Official Transcript of Proceedings

NUCLEAR REGULATORY COMMISSION

Title: Advisory Committee on Reactor Safeguards
593rd Meeting

Docket Number: (n/a)

Location: Rockville, Maryland

Date: Friday, April 13, 2012

Work Order No.: NRC-1546 Pages 1-97

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ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

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This transcript has not been reviewed, corrected, and edited, and it may contain inaccuracies.

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

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593RD MEETING

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

(ACRS)

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FRIDAY

APRIL 13, 2012

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ROCKVILLE, MARYLAND

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The Advisory Committee met at the Nuclear Regulatory Commission, Two White Flint North, Room T2B3, 11545 Rockville Pike, at 8:30 a.m., J. Sam Armijo, Chairman, presiding.

COMMITTEE MEMBERS:

J. SAM ARMIJO, Chairman

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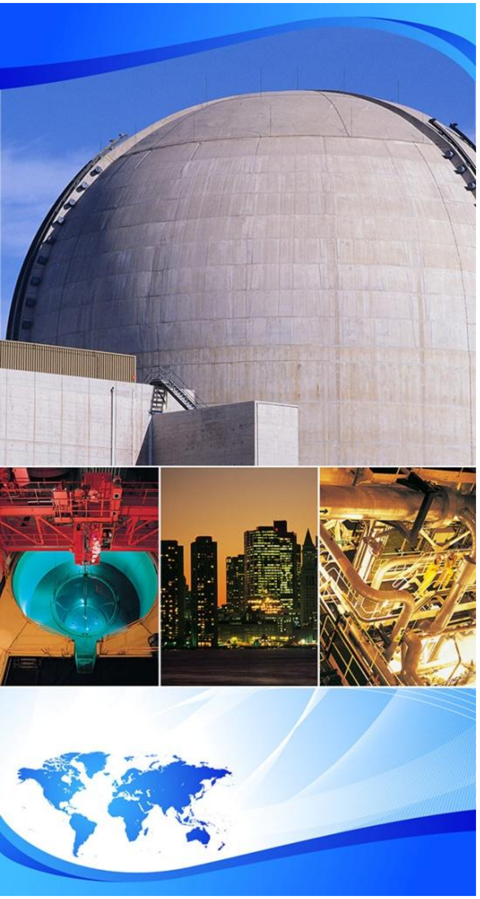
STEPHEN P. SCHULTZ, Member
WILLIAM J. SHACK, Member
JOHN D. SIEBER, Member
GORDON R. SKILLMAN, Member

NRC STAFF PRESENT:
JOHN LAI, Designated Federal Official
ERIC E. BOWMAN, NRR/DPR
SUSAN E. COOPER, RES/DRA
RICHARD CORREIA, RESPONSIBILITY
KIM MORGAN BUTLER, NRR/DPR
SEAN PETERS, RES
MARK HENRY SALLEY, RES/DRA

ALSO PRESENT:
ERIN COLLINS, SAIC*
JEFF JULIUS, Scientech
KAYDEE KOHLHEPP, Scientech*
STUART LEWIS, EPRI

*Present via telephone

A-G-E-N-D-A



EPRI/NRC-RES FIRE HRA GUIDELINES, NUREG-1921/EPRI 1023001

Mark Henry Salley and Susan E. Cooper (NRC/RES/DRA)
Stuart Lewis (EPRI)

ACRS Full Committee Meeting
April 13, 2012
Rockville, MD

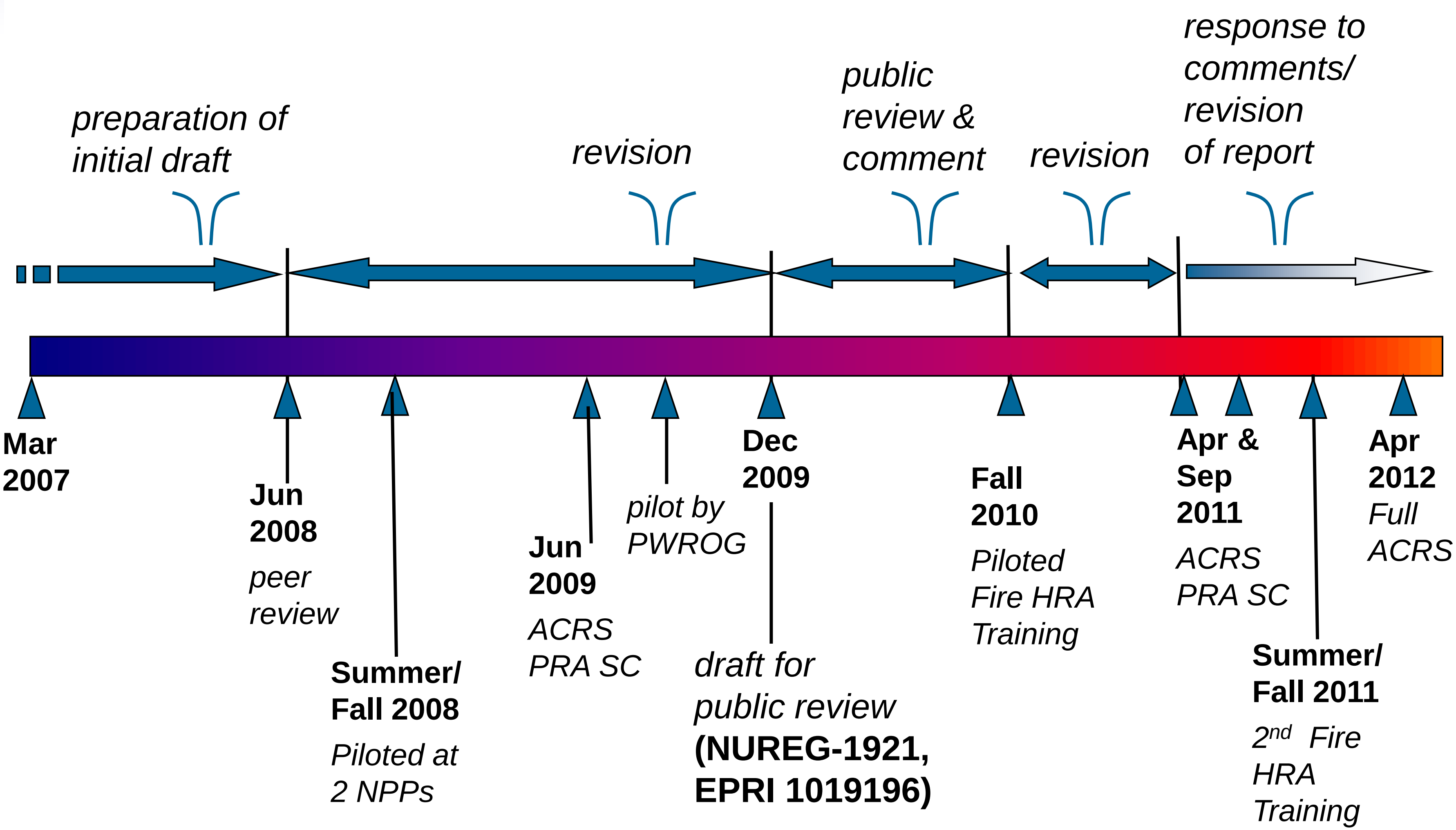
A Collaboration of U.S. NRC Office of Nuclear Regulatory Research (RES) & Electric Power Research Institute (EPRI)

Today's Presentation

- Short history and background of the project
- Project objectives
- Examples of challenges
- Industry perspective
- Review, Testing and Trial Applications
- Uses for other HRA projects

Project Team requests letter from ACRS

Evolution of the Fire HRA Guidelines



Background on Fire HRA

Status of fire PRA at project initiation

- About half of US NPPs transitioning to NFPA-805
- NUREG/CR-6850 [EPRI 1011989] provided detailed guidance for fire PRA to support transition to NFPA-805

HRA for fire PRA

- Guidance in NUREG/CR-6850
  - Conservative screening human error probabilities (HEPs)
  - Performance shaping factors (PSFs)
- Needs beyond NUREG/CR-6850
  - Approach for detailed/best-estimate HRA
  - Guidance to satisfy requirements in PRA Standard

Objectives of Fire HRA Guidelines

- Address HRA needs beyond NUREG/CR-6850
  - Detailed quantification method for fire PRA context
  - Treatment of relevant PSFs
  - Steps to satisfy PRA Standard requirements

- Satisfy NRR User Need 2008-003, Rev. 1, Task 13

  "…*expand existing HRA methods* … *to incorporate the effect of fires in full-power PRA models*."

Pursued via joint EPRI/NRC MOU analogous to NUREG/CR-6850
(third major joint fire-related project)

Examples of challenges addressed

- Need for advances in state-of-the-art for fire HRA
  - Full delineation of HRA process for fire context
  - Feasibility of human actions
  - Guidance for:
    - Response to spurious signals/actuations from cable failures
    - Potential errors of commission (EOCs)
    - Distractions in control room
    - Uncertainties (e.g., for timing information)
  - Appropriate quantification methods
    - New scoping approach
    - Adaptation of (two) existing methods for detailed analysis
  - Implications for ex-control room actions

Examples of challenges addressed (continued)

- Piloting of methods and guidance
- Guidance to meet evolving requirements in PRA Standard
- Evolving approaches to implementing fire PRA tasks
- Continuing improvements to fire procedures in plants
- Need to develop training material in parallel with report

Industry Perspective

- Focus has been on
  - Assuring guidance meets technical needs of users
  - Ensuring adequate review, testing and trial application

- Important attributes of technical approach
  - Addresses range of fire response strategies in place at plants
  - Coordinates with development of actual fire PRA models
  - Capable of producing useful insights
  - Consistent with HRA for internal events

Review, Testing and Trial Application

- Peer review (June 2008)
- Pilot applications
  - Scoping tested by project team at two NPPs (2008)
  - Pilot by PWR Owners Group (2009)
- Public review of full draft (early 2010)
- Applications
  - Use of draft guidance to complete fire PRAs (eight sites, all with peer reviews)
  - Feedback from students in training courses (2010 and 2011)
- Review by ACRS Subcommittee on Reliability and PRA

All elements tested via variety of applications

Review, Testing and Trial Application (cont'd)

Examples of changes to report from feedback

- Increased guidance on qualitative analysis (especially feasibility assessments)
- Simplified scoping approach to quantification
- Modified timing considerations for scoping approach
- Enhanced guidance for walkthroughs/talkthroughs
- Expanded treatment of spurious actuations/operations
- Simplifications in recovery analysis, dependency analysis, and uncertainty

Review and experience substantially improved Guidelines

Advances Beneficial to Other Projects

- Fire HRA guidelines directly benefit other NRC HRA projects
  - New HRA development per SRM M061020
  - Site-wide Level 3 PRA Project

- Commonality of team members among projects facilitates coordination

Advances from Fire HRA Guidelines: Examples

- Comprehensive guidance for all steps in HRA process
- Examples on how to address PRA Standard requirements
- Integration of HRA with larger PRA study
- Example of a quantification approach that addresses traceability concerns (i.e., scoping fire HRA approach)
- Detailed guidance on feasibility assessments
- Guidance on HRA tasks for ex-control room actions and challenging environmental conditions
- Framework for HRA for other challenges, e.g.,
  - Seismic PRA

Examples of Advances (continued)

- Situations involving problems with cues and distractions
- Development of timing estimates (including treatment of uncertainties)
- Use of procedures other than EOPs
- Training materials for all HRA process steps

Conclusions

- Project objectives have been satisfied
  - Comprehensive, useful guidance for fire HRA
  - Approach refined through testing and application in production PRAs
- Elements of Guidelines of significant value to other HRA research and development

Project Team requests letter from ACRS

RISK-INFORMED REGULATORY FRAMEWORK FOR NEW REACTORS

Advisory Committee on Reactor Safeguards

Contacts: Don Dube, NRO/DSRA, 301-415-1483
Ron Frahm, NRR/DIRS, 301-415-2986

April 12, 2012

Meeting Purpose

Discuss staff's response to the SRM on SECY-10-0121 and request a letter

Agenda

- Brief background
- Tabletop exercise results
  - RITS 4b, completion times
  - Reactor oversight process
- Conclusions, options and recommendations in draft paper

Options Provided in SECY-10-0121

1) No changes to existing risk-informed guidance (status quo)
2) Implement enhancements to existing guidance to prevent significant decrease in enhanced safety (NRC staff recommendation)
3) Develop lower numeric thresholds for new reactors

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Commission SRM Dated March 2, 2011

- **Commission approved a hybrid of Options 1 and 2**
  - Continue existing risk-informed framework pending a series of tabletop exercises that test existing guidance
- **Commission "reaffirms" existing**
  - safety goals
  - safety performance expectations
  - subsidiary risk goals and associated risk guidance
  - key principles (e.g., RG 1.174)
  - quantitative metrics
- **New reactors with enhanced margins and safety features should have greater operational flexibility than current reactors**

