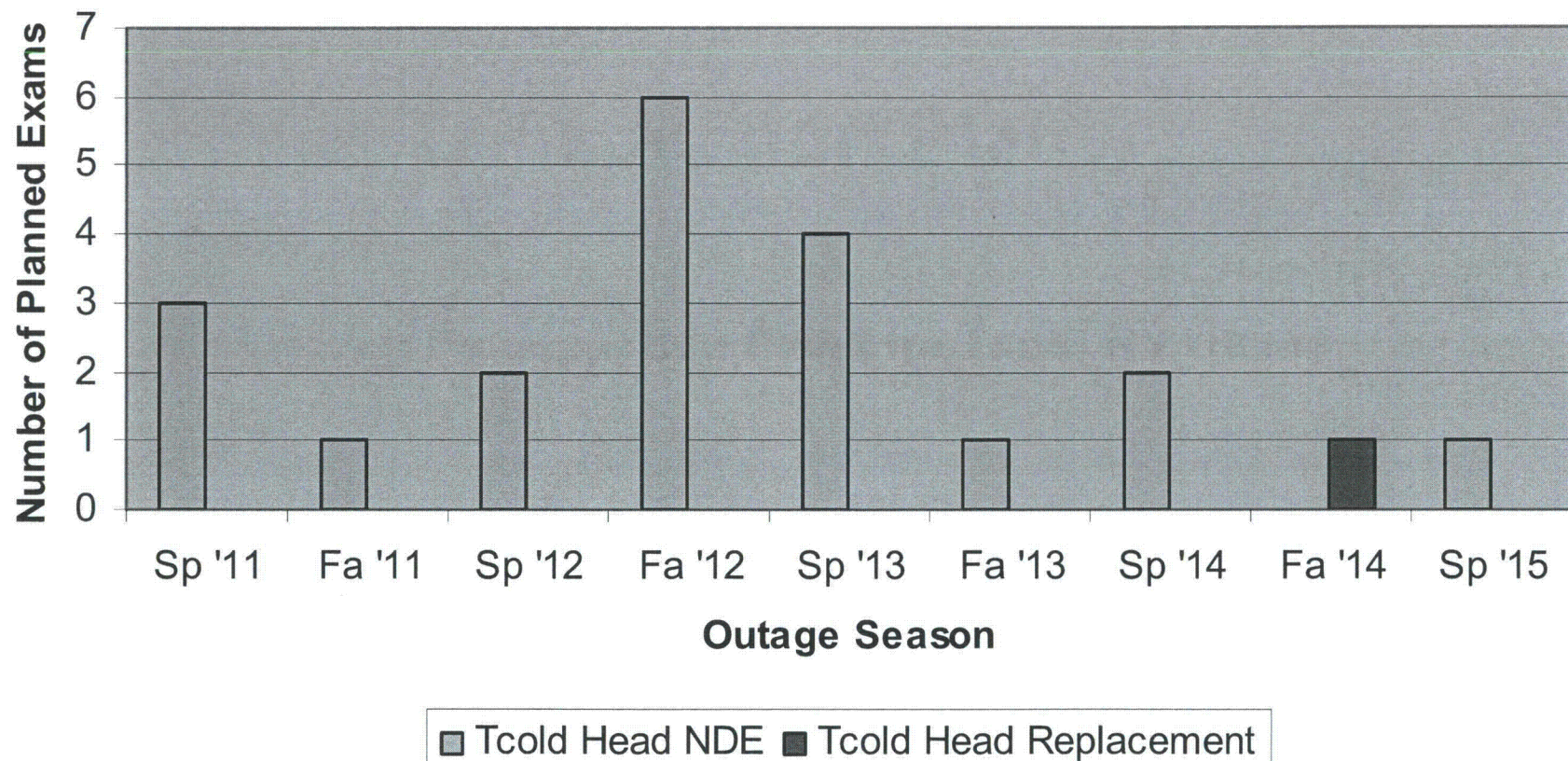
- CRDM inspections required by CC N-729-1
 - B1R17 Refuel Outage
 - UT & PT indications in penetrations 64, 76, 43 & 31
 - Indications just below & at the J-groove weld
 - “Low” susceptibility T_{cold} head $\sim 557^{\circ}\text{F}$
- Head fabricated by B&W
- CRDM penetration tubes
 - Nominal 4” dia. x 0.625” wall
 - B&W material heats
- Previous volumetric inspection in 2005
- PWSCC assumed

US PWR RV Head Inspections

- Baseline volumetric exams
 - Completed for US PWR fleet in accordance with NRC First Revised Order EA-03-009
 - Completed in 2008
- Re-inspections for T_{cold} RV heads
 - Order replaced by CC N-729-1
 - Lesser of 2.25 RIY or eight calendar years
 - First volumetric re-inspections of T_{cold} RV heads just beginning
 - Temporal distribution of upcoming inspections presented in next slide

T_{cold} Head Reinspection Plans

Current Reinspection Plans for Tcold RV Heads



MRP OE Evaluation Screening Questionnaire

- *Is there anything about this indication that would suggest it appropriate to re-evaluate any program requirements, previous inspection results, or upcoming inspection plans?*
 - Initial qualitative assessment indicates that Code Case N-729-1 remains acceptable.
 - Although the indications were not safety significant in their orientation, did not challenge structural integrity of the penetration, and did not leak, the timing of identification of PWSCC in a T_{cold} RV head was sooner than may have been expected.
 - MRP will review the inspection program technical basis in light of this event.