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Tabletop Exercises

- December 2, 2010: 50.59-like change process for ex-vessel severe accident (EVSA) design features under Section VIII.B.5.c of each design certification rule
- May 4, 2011: Risk-informed inservice inspection of piping
- May 26, 2011 and June 1, 2011: Risk-Informed Technical Specifications (RITS) Initiative 4b on completion times and the Maintenance Rule (a)(4)
- June 29, 2011: RITS Initiative 5b (surveillance frequency control program)
- August 9, 2011: 50.69 and guidance in NEI 96-07 Appendix C on the change processes for Part 52 specific to EVSA design features
- October 5, 2011: RG 1.174; transition options from large release frequency (LRF) as a risk metric to large early release frequency (LERF); and ROP risk-informed case studies including SDP, reactive inspections under Management Directive 8.3, and MSPI
- October 26, 2011: Follow-up discussions with stakeholders on the ROP

Major Conclusions

- During the tabletop exercises for licensing applications, the staff did not identify any potentially significant decreases in the enhanced safety margins for new reactors
- Identified potential gap in the Tier 2 change process regarding severe accident features that are not related to ex-vessel severe accident prevention and mitigation
- Current risk thresholds are appropriate for ROP; however, a few changes to the ROP may be warranted consistent with the integrated risk-informed principles in RG 1.174

Key Tabletop Exercise Results

- **RITS 4b (completion times): Two key programmatic controls**
  - The risk-informed completion time is limited to a deterministic maximum of 30 days (referred to as the backstop completion time) from the time the TS action was first entered
  - Voluntary use of the risk-managed TS for a configuration which represents a loss of TS specified safety function, or inoperability of all required safety trains, is not permitted

AP1000: RITS 4b Case Study

Class 1E DC System (IDS)			
Division A	**Division B**	**Division C**	**Division D**
1 - 24hr Battery	1 - 24hr Battery	1 - 24hr Battery	1 - 24hr Battery
	1 - 72hr Battery	1 - 72hr Battery	

Passive Core Cooling (PXS)	
DVI Line A	**DVI Line B**
Accum.-A (CKV)	Accum.-B (CKV)
CMT-A (CKV)	CMT-B (CKV)
IRWST-A (MOV)	IRWST-B (MOV)
IRWST-A (CKV1)	IRWST-B (CKV1)
IRWST-A (CKV2)	IRWST-B (CKV2)

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AP1000 SPAR Model Results

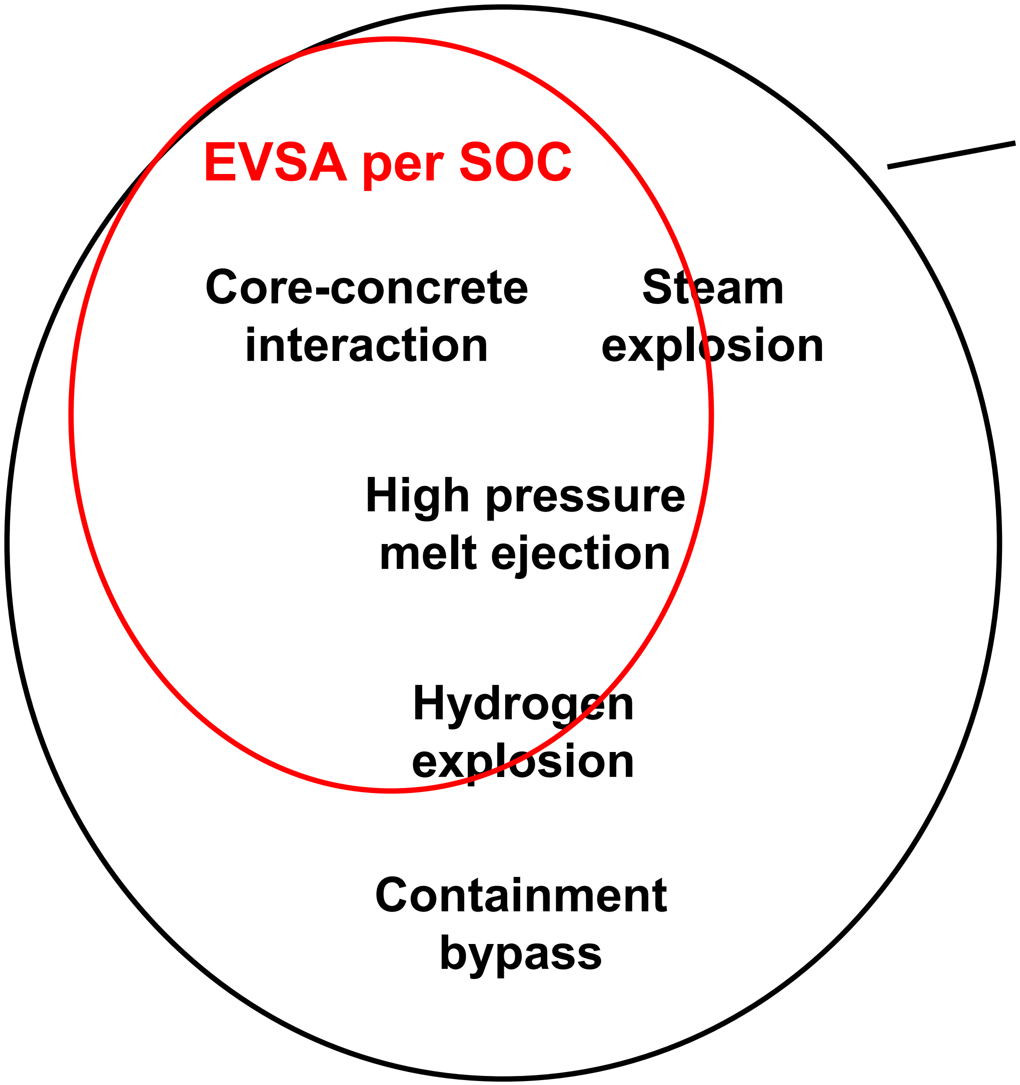
RITS 4b Case	Equip. Not Functional	CDF (/yr)	∆CDF (/yr)	Calc Completion Time (days)	Tech. Spec. Limit (hrs)	Allowed Completion Time (days)	ICDP	Other Available Equip
Base	None (no T&M)	2.1E-07	--	--	--	--	--	All
1	1 - 1E-DCP-A (DC/AC)	5.9E-07	3.8E-07	9623	6	30	3.1E-08	1 - 24hr division and 2 - 24/72hr divisions
7*	1 IRWST Injection Line-B	1.1E-04	1.1E-04	33	1	[1hr]	[1.3E-08]	2 Accum., 1 IRWST ILs (2 flow paths), 2 PHRHs flow paths, and 2 CMTs
9-A*	1 CMT-A and 1 Accum.-A	1.6E-04	1.5E-04	24	CMT - 1 Accum. - 1	[1hr]	[1.8E-08]	1 Accum., 2 IRWST ILs (4 flow paths), 2 PHRHs flow paths, and 1 CMT

Key Tabletop Results (cont.)

- **RITS 4b staff exercises**
  - Staff identified some configurations of equipment outages that would represent 10 years' worth of core damage probability
  - Repeated entry into such condition over time could increase CDF by one or more orders of magnitude, which could approach the baseline CDF of currently operating plants
  - Staff believes these configurations are unlikely or unrealistic, and that there were additional regulatory and programmatic controls that would limit the aggregated risk increase (e.g., performance monitoring, periodic PRA maintenance and upgrade under 50.71(h))

- **Staff concludes no substantive changes to methodology is necessary**

Tier 2 Change Process: Gap identified for ex-vessel severe accident features



Containment Challenges per § 52.47(a)(23) & § 52.79(a)(38)

Key Tabletop Results (cont.)

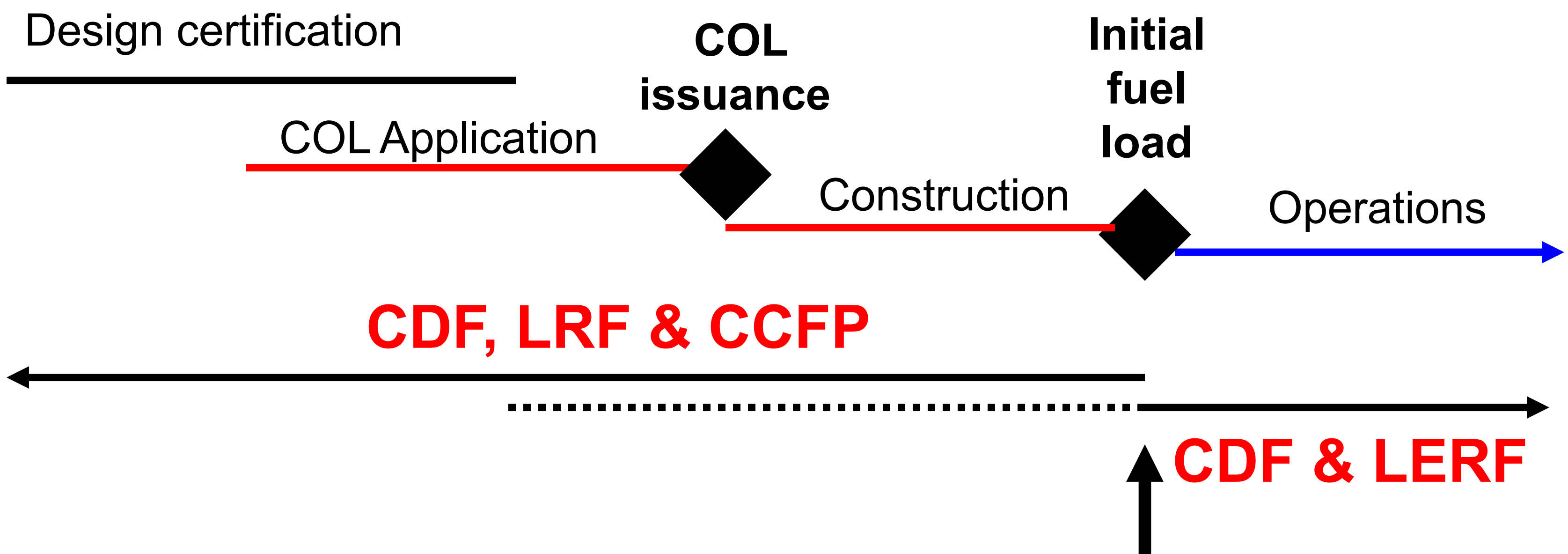
Recommendation 1

Address the potential gap, by a) ensuring that there are sufficient details on all key severe accident features in Tier 1, and b) including a change process in future design certification rulemakings in Section VIII for *non-ex-vessel severe accident features* similar to Section VIII.B.5.c for *ex-vessel severe accident features*

LRF-to-LERF Transition

- **LRF vs. LERF**
  - Commission goals for new reactors are based on a conditional containment failure probability (CCFP) of less than 0.1, and a LRF of less than 10^{-6}/yr, as well as 10^{-4}/yr for core damage frequency (CDF)
  - Operating reactors use CDF and LERF as risk metrics
- **LRF issues**
  - LRF (and CCFP) have not been defined by the staff
  - Each design center has chosen different definitions
  - LERF is used in the ASME/ANS level 1 PRA standard, in risk-informed staff guidance (e.g., RG 1.174), and ROP
  - No existing or proposed level 2 PRA standard provides a universal definition of LRF

Recommendation 2: Option 2C



- LERF calculated at or prior to initial fuel load. CDF & LERF used for RG 1.174 acceptance guidelines going forward.
- Last regulatory use of LRF & CCFP
- Continue to meet containment performance objective following core damage per SECY-90-016 and SECY-93-087

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Tabletop Results on Other Licensing and Operational Programs

- **50.65(a)(4) – no gaps**
  - Defense in depth and plant transient assessment often more limiting in terms of risk management action level
- **RITS 5b (surveillance frequency) – no gaps**
  - Much more deterministically oriented, with risk impact only a secondary consideration in the criteria for changing surveillance test interval
- **50.69 (SSC categorization) – no gaps**
  - Rule has built-in measures to monitor RISC-3 components and take corrective actions (e.g., periodic program review every 2 refuel cycles)
- **RG 1.174 – no gaps**
  - Considerations such as defense in depth and margin of safety often more limiting than risk impact

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ROP Tabletop Approach

- Tested various realistic scenarios to confirm the adequacy of the current ROP risk-informed processes for regulatory decision-making or identify areas for improvement
- Used a broad cross-section of well-vetted cases, developed from actual greater-than-green examples from the current fleet of reactors:
  - Significance Determination Process (SDP) findings
  - Mitigating Systems Performance Index (MSPI) data
  - Management Directive (MD) 8.3 applications
- Applied similar situations to the new reactor designs, filling in gaps with realistic hypothetical situations and reasonable assumptions, and then compared the risk values and resultant regulatory response

SDP Tabletops

RESULTS

- Existing risk thresholds for determining significance of inspection findings are generally acceptable
- Greater-than-green inspection findings would likely involve common cause failures and/or long exposures of risk-significant components
- Existing process does not always ensure an appropriate regulatory response for degradation of passive components and barriers

CONCLUSION

- SDP analyses could be augmented with additional qualitative considerations (deterministic backstop) to appropriately address performance issues

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MD 8.3 Tabletops

RESULTS

- Existing risk thresholds for invoking reactive inspections are adequate for new reactors
- Deterministic criteria used initially for event screening and then within a range of response determined by risk values
- Risk values heavily influence whether or not a reactive inspection is warranted and, if so, at what level
- Variations in or minor revisions to risk models used can potentially result in an inadequate response

CONCLUSION

- Contribution of existing deterministic criteria could be modified or new deterministic criteria developed for initiating reactive inspections for new reactors

MSPI Tabletops

RESULTS

- Existing MSPI is not adequate and would be largely ineffective in determining an appropriate regulatory response for active new reactor designs
- Meaningful MSPI may not even be possible for passive systems using the current formulation of the indicator
- Existing performance limit (backstop) could be further leveraged for active new reactor designs

CONCLUSION

- Alternate PIs in the mitigating systems cornerstone could be developed and/or additional inspection could be used to supplement insights currently gained through MSPI

ROP Options

OBJECTIVES FOR ROP OPTIONS

- Maintain current risk thresholds for new reactor designs
- Consistent with integrated risk-informed decision-making concepts in RG 1.174
- Afford greater operational flexibility based on enhanced safety margins

A. USE AS IS

- Use the existing risk-informed ROP tools for new reactor applications without making any changes
- No additional action or resources needed, but existing tools may not always provide for an appropriate regulatory response

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ROP Options (cont.)

B. AUGMENT EXISTING PROCESSES

- SDP: Use existing risk-informed SDP, but augment with deterministic backstops to ensure an appropriate regulatory response to address performance issues
- MD 8.3: Modify the contribution of existing deterministic criteria or develop new criteria for determining the appropriate regulatory response to plant events
- MSPI: Develop alternative to MSPI or augment existing guidance to emphasize performance limit for active new reactor designs, and increase inspection of passive mitigating systems for passive new reactor designs
- Proposed enhancements could be developed using existing resources and working with stakeholders

ROP Options (cont.)

C. DEVELOP DETERMINISTIC TOOLS

- Do not use the existing risk-informed ROP tools
- Capture risk insights to a lesser extent than the current fleet using deterministic guidance consistent with new reactor design certification and licensing basis
- Additional resources may be necessary to research and develop the new guidance documents

Staff Recommendation: Option B

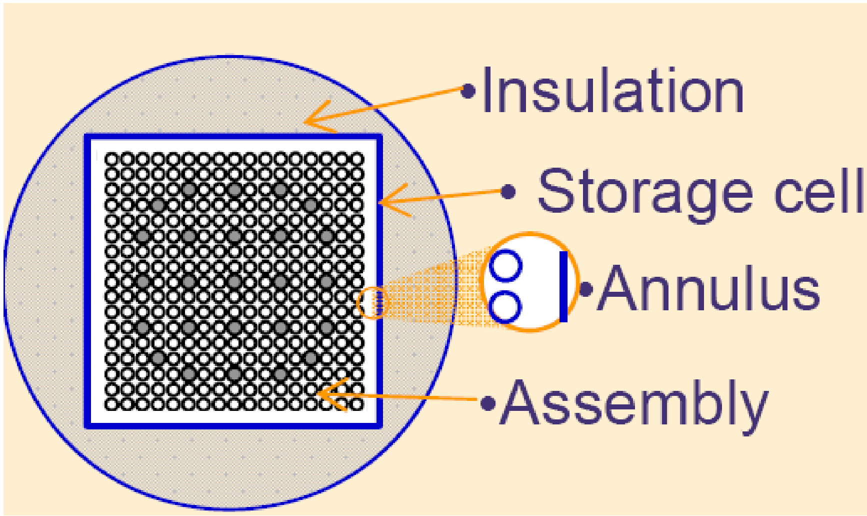
- Staff would obtain Commission approval for proposed changes to ROP at least one year prior to implementation
- Process enhancements could be further refined based on experience and lessons learned

Next steps

- Finalize Commission paper based on ACRS and stakeholder feedback
- SECY due to be issued early June, 2012

SFP Zirc-Fire Research Overview

Phase 1 Testing



This Phase 1 bundle is a detailed PWR assembly (17 by 17). This testing includes the complex thermal hydraulic conditions that strongly impact the reaction kinetics of Spent Fuel Pool LOCAs. It is unfortunate that NRC has not applied similar resources in responding to PRM-76. Instead, NRC repeatedly extols its programs that sidestep the role of the reaction kinetics during LOCAs.

In promoting the denial of PRM-50-76 on June 29, 2005, ML050250359, the NRC Staff asserted:

According to him (Robert H. Leyse)*, it is fundamentally important that the determinations of LOCA transient chemical kinetics include the geometry of the stationary Zircaloy reactant in combination with the thermal-hydraulic conditions of the flowing-water/steam reactant.*

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Presentation to the ACRS Full Committee – 593rd Meeting

Briefing on Calvert Cliffs Unit 3 COL Application Safety Evaluation Reports with Open Items for FSAR Chapters 6, 7, 15, and 18

Surinder Arora
Project Manager

April 12, 2012

Major Milestones - Chronology

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DATE	MAJOR MILESTONE
07/13/2007	Part 1 of the COL Application (Partial) submitted
12/14/2007	Part 1, Rev. 1, submitted
03/14/2008	Part 1, Rev. 2, & Part 2 of the Application submitted
08/01/2008	Revision 3 submitted
03/09/2009	Revision 4 submitted
06/30/2009	Revision 5 submitted
07/14/2009	Review schedule published
09/30/2009	Revision 6 submitted
04/12/2010	Phase 1 review completed
12/20/2010	Revision 7 submitted
11/15/2011	ACRS reviews complete for Chapters 2 (Group I), 4, 5, **6, 7,** 8, 10, 11, 12, **15,**16, 17, **18** & 19
03/27/2012	Revision 8 submitted

Review Schedule

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Phase - Activity	Target Date
Phase 1 - Preliminary Safety Evaluation Report (SER) and Request for Additional Information (RAI)	April 2010 (Actual)
Phase 2 - SER with Open Items	Schedule under Review
Phase 3 – Advisory Committee on Reactor Safeguards (ACRS) Review of SER with Open Items	Schedule under Review
Phase 4 - Advanced SER with No Open Items	Schedule under Review
Phase 5 - ACRS Review of Advanced SER with No Open Items	Schedule under Review
Phase 6 – Final SER with No Open Items	Schedule under Review

NOTE: The target dates for Phase 2 to 6 are currently being evaluated based on the RAI response dates provided by UniStar in their February 21, 2012 letter.

Review Strategy

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- Pre-application activities
- Acceptance Review of the application
- COLA has chapters and sections incorporated by Reference
- Review of COLA site specific information in conjunction with the DC review. Same technical reviewers in most cases.
- Generic Open Item that ties DC and COLA Reviews
- Frequent interaction with the applicant via
  - Teleconferences
  - Audits
  - Public meetings
- Use of Electronic RAI (eRAI) System
- Phase discipline

Summary of SER with OI: Chapter 6 Engineered Safety Features

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SRP Section/Application Section		Number of RAI Questions	Number of SE Open Items
6.1.1	Metallic Materials	1	0
6.1.2	Organic Materials	3	0
6.2.1 6.2.2 6.3	Containment Functional Design Containment Heat Removal Emergency Core Cooling System	These Sections were not delivered in the Phase 2 SE	N/A
6.2.3 6.2.4 6.2.5 6.2.7 6.5	Secondary Containment Functional Design Containment Isolation System Combustible Gas Control in CTMT Fracture Prevention of CTMT Pressure Vessel Fission Product Removal & Control Systems	IBR	0
6.2.6	Containment Leakage Testing	0	0
6.4	Habitability Systems	6	2
6.6	Inservice Inspection of ASME Class 2 & 3 Components	0	0
Totals		10	2

Summary of SER with OI: Chapter 7 Instrumentation and Controls

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SRP Section/Application Section		Number of RAI Questions	Number of SE Open Items
7.1	Introduction	2	0
7.5	Information Systems Important to Safety	2	2
7.7	Control Systems	1	1
7.9	Data Communication Systems	1	0
Totals		6	3

Summary of SER with OI: Chapter 15 Transient and Accident Analyses

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SRP Section/Application Section		Number of RAI Questions	Number of SE Open Items
15.0	Transient and Accident analysis (except Section 15.0.3)	0	0
15.0.3	Radiological Consequences of Design Basis Accidents	1	0
Totals		1	0

Summary of SER with OI: Chapter 18 Human Factors Engineering

SRP Section/Application Section		Number of RAI Questions	Number of SE Open Items
18.8	Procedure Development	1	0
18.12	Human Performance Monitoring	1	0
Totals		2	0

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Advisory Committee on Reactor Safeguards (ACRS) License Renewal Full Committee

Columbia Generating Station (Columbia)

Safety Evaluation Report (SER)

April 12, 2012

Arthur Cunanan, Project Manager
Office of Nuclear Reactor Regulation

Presentation Outline

- Overview
- Closure of Open Items
  - Operating Experience
  - High-Voltage Porcelain Insulators
  - Crane Load Cycle Limit
  - Upper-Shelf Energy
  - Metal Fatigue
  - Core Plate Rim Hold-Down Bolts
- Conclusion

Overview

- Safety Evaluation Report (SER) with Open Items was issued August 30, 2011
- The Open Items for the SER are closed
- Region IV Administrator's Letter of Recommendation received February 27, 2012
- The final SER was issued February 28, 2012

Internal Corrosion of Buried Piping

- Applicant determined that the buried pipe that leaked was out-of-scope piping and it did not fail due to internal corrosion

- Internal corrosion of buried and aboveground piping is age managed by several programs

- Based on recent operating experience at other plants, the staff is developing an ISG to provide guidance for plant-specific programs

SER Section 3 Closure of Open Items

SER Section 3.0.5 – Operating Experience

Activities will be implemented throughout the term of the renewed license to:

- Capture, identify, process, and evaluate plant-specific and industry operating experience related to aging
- Implement changes to the aging management activities as identified through operating experience evaluations
- Provide training on aging to those personnel that screen, evaluate, and submit operating experience
- Report plant operating experience on aging to the industry

SER Section 3 Closure of Open Items

SER Section 3.0.3.3.7— High-Voltage Porcelain Insulators

High-voltage post insulators at the 230 kV Ashe Substation are included in the AMP with testing every 8 years and cleaning if needed

SER Section 4 Closure of Open Items

SER Section 4.1.2.9 – TLAA Identification (Crane Load Cycle Limit)

- The applicant stated that the analyses for cranes are TLAAs
- The applicant dispositioned the TLAAs under 10 CFR 54.21(c)(1)(i) that the analyses remain valid during the period of extended operation

SER Section 4 Closure of Open Items

SER Section 4.2.2 – Upper-Shelf Energy

Applicant projected upper shelf energy (USE) for the N12 nozzle forgings to 54 EFPY, and justified:

- The initial USE of 62 ft-lbs
- The copper content of 0.27 percent

Staff verified applicant's analysis that the USE for the N12 nozzle will remain > 50 ft-lbs at the end of vessel life IAW 10 CFR Part 50 Appendix G

SER Section 4 Closure of Open Items

SER Section 4.3 – Metal Fatigue

Environmentally-Assisted Fatigue (EAF)

- The applicant addressed EAF for components beyond those identified in NUREG/CR-6260
- Audit was able to:
  - review the applicant's methodology for selecting additional plant-specific locations
  - confirm locations screened-out for review of EAF were appropriate
  - conclude that EAF has been assessed for the applicant's plant configuration

SER Section 4 Closure of Open Items

SER Section 4.7.4 – Core Plate Rim Hold-Down Bolts

- Applicant evaluated this TLAA under 10 CFR 54.21(c)(1)(iii) and provided AMR line items for the core plate rim hold-down bolts
- Applicant also committed to install core plate wedges at least two years prior to the period of extended operation
- Staff intends to issue a license condition requiring the applicant to install wedges on or before December 20, 2021

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Conclusion

On the basis of its review, the staff determines that the requirements of 10 CFR 54.29(a) have been met for the license renewal of Columbia Generating Station

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Spent Fuel Pool (SFP) Scoping Study

Katie Wagner
General Engineer
Office of Nuclear Regulatory Research

Briefing for the Advisory Committee on Reactor Safeguards (ACRS)

April 12, 2012

Background

- The agency has a rich regulatory basis for its current position on spent fuel storage
- A number of events (e.g., change in path forward on long-term storage; Fukushima accident) motivated re-assessment of the underlying knowledge base
- To launch this re-assessment, an expedited limited-scope consequence study was undertaken (to provide insights in 1 year)
  - Objective: to re-examine the impact of moving older spent fuel to dry cask storage in an expedited manner
- Results from this study will inform a regulatory decision-making process guided by the "Tier 3" Japan Lessons-Learned item entitled Transfer of Spent Fuel to Dry Cask Storage (referenced in SECY-12-0025)