MRP T_{Cold} Upper Head Action Plan

- Complete a review of the technical basis for ASME CC N-729-1
 - Address potential impact of OE on underlying analyses and conclusions
 - Substantiate the continued validity of T_{cold} head inspection requirements
- Bottom Mounted Nozzle Implication Evaluation
 - The implications of all CRDM conclusions reached will be reviewed relative to the current BMN inspection requirements (CC N-722) and susceptibility to PWSCC

Coordinated Reactor Vessel Surveillance Program (CRVSP)

Objective:

Develop a coordinated PWR capsule withdrawal/test plan to increase the high-fluence PWR surveillance data, to support development of a future ETC applicable to the U.S. PWR fleet.

Description:

Existing RVSP of each US PWR was reviewed (capsule contents, fluences, withdrawal schedules); projected gaps in high-fluence data ($>3E+19$ n/cm²) were identified. Changes to withdrawal schedules are recommended to obtain high fluence surveillance data for the full range of materials across the entire industry.

Results to Date:

CRVSP will significantly add to the quantity and quality of high fluence surveillance data by the year 2025.

Status:

Utility comments on Draft #2 are being addressed; Draft #3 expected from AREVA in June 2011; submit for TSC/IIG/PMMP review & approval and publish by end of 2011.

Preliminary Results

- CRVSP increases amount of high-fluence data across broad spectrum of RPV materials by 2025
- No. of additional capsules to be tested by 2025 at or above the stated fluence

Capsule Fluence	Current Plan	Recommended Plan
$3 \times 10^{19} \text{ n/cm}^2$	30	40
$6 \times 10^{19} \text{ n/cm}^2$	6	17
$8 \times 10^{19} \text{ n/cm}^2$	0	8
$9 \times 10^{19} \text{ n/cm}^2$	0	2

Surface Stress Mitigation Techniques – MRP R&D Status

- Technical Basis Document for PWSCC Mitigation by Surface Treatments (MRP-267) - Product ID – 1020481 (January 2010)
 - Cavitation/Water Jet Peening and Fiber Laser Peening
 - Surface Stress Mitigation Technologies
 - Vendor laboratory testing and data
 - MRP laboratory testing and data
 - Factor of Improvements
 - Definition of effective application
 - Plant application and experience
- Experimental Program on the Effects of Surface Condition and Mitigation of Primary Water Stress Corrosion Cracking of Alloy 182 Welds (MRP-265) - Product ID – 1019084 (December 2009)
- Addressing remaining technical questions with resolution planned for the end of 2011 with no outstanding issues

Surface Stress Mitigation Techniques – Implementation and Summary

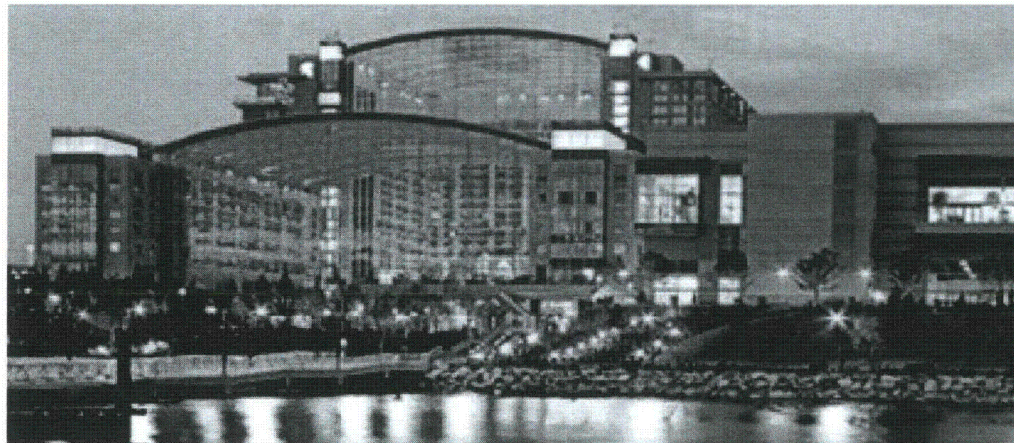
- Robust technologies
 - Implemented routinely in LWRs in Japan
 - Implemented in routinely Safety Critical Applications in Power, Defense, Aerospace, Automotive and Medical Industries
 - CRDM repair mitigation used in the U. S. in numerous PWRs
 - Abrasive Water Jet Peening part of ½ nozzle repairs
- Proactive mitigation desired
- Utilities are making near-term decisions on implementation for asset protection
- Warrants inspection credit and currently Code actions have been initiated
- Seek further NRC engagement

2012 International BWR/PWR Conference

International Boiling Water Reactor and Pressurized Water Reactor Materials Reliability Conference & Exhibition 2012

July 16-19, 2012

Gaylord Resort and Convention Center, 201 Waterfront
Street, National Harbor, MD 20745



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