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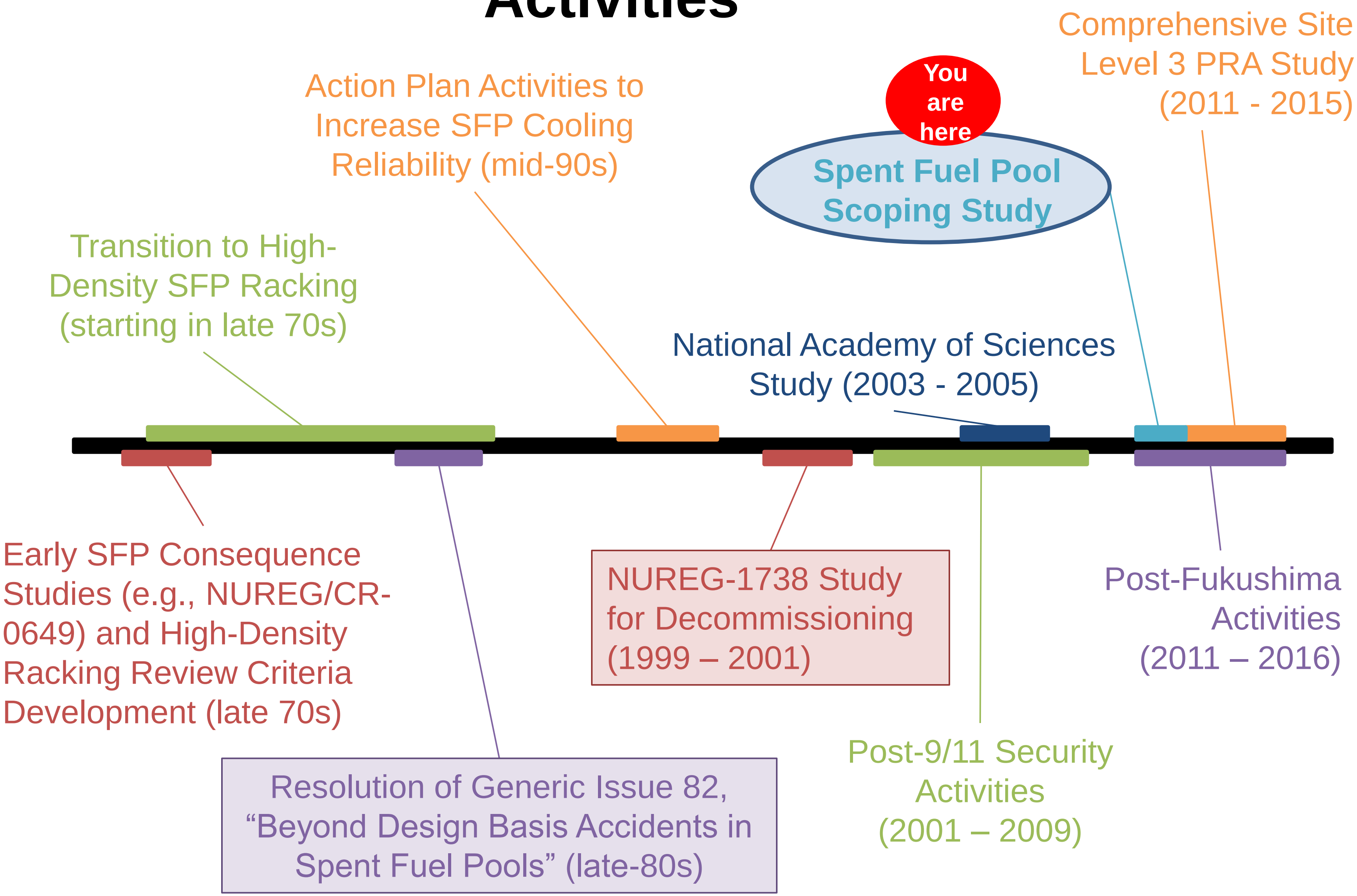
Timeline of Major SFP-related Activities



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Motivation for Focusing on SFP Seismic Hazards

Spent fuel storage considerations include:

- SFP Seismic Hazards
- Dry Cask Storage Risk *(e.g., NUREG-1864)*
- Cask Drop Hazards for SFPs *(e.g., NUREG-1738)*
- Repackaging For Transportation
- Fuel Storage Infrastructure *(e.g., 2010 EPRI study)*
- Worker Dose *(e.g., 2010 EPRI study)*
- Emergency Preparedness *(e.g., NUREG-1738)*
- Part 50, 72 & 73 Regulatory Requirements
- Multi-Unit Risk *(e.g., SECY-11-0089 project)*
- Design/Operation Differences Between Sites
- Boraflex Degradation & Inadvertent Criticality
- Protection Against Malevolent Acts *(e.g., post-9/11 security assessments)*
- Other SFP Hazards *(e.g., NUREG-1353)*
- Actions in Response to Japan Events *(e.g., Near-Term Task Force Recommendation 7)*

SFP Seismic Hazard

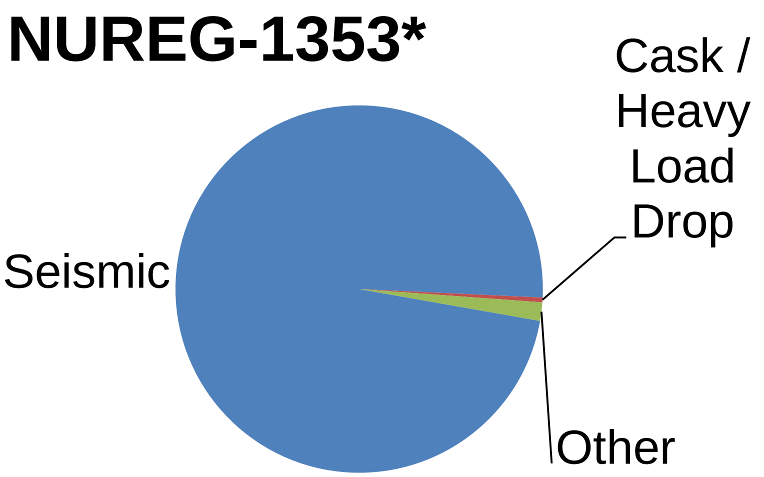
Past studies have indicated that SFP seismic hazard is an important piece of overall spent fuel risk.

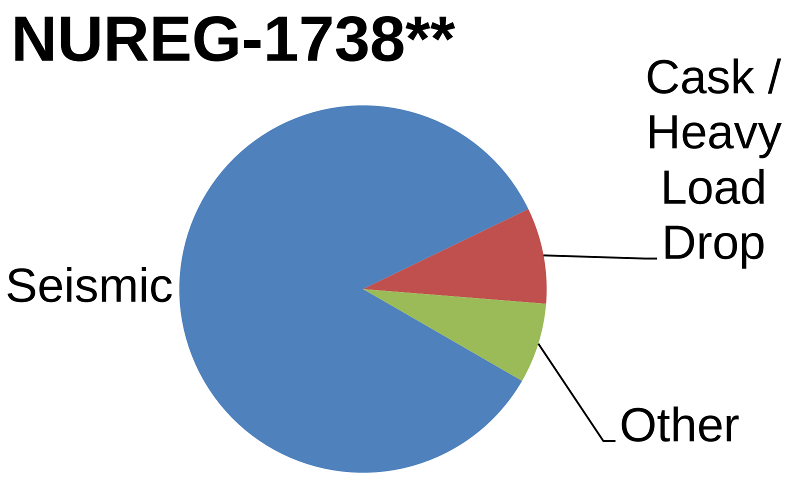
For this reason, SFP seismic hazard is the logical place to start in probing the continued applicability of past studies and developing insights for the current spent fuel storage situation.

Depending on the results gained from the study, additional work might be necessary to obtain a more holistic answer.

Motivation for Seismic Study

Annual frequency of SFP fuel uncovery as reported in previous SFP risk studies





*BWR, best estimate results

**Based on Livermore hazard curves which generally more closely match the updated USGS curves for the studied plant

Past SFP risk studies indicate that seismic hazard is the most prominent contributor to SFP fuel uncovery. While these studies have known limitations, this is sufficient motivation to focus on this class of hazards in the SFPSS.

Overview of Spent Fuel Pool Scoping Study (SFPSS)

- Focus: re-examine the potential impacts on SFP safety in the event of a challenging, beyond-design-basis seismic event
- Emphasis is given to acquiring timely results for ongoing deliberations and external stakeholder interest. The project is using:
  - Available information / methods
  - A representative operating cycle for a BWR Mark I (Peach Bottom)
  - Past studies to narrow scope
- Plan finalized in July 2011; study results to be sent to NRR: June 2012
- The closely related Japan Lessons Learned Tier 3 item from SECY-12-0025 (Transfer of Spent Fuel to Dry Cask Storage) addresses the bigger picture, with SFPSS being a key component

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Technical Approach

- Two conditions to be considered:
  - Representative of the current situation for the selected site (i.e., high-density loading and a relatively full SFP)
  - Representative of expedited movement of older fuel to a dry cask storage facility (i.e., low-density loading)
- Elements of the study include
  - Seismic and structural assessments based on available information to define initial and boundary conditions
  - SCALE analysis of reactor building dose rates
  - MELCOR accident progression analysis (effectiveness of mitigation, fission product release, etc.)
  - Emergency planning assessment
  - MACCS2 offsite consequence analysis (land contamination and health effects)
  - Probabilistic considerations

Seismic and Structural Methods

Jose Pires
Senior Structural Engineer
Office of Nuclear Regulatory Research

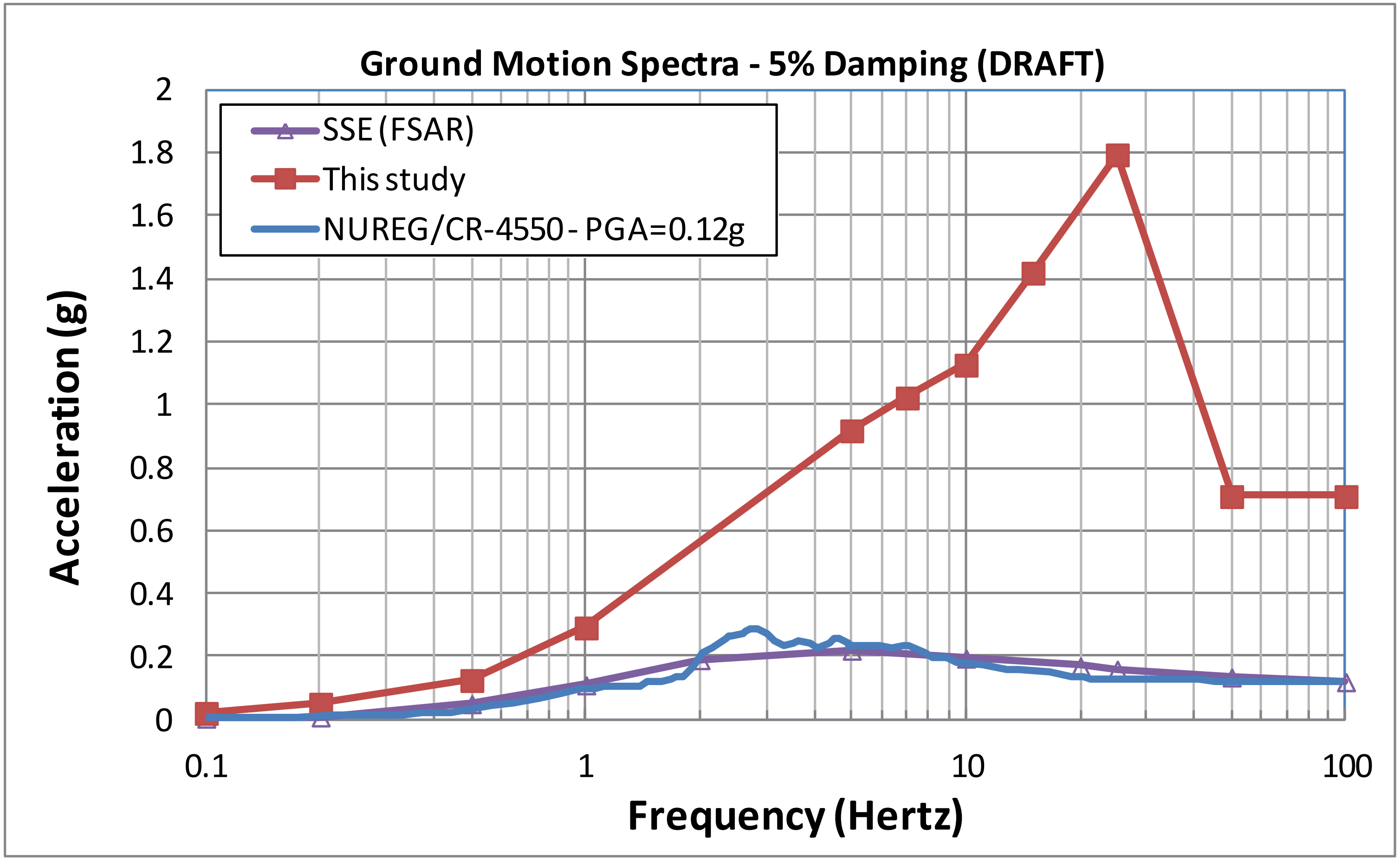
Prescribed Seismic Scenario

- Seismic event: 0.5 g to 1.0 g peak ground acceleration (PGA)
  - Challenging event, but very low frequency of occurrence (one event in 61,000 years)
    - OBE is 0.05g
    - SSE is 0.12g
    - Scenario PGA is 0.71 g -- It is about 6 times that for the SSE and beyond the seismic design basis for Eastern US plants
  - USGS hazard data and models (2008) being used as starting seismic hazard model
- Review of past studies indicates that less severe events would not challenge the SFP

Seismic Input

- Objective: to provide initial ground motion characteristics
  - Site Ground Motion Response Spectrum (GMRS)
- Rock site
- USGS Hazard Assessments (2008) used to obtain site GMRS (Similar to GI-199 resolution)
  - Site GMRS scaled up to obtain input ground motion spectra for the 0.71 g scenario
- Site GMRS rich in high frequencies (10 to 25 Hz)

Seismic Input



Comparison of ground motion spectra: this study, SSE, and spectrum for the NUREG-1150 PRA (scaled to the SSE PGA) (NUREG/CR-4550)

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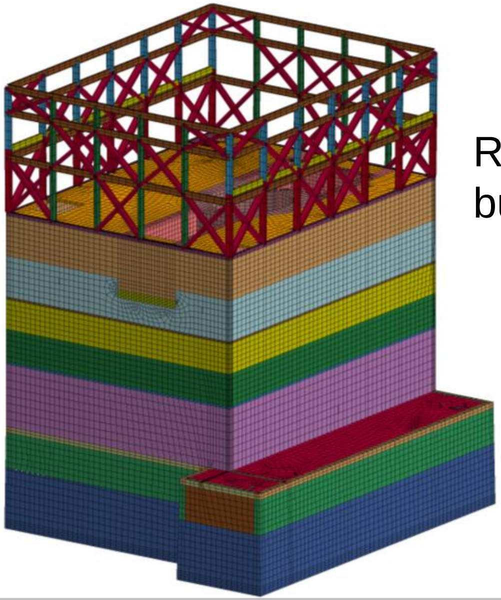
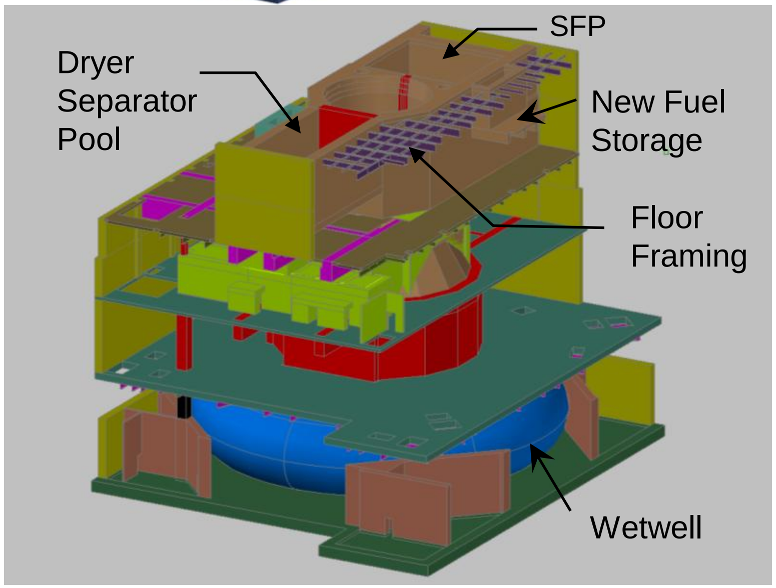
Structural Input

- Objective: to determine starting point for subsequent accident progression analysis
- Approach:
  - Generally follows approach used for GI-82 (NUREG/CR-5176)
    - Enhanced to address specific study aspects (Finite Element Modeling)
  - Uses in-structure response spectra (accelerations) calculated for the NUREG-1150 study (NUREG/CR-4550, Vol. 4, Part 3)
    - Scaled for increased PGA (from 3xSSE to about 6xSSE)
    - Scaled to account for high frequency content in the site GMRS
  - Uses 3D nonlinear finite element analysis of the SFP structure and its supports (subjected to equivalent static loads) to calculate:
    - Displacements, concrete and reinforcement strains and stresses, structural distortion, and liner strains

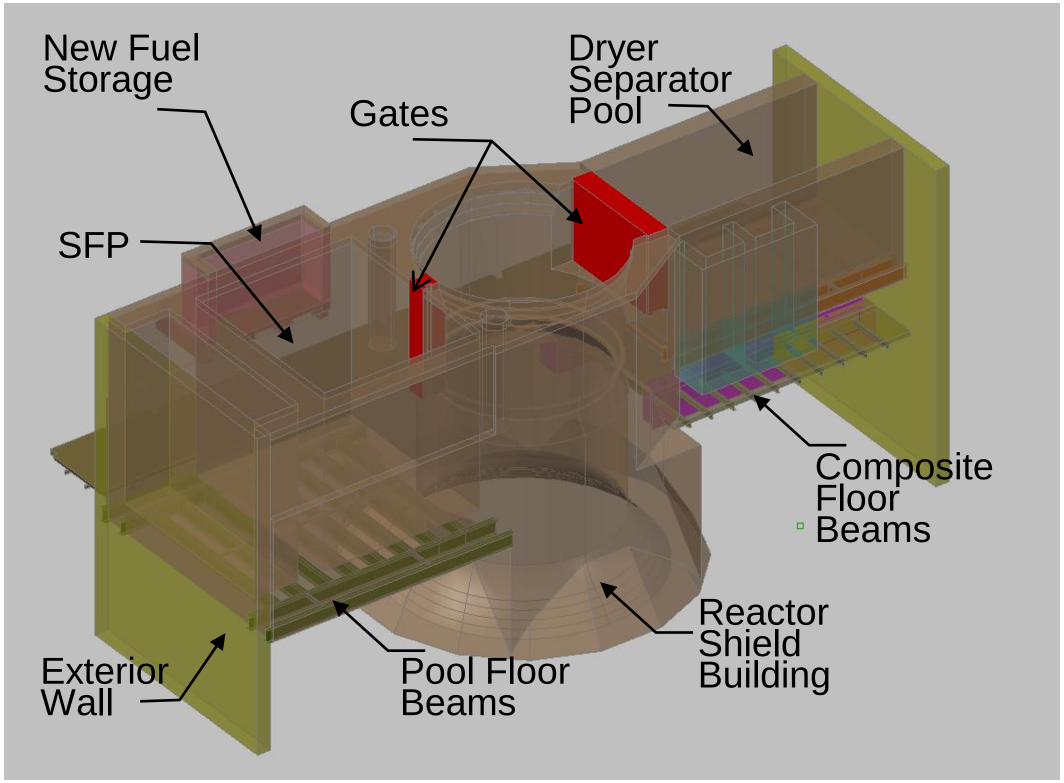
Reactor Building and SFP



Reactor building



SFP Details



Used to generate 3D finite element models of the SFP structure and its supports

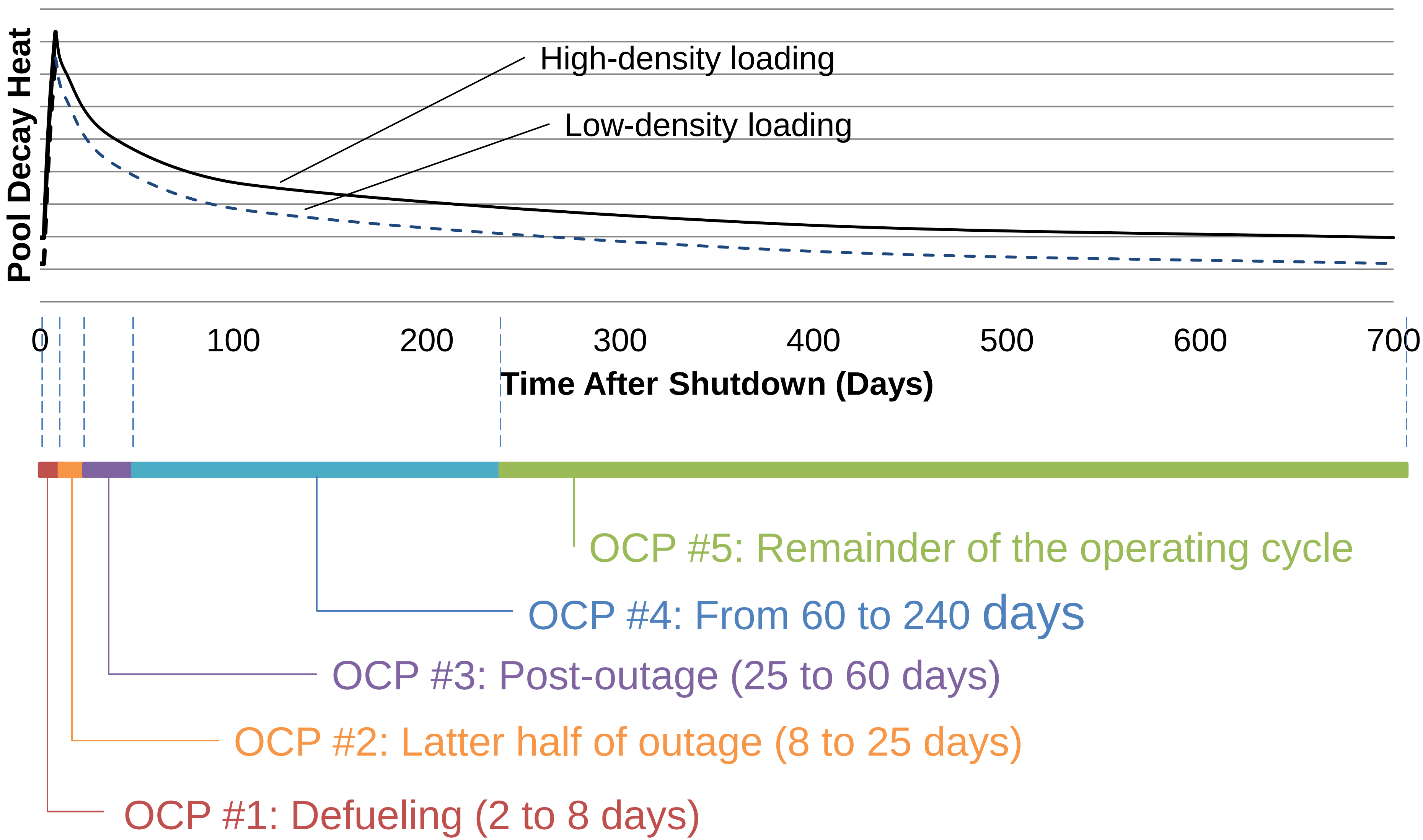
Structural Input

- Simpler approaches to assess damage to:
  - Penetrations, support systems, AC and DC power, other SSCs necessary for accident mitigation (e.g., building housing a portable diesel pump), other structures
- Approximations / assumptions
  - Effects of ground motion incoherency on high-frequency components of floor spectra approximated (possible conservatism)
  - Floor spectra do not account for coupling of SFP components to building (possible conservatism)
    - Hydrodynamic pressures based on scaled floor response spectra
    - Dynamic time-history analyses of the whole reactor building including the SFP were not done at this stage
  - Seismic loads from spent fuel racks and assemblies approximated
    - May need adjustment based on the analysis reports submitted by the licensee at the time of the license amendment for high density loading
  - Uses the SFP damage state to envelope potential leakage from the transfer gate, reactor piping, or dryer pool
- Starting conditions for accident progression analysis
  - Binned into a few discrete states with relative likelihood estimates

Scenario Delineation, Accident Progression Methods, and Consequence Analysis Methods

Don Helton
Senior Risk and Reliability Engineer
Office of Nuclear Regulatory Research

Illustration of Pool Decay Heat and Operating Cycle Phases (OCPs)



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Mitigation Assumptions

- For high-density loading, two alternatives are considered for required arranging of recently discharged fuel in to a pattern that facilitate passive cooling:
  - pre-arrangement
  - arrangement following the outage
- For scenarios not including mitigative actions:
  - No operator action is considered
- For scenarios including mitigative actions:
  - Diagnosis is assumed to take until SFP level drops 5 feet + 30 minutes for observation/decision-making (recall unavailability of AC power)
  - Capacities / timings generally follow underlying endorsed guidance in NEI-06-12, Revision 2
  - Once deployed, equipment runs indefinitely
    - Represents successful arrival of offsite support or deployment of other onsite assets
- <u>Effectiveness is determined by MELCOR</u>

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Other Issues Not Addressed in Defining Scenarios

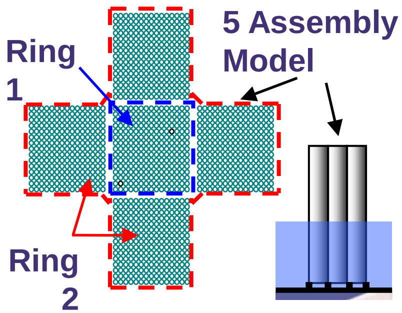
- Full core offload outages for vessel inspections
  - Not the typical situation for BWRs
- Presence of new fuel in the SFP as source of zirconium
  - Present for a short period of time
- Multi-unit effects
  - Only addressed until reactor/SFP become hydraulically decoupled
  - A focus of a recently initiated site Level 3 PRA project
- Inadvertent criticality events
- Recovery and repair actions

➢ The intent is to address as many uncertainties as practical via sensitivity studies

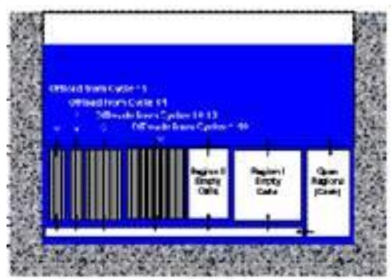
Use of MELCOR for SFP Analysis

Analysis

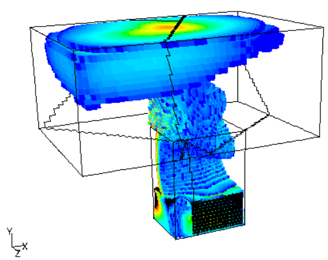
Experimental studies



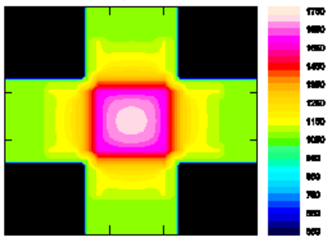
MELCOR Separate Effects Analysis



MELCOR Whole-Pool (i.e. Integrated) Analysis

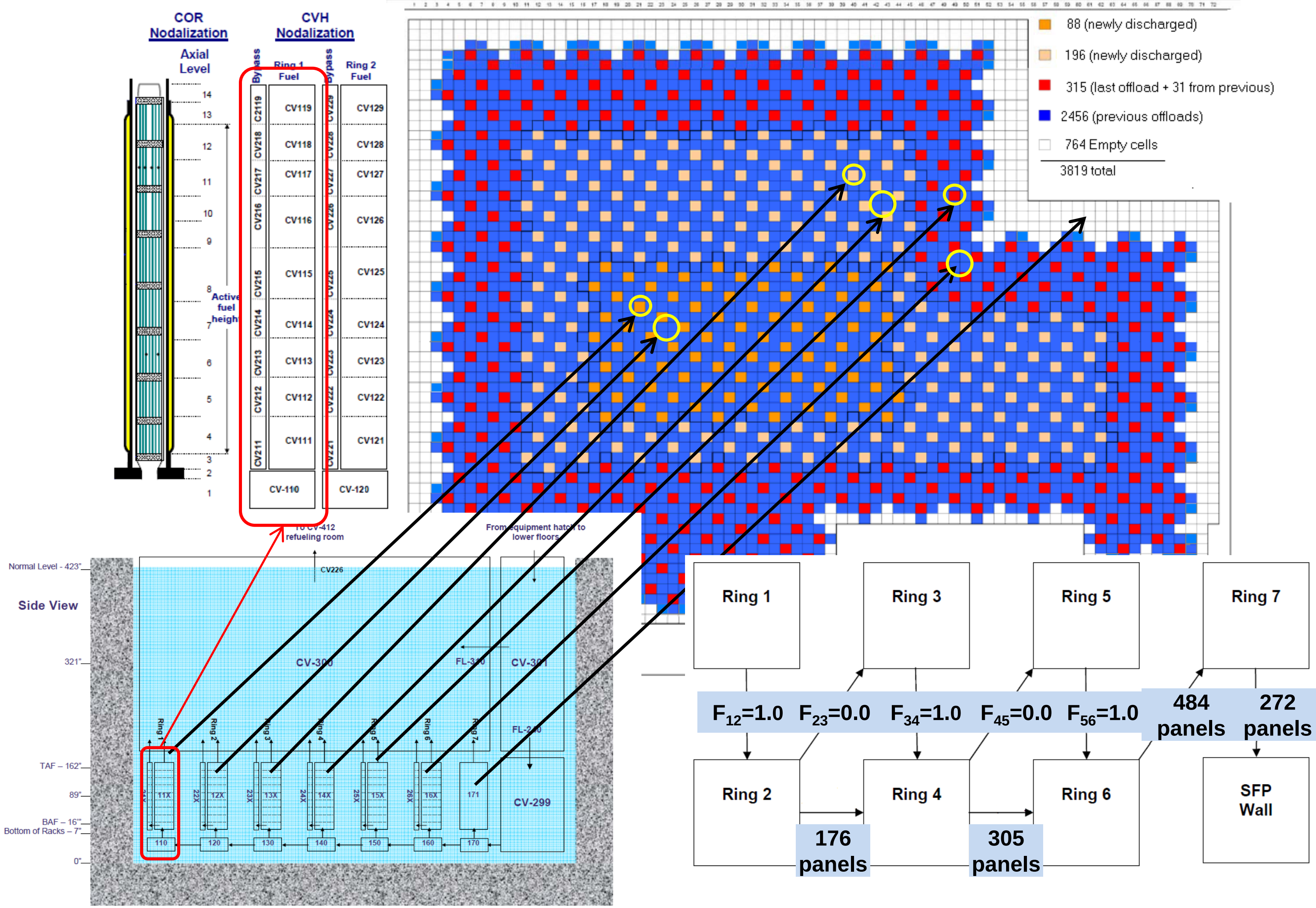


Computational Fluid Dynamics

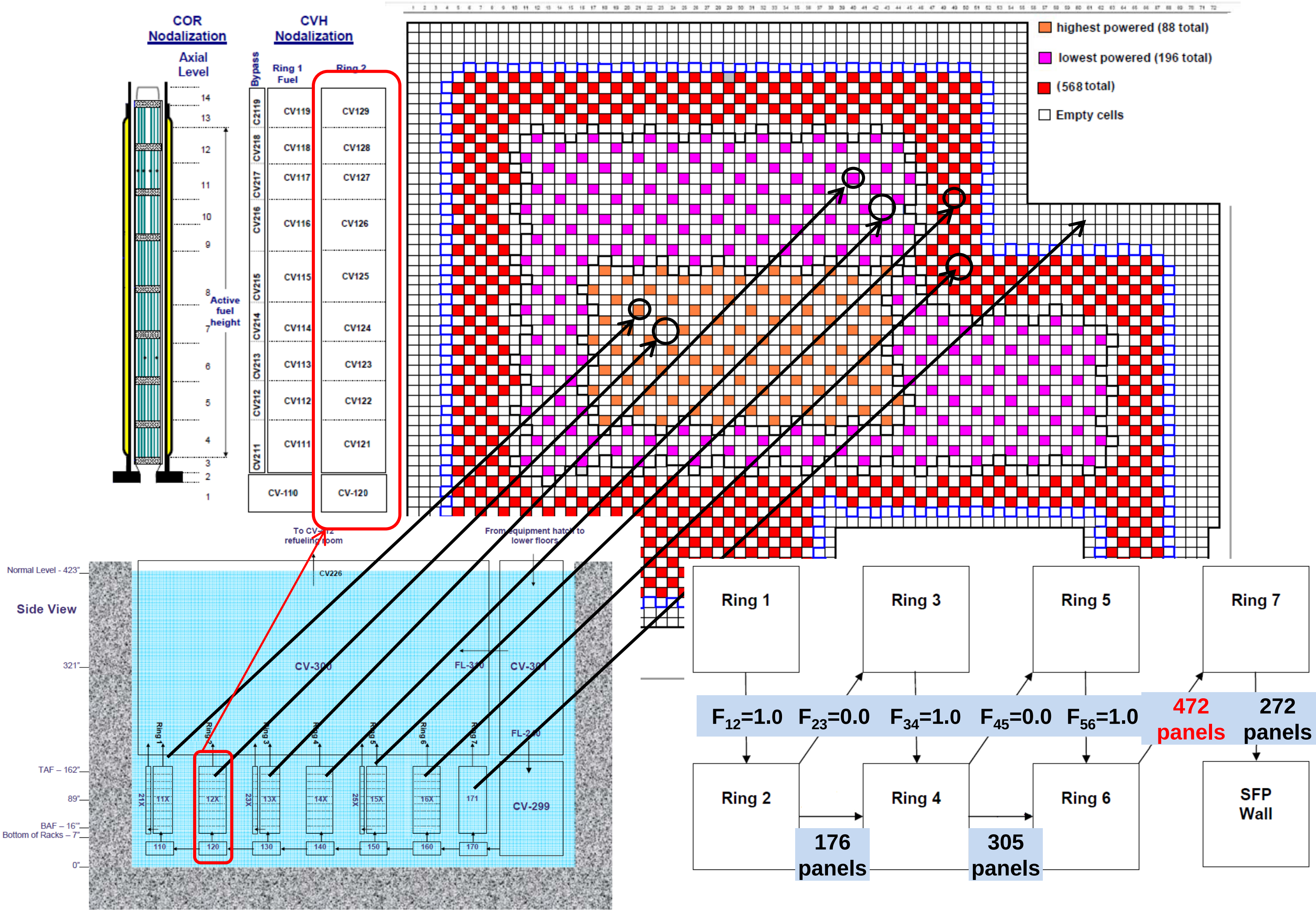


COBRA-SFS Analysis

High-Density Post-Outage SFP MELCOR Model



Low-Density Post-Outage SFP MELCOR Model

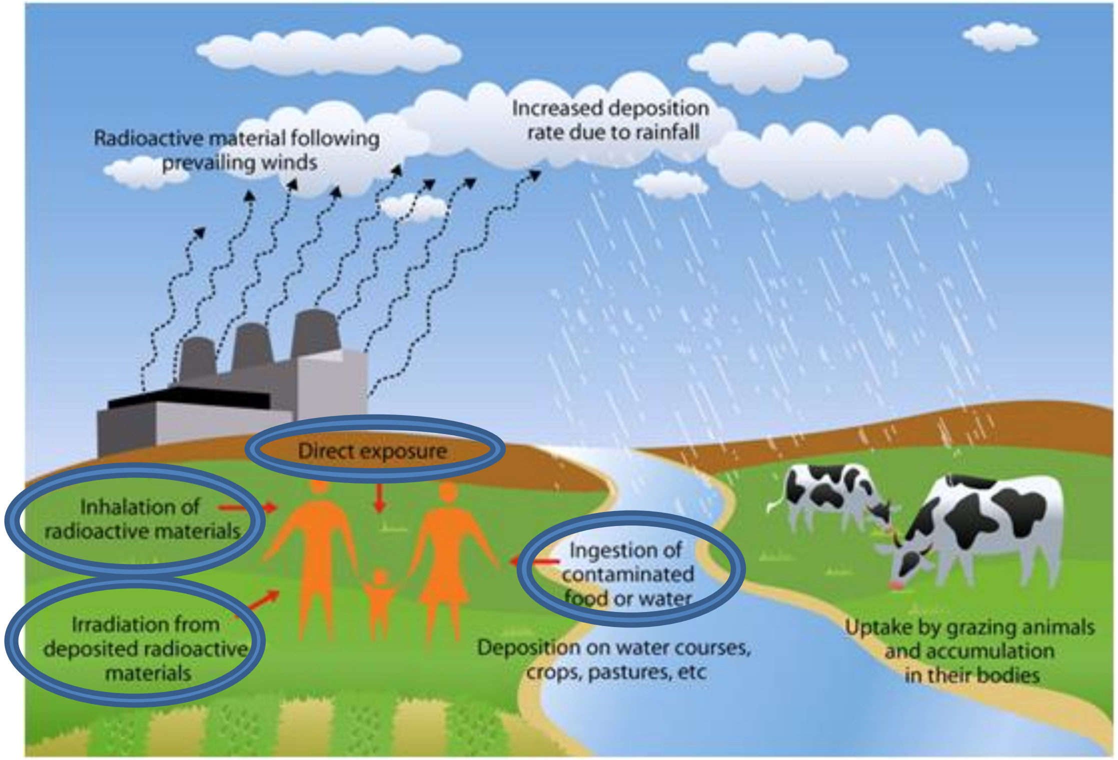


Offsite Consequence & Emergency Preparedness Modeling

- MACCS2 code will be used
  - Input: Accident source term (from MELCOR/ORIGEN), weather, population and economic data, protective measures
  - Output: Consequences (e.g. contamination, health effects) from atmospheric release
- Modeling will leverage best practices from draft NUREG-1935 (SOARCA)
- Population and economic data updated for 2011
- Emergency preparedness considerations
  - Pennsylvania specific evacuation
  - Cohorts to represent different groups of the public
  - Road network
  - Scenario-specific

MACCS2 Modeling: Atmospheric Release and Exposure Pathways

MACCS2 models the radioactive release to the atmosphere (e.g. plume rise, dispersion, dry and wet deposition)



MACCS2 estimates the health effects from: inhalation, cloudshine, groundshine, skin deposition, and ingestion (e.g. water, milk, meat, crops)

Consequence Modeling & Reporting

- Consequence Modeling (continued):
  - Stochastic health effects (e.g. latent cancer fatalities)
  - Three dose response models
    - Linear, no threshold (LNT) hypothesis
    - Linear, low-dose truncation - 620 mrem/yr (U.S. average dose)
    - Linear, low-dose truncation - 5 rem/yr or 10 rem lifetime (HPS position)
  - Deterministic health effects (e.g. early fatalities)
  - Federal Guidance Report 13
    - Most current federal guidance published by EPA
- Consequence Reporting:
  - Health Effects - conditional risk of early fatalities and latent cancer fatalities as related to distance from the site. (Ideal for informing individual members of the public)
  - Land Contamination - total land contamination for the site region above a specified dose level (e.g., the habitability criterion for the selected site of 500 mrem/year)

Concluding Remarks and Questions

Katie Wagner

Coordination and Communication

- SECY paper to be submitted in July 2012 will include a plan for the resolution of the broader item on expedited transfer of spent fuel to dry cask storage
  - Commitment was made in SECY-12-0025
- Input from program offices
- Briefings for Senior Management and Commissioners
- Interactions with licensee
- Consider feedback provided by the ACRS
- A communication plan has been drafted
- Study results to be sent to NRR by: June 2012

SFPSS Project Team and Other-Office Working Group Representatives

- Katie Wagner – Overall project lead
- Hossein Esmaili – Accident progression lead
- Don Helton – Boundary conditions and probabilistic aspects lead
- Andy Murphy – Seismic analysis lead
- AJ Nosek – Offsite consequence lead
- Jose Pires – Structural analysis lead

Working Group Members

- NMSS – Drew Barto
- NRO – Eric Powell, Bret Tegeler
- NRR – Steve Jones, Jeff Mitman, Eric Bowman, Kent Wood, Rick Ennis
- NSIR – Randy Sullivan, Eric Schrader

Acronym List

- 3D = Three-Dimensional
- AC = Alternating Current
- BWR = Boiling Water Reactor
- COBRA-SFS = COBRA Spent Fuel Storage
- DC = Direct Current
- GI = Generic Issue
- GMRS = Ground Motion Response Spectra
- HPS = Health Physics Society
- LNT = Linear No Threshold
- MACCS2 = MELCOR Accident Consequence Code System
- MELCOR – Not an acronym
- NMSS = Office of Nuclear Material Safety and Safeguards
- NRO = Office of New Reactors
- NRR = Office of Nuclear Reactor Regulation
- NSIR = Office of Nuclear Security and Incident Response
- OBE = Operating Basis Earthquake
- OCP = Operating Cycle Phase
- ORIGEN = Oak Ridge Isotope Generator
- PGA = Peak Ground Acceleration
- PRA = Probabilistic Risk Assessment
- SCALE – Not an acronym
- SECY = Office of the Secretary
- SFP = Spent Fuel Pool
- SOARCA = State-Of-The-Art Reactor Consequence Analysis
- SSC = Structure, System and Component
- SSE = Safe Shutdown Earthquake
- USGS = United States Geological Survey

Columbia Generating Station

ACRS License Renewal Committee Meeting

April 12, 2012

Columbia Generating Station

Dale Atkinson -	**Vice President, Emp Dev/Corp Services**
Don Gregoire -	**Manager, Regulatory Affairs**
John Twomey -	**Project Manager, License Renewal**

ENERGY NORTHWEST

Agenda

- Station Overview
- Aging Management Programs and Commitments
- Closure of Open Items
- Subcommittee Topics Requiring Additional Information
- Implementation Overview
- Closing Remarks

ENERGY NORTHWEST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Station Overview - Description

- General Electric Boiling Water Reactor
  - BWR-5 / Mark II Containment
  - Plant circulating water & ultimate heat sink makeup supplied from the Columbia River
- 3486 MWt/1230 MWe

Station Overview - History

- Construction Permit – March 19, 1973
- Operating License – December 20, 1983
- 5% Power Up-Rate - May 1995
- License Renewal application submitted-Jan. 2010
- License Expires – December 20, 2023

ENERGY NORTHWEST

Aging Management Programs and Commitments

Don Gregoire
Manager, Regulatory Affairs

ENERGY NORTHWEST

Aging Management Programs & Commitments

- Aging Management Programs (AMP)
  - 55 Programs Credited for License Renewal
    - 35 Existing
      - 13 Enhancements
    - 20 New
- License Renewal Commitments – 71 total

ENERGY NORTHWEST

Closure of Open Items

- High-Voltage Porcelain Insulators
- Operating Experience
- Upper-Shelf Energy
- Metal Fatigue
- Core Plate Rim Hold-Down Bolts
- Fatigue Analysis of Polar Crane

Closure of Open Items

- OI 3.0.3.3.7

High-Voltage Porcelain Insulators

230 kV Station Blackout recovery source insulators at Ashe substation were not included in the Insulator Aging Management Program

Resolution

- Insulators are now in program
- Tests performed in July 2011 conclude minimal accumulation and within industry limits
- Testing on 8 year frequency consistent with operating experience

Closure of Open Items

- OI B.1.4-1

  Operating Experience (OE)

  Future operating experience evaluations for aging effects were not specifically included in the License Renewal Application (LRA)

  Resolution

  – LRA amended to clearly call out intent to review internal and external OE on an on-going basis

  – Operating Experience program revised to specifically address evaluation of OE for aging effects

  – Initial/recurring training for plant staff

Closure of Open Items

- OI 4.2-1

  Upper-Shelf Energy (USE)

  Technical basis not provided for initial transverse USE and copper content for instrument nozzle forgings

  Resolution

  – Technical basis was provided

  – Supports acceptability through end of period of extended operation

ENERGY NORTHWEST

Closure of Open Items

- OI 4.3-1

  Metal Fatigue

  Columbia's metal fatigue Time Limited Aging Analysis (TLAA) performed for sample of critical locations listed in NUREG/CR-6260 may not be limiting

  Resolution

  – The other limiting locations were identified and evaluated for Columbia

  – All locations have an environmental cumulative usage factor below 1.0

Closure of Open Items

- OI 4.7.4-1

  Lower Core Plate Rim Hold-Down Bolts

  Neither an Aging Management Review (AMR) line item nor a TLAA for the reactor pressure vessel lower core plate hold-down bolts were provided

  Resolution

  – LRA was amended to include:
    - AMR line item for TLAA
    - TLAA disposition for 10 CFR 54.21(c)(1)(iii)

Closure of Open Items

- OI 4.7.5-1

  Fatigue Analysis of Polar Crane

  Columbia's LRA did not include TLAA for polar crane

  Resolution

  – Columbia has an overhead crane but not a polar crane

  – TLAA performed for all fifteen (15) in-scope cranes and hoists

  – TLAA remains valid for the period of extended operation as per 10 CFR 54.21(c)(1)(i)

ENERGY NORTHWEST

Subcommittee Topics Requiring Additional Information

Following are topics for which additional information was provided to subcommittee in December 2011:

- Microbiologically Influenced Corrosion (MIC) in systems
- Metal-Enclosed Bus (MEB) catastrophic failure
- Makeup water line from river
- Scope of Plant Service Water (TSW) piping to Reactor Closed Cooling (RCC) system
- Internal inspection of raw water buried piping
- Additional long-term plans for copper reduction

Implementation Overview

- Implementation Activities incorporated into Columbia's Long Range Plan
  - Implementation coordinator on staff
  - Implementation procedure in place
  - Development of remaining AMPs scheduled
  - Active participation in License Renewal Implementation Working Group
  - Benchmarking of other sites with renewed licenses

Closing Remarks

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Advisory Committee on Reactor Safeguards

Bulletin 2011-01, “Mitigating Strategies”

Eric E. Bowman, Sr. Project Manager, NRR/DPR

April 13, 2012

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Purpose

1. To achieve comprehensive verification of compliance with 10 CFR 50.54(hh)(2)
2. To gather information on licensee programs in order to determine if:
   a. Additional assessment is needed
   b. The current inspection program should be enhanced, or
   c. Further regulatory action is warranted.

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30-Day Request

1. Is the equipment necessary to execute the mitigating strategies, as described in your submittals to the NRC, available and capable of performing its intended function?
2. Are the guidance and strategies implemented capable of being executed considering the current configuration of your facility and current staffing and skill levels of the staff?

Responses

- All licensees verified compliance.

60-Day Request, Questions 1 - 3

1. Describe in detail the maintenance of equipment procured to support the strategies and guidance required by 10 CFR 50.54(hh)(2) in order to ensure that it is functional when needed.
2. Describe in detail the testing of equipment procured to support the strategies and guidance required by 10 CFR 50.54(hh)(2) in order to ensure that it will function when needed.
3. Describe in detail the controls for assuring that the equipment is available when needed.

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60-Day Request, Questions 4 and 5

4. Describe in detail how configuration and guidance management is assured so that strategies remain feasible.
5. Describe in detail how you assure availability of off-site support.

Requests for Additional Information

- 53 RAIs out of 65 Sites
- Completeness based on comparison of information in responses and information on equipment, etc., in earlier submittals

Discussion

- B.5.b guidance contains limited detail on maintenance, training and control of equipment, training requirements, and validation of feasibility of strategies
  - Phase 1 Guidance Document of 2/25/2005
  - NEI 06-12, Revision 2, as endorsed

Maintenance, Testing and Control of Equipment

"Equipment associated with these strategies will meet standard industry practices for procuring and maintaining commercial equipment."

Off-site Support

- B.5.b Phase 1 effort included verification and evaluation of memoranda of understanding, etc.

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Responses (Questions 1-3)

- Evaluation of responses resulted in synthesis of "Standard Industry Practices" for maintenance, inventory control and testing
- Maintenance items and periodicity
- Engineering judgment based on vendor or manufacturer recommendations, informed by site characteristics, different utilization of equipment and industry standards (e.g., NFPA)

Responses (Question 4)

- Configuration change evaluations
- Procedure validation
- Design change process
- Systematic approach to training

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Responses (Question 5)

- Off site support arrangements

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Bulletin 2011-01 Effectiveness

- Compliance re-verified comprehensively
- This dialogue with Industry resulted in identification of areas where improvements were possible and directly attributable to the Bulletin and Requests for Additional Information

Questions?

UNISTAR NUCLEAR ENERGY

Presentation to ACRS Full Committee
U.S. EPR™
Calvert Cliffs Nuclear Power Plant Unit 3
FSAR Chapters 6, 7,15 & 18
SER with Open Items
April 12, 2012

Introduction

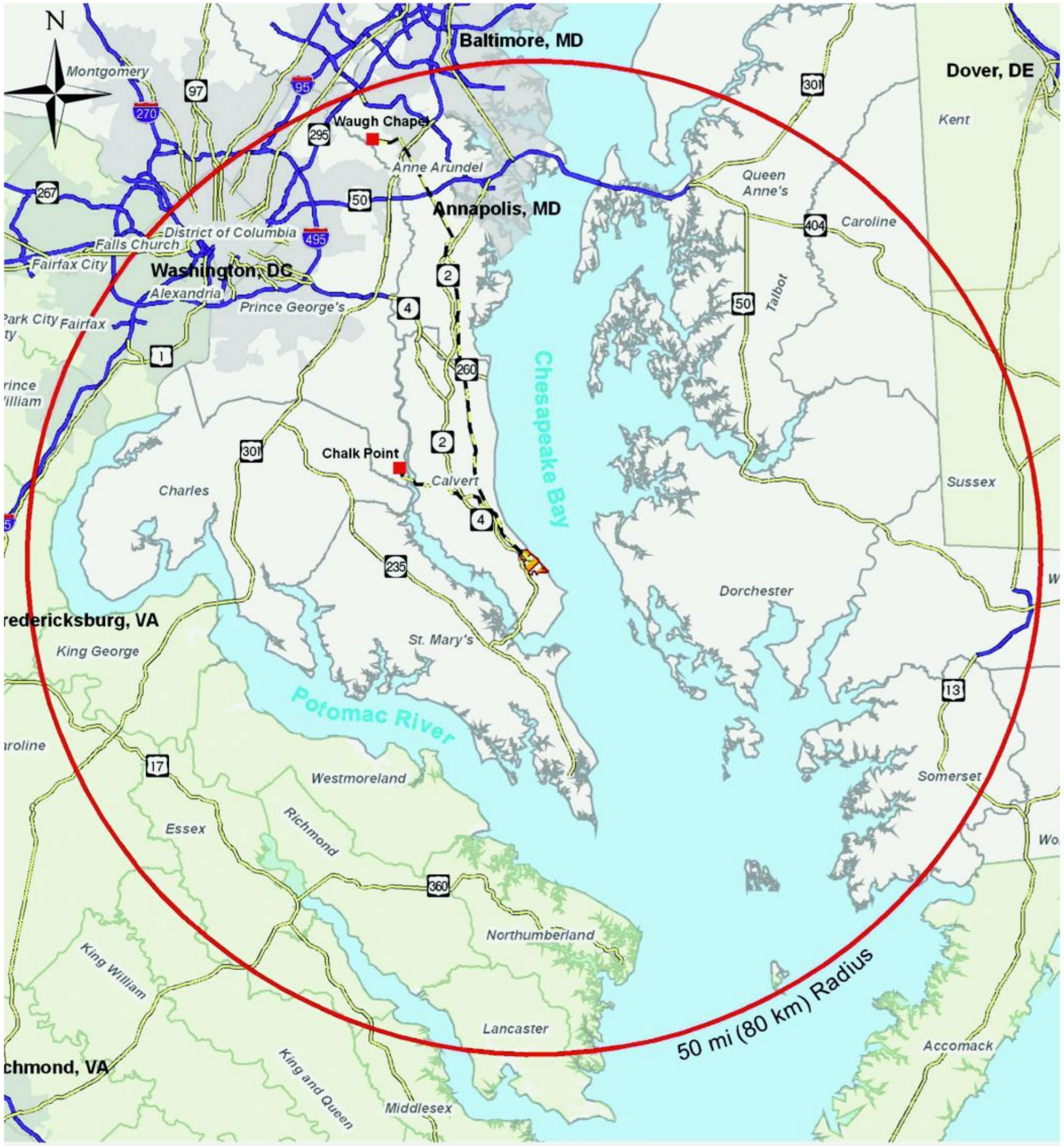
- Mark Finley, Senior Vice President, Regulatory Affairs & Engineering, will lead the Calvert Cliffs Unit 3 presentation.
- Presentation was prepared by UniStar and is supported by:
  - Vincent Sorel (UniStar – Director Regulatory Affairs PRA & EPR Design)
  - Sebastien Thomas (UniStar – Manager of Nuclear Engineering)

Calvert Cliffs Unit 3 Overview

Calvert Cliffs Unit 3 Summary				
Chapter	# Departures	#Exemptions	# SER Open Items	# SER Open Items Responses Submitted
6	1	1	2	2
7	0	0	3	2
15	1	1	0	N/A
18	1	0	0	N/A
Totals	3	2	5	4

Calvert Cliffs Unit 3
ACRS Full Committee Meeting
Introduction

- UNE is responsible for the design of Calvert Cliffs Unit 3 and develops the design primarily through contracts with Bechtel and AREVA who have joined in a Consortium to develop the detailed design of the US EPR.
- RCOLA authored using ‘Incorporate by Reference’ (IBR) methodology.
- The focus of today’s presentation will be a summary of the second set (four) of FSAR Chapters that have been presented to the U.S. EPR ACRS Subcommittee.
- The initial Calvert Cliffs Unit 3 ACRS Full Committee meeting, addressing the first set (9½) of FSAR Chapters, was conducted on April 7, 2011.
- For today’s presentation only supplemental information, or site-specific information, departures or exemptions from the U.S. EPR FSAR are discussed.



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Baltimore, MD
Dover, DE
Montgomery
Waugh Chapel
Anne Arundel
Annapolis, MD
Queen Anne's
Kent
Caroline
Talbot
District of Columbia
Falls Church
Fairfax City
Washington, DC
Alexandria
Prince George's
Fairfax
Chesapeake Bay
Chalk Point
Calvert
Charles
Sussex
Dorchester
St. Mary's
King George
Potomac River
Westmoreland
Richmond
Essex
Somerset
Northumberland
King William
Lancaster
Accomack
King and Queen
Middlesex
50 mi (80 km) Radius

List of Chapters

- Chapter 6, Engineered Safety features
- Chapter 7, Instrumentation and Controls (I&C)
- Chapter 15, Transient & Accident Analysis
- Chapter 18, Human Factors Engineering (HFE)

ACRS Full Committee Meeting Agenda

- Chapter 6
  - Departure/Exemption
  - Summary
- Chapter 7
  - Site-specific Post Accident Monitoring Variables
  - Summary
- Chapter 15
  - Departure/Exemption
  - Summary
- Chapter 18
  - Departure
  - Summary
- Conclusions

Chapter 6
Engineered Safety Features
Departure and Exemption

- Habitability Systems – Main Control Room, Toxic Chemicals
  - For Calvert Cliffs Unit 3, the detection of toxic gases and subsequent automatic isolation of the Control Room Envelope (CRE) is not required and is not a part of the site-specific design.
    - The evaluation of the Calvert Cliffs Unit 3 toxic chemicals in Calvert Cliffs Unit 3 FSAR Section 2.2.3 did not identify any credible toxic chemical accidents that exceeded the limits established in Regulatory Guide 1.78.
    - No specific provisions are required to protect the operators from an event involving a release of a toxic gas.
    - Therefore, Seismic Category 1/Class 1E toxic gas detectors and automatic isolation are not required and will not be provided at Calvert Cliffs Unit 3.

Chapter 6
Engineered Safety Features
Summary

- COL Information Items, as specified by U.S.EPR FSAR, are addressed in Calvert Cliffs Unit 3 FSAR Chapter 6
- One Departure/Exemption from U.S. EPR FSAR
- No ASLB Contentions
- There are two (2) SER Open Items and responses have been submitted (March 25, 2011).
- There are three (3) Confirmatory Items and they have been incorporated into the COLA (Revision 05).

ACRS Full Committee Meeting Agenda

- Chapter 6
  - Departure/Exemption
  - Summary
- Chapter 7
  - Site-specific Post Accident Monitoring Variables
  - Summary
- Chapter 15
  - Departure/Exemption
  - Summary
- Chapter 18
  - Departure
  - Summary
- Conclusions

Chapter 7
Instrumentation and Controls
PAM Variables

- Site-specific Post Accident Monitoring (PAM) Variables
  - ✓ PAM variables supplemented with site specific variables
    - Ultimate Heat Sink (UHS) Tower Basin water level
    - Meteorological data
  - ✓ PAM variables list confirmed prior to fuel load after completion of the Emergency Operating procedures (EOPs) and Abnormal Operating Procedures (AOPs)

Chapter 7
Instrumentation and Controls
Summary

- All COL Information Items, as specified by U. S. EPR FSAR, are addressed in Calvert Cliffs Unit 3 FSAR Chapter 7, Instrumentation and Controls.
- No Departures/Exemptions from the U.S. EPR FSAR for Chapter 7 of the Calvert Cliffs Unit 3 FSAR
- No ASLB Contentions
- There are three SER Open Items and No Confirmatory Items
- The responses to two SER Open Items (RAI 326 and RAI 325 Question 07.05-2) have been submitted and the response to the remaining Open Item is in progress. (RAI 325 Question 07.05-1)

ACRS Full Committee Meeting Agenda

- Chapter 6
  - Departure/Exemption
  - Summary
- Chapter 7
  - Site-specific Post Accident Monitoring Variables
  - Summary
- Chapter 15
  - Departure/Exemption
  - Summary
- Chapter 18
  - Departure
  - Summary
- Conclusions

Chapter 15
Transient and Accident Analysis Departure/Exemption

- Site Specific χ/Q Values
  - Conservative estimates of atmospheric Accident values for the Exclusion Area Boundary (EAB), Low Population Zone (LPZ) and Main Control Room are presented in the U.S. EPR FSAR and bound the Calvert Cliffs Unit 3 values except the 0-2 hour value for the LPZ.
  - The U.S.EPR FSAR provides the Accident χ/Q of 1.75E-04 sec/m^3 at the LPZ - 1.5 miles during the 0-2 hr period. The corresponding calculated site-specific short-term atmospheric dispersion factor for Calvert Cliffs Unit 3 is 2.15E-04 sec/m^3 which exceeds/departs from the U.S. EPR value.
  - The site-specific Accident Dispersion factors were used in calculating doses from accident scenarios specified in the U.S. EPR FSAR Chapter 15. Calvert Cliffs Unit 3 doses are conservatively within the limitations of 10 CFR 50.34 and GDC 19.

Chapter 15
Transient and Accident Analysis Departure/Exemption

Table 15.0-2— {CCNPP Unit 3 LPZ Radiological Consequences of U.S. EPR Design Basis Accidents}

Design Basis Accident		Offsite Dose CCNPP Unit 3 LPZ rem (TEDE)	Acceptance Criterion rem (TEDE)
LOCA		9.1	25
Small line break outside of Reactor Building		0.4	2.5
SGTR	Pre-incident spike	0.3	25
	Coincident spike	0.3	2.5
MSLB	Pre-incident spike	0.1	25
	Coincident spike	0.2	2.5
	Fuel rod clad failure	2.6	25
	Fuel overheat	2.8	25
RCP locked rotor/broken shaft		0.9	2.5
Rod ejection		3.4	6.3
Fuel handling accident		1.2	6.3

Chapter 15
Transient and Accident Analysis
Summary

- One COL Information Item, as specified by U. S. EPR FSAR, is addressed in Calvert Cliffs Unit 3 FSAR Chapter 15, Transient and Accident Analysis.
- One Departure/ One Exemption in Chapter 15 from the U.S. EPR FSAR for Chapter 15 of the Calvert Cliffs Unit 3 FSAR
- There are no NRC SER Open Items or Confirmatory Items
- No ASLB Contentions
- Responses to all RAIs have been submitted.

ACRS Full Committee Meeting Agenda

- Chapter 6
  - Departure/Exemption
  - Summary
- Chapter 7
  - Site-specific Post Accident Monitoring Variables
  - Summary
- Chapter 15
  - Departure/Exemption
  - Summary
- Chapter 18
  - Departure
  - Summary
- Conclusions

Chapter 18
Human Factors Engineering
Departure

- Human Performance Monitoring (HPM) Program - Departure
  - The U.S. EPR HPM is replaced by the UniStar HPM Program entirely
  - The key differences are summarized below:
    - An Operational Focus Aggregate Index is used to trend performance of key variables that can impact Operations Human Performance
      - ✓ Aligns with INPO 09-011, Achieving Excellence in Performance Improvement
    - UniStar Corrective Action Program is utilized:
      - ✓ To track HFE issues in lieu of a separate program (HFE issue tracking system)
  - The UniStar Nuclear Energy Human Performance Monitoring Program meets the requirements of NUREG - 0711

Chapter 18
Human Factors Engineering
Summary

- Five COL Information Items, as specified by U.S. EPR FSAR, are addressed in Calvert Cliffs Unit 3 FSAR Chapter 18
- No ASLB Contentions
- The Departure from the U.S. EPR Human Performance Monitoring Program implements the requirements of NUREG - 0711
- No SER Open Items
- All RAI responses have been submitted
- There are two SER Confirmatory Items and they have been incorporated into the COLA (Revision 08)

ACRS Full Committee Meeting Agenda

- Chapter 6
  - Departure/Exemption
  - Summary
- Chapter 7
  - Site-specific Post Accident Monitoring Variables
  - Summary
- Chapter 15
  - Departure/Exemption
  - Summary
- Chapter 18
  - Departure
  - Summary
- Conclusions

Chapters 6, 7, 15 and 18 Conclusions

- No ASLB Contentions
- There are three (3) departures and two (2) exemptions
- All Confirmatory Items have been incorporated in the COLA (Revision 08)
- Responses have been submitted to four (4) of the five (5) SER Open Items. The response to the remaining SER Open Item is in progress
- As of April 12, 2012, thirteen and one-half (13½) of the nineteen (19) Chapters of the Calvert Cliffs Unit 3 FSAR have completed Phase 3

Acronyms

- ACRS – Advisory Committee on Reactor Safeguards
- AOP – Abnormal Operating Procedure
- ASLB – Atomic Safety & Licensing Board
- CFR – Code of Federal Regulations
- COL – Combined License
- COLA – Combined License Application
- CRE – Control Room Envelope
- DC – Design Certification
- EAB – Exclusion Area Boundary
- EOP – Emergency Operating Procedure
- FSAR – Final Safety Analysis Report
- GDC – General Design Criteria
- HFE – Human Factors Engineering
- HPM – Human Performance Monitoring
- I&C – Instrumentation and Controls
- LPZ – Low Population Zone
- MSLB – Main Steam Line Break
- PAM – Post Accident Monitoring
- PRA – Probability Risk Assessment
- RAI – Request for Additional Information
- RCP – Reactor Coolant Pump
- SER – Safety Evaluation Report
- SGTR – Steam Generator Tube Rupture
- TEDE – Total Effective Dose Equivalent
- UHS – Ultimate Heat Sink

P-R-O-C-E-E-D-I-N-G-S

8:30 a.m.

CHAIR ARMIJO: Good morning. The meeting will now come to order. This is the second day of the 593rd meeting of the Advisory Committee on Reactor Safeguards. During today's meeting the committee will consider the following. First, Draft Final NUREG-1921, "Fire Human Reliability Analysis (HRA) Guidelines;" two, future ACRS activities and report on the Planning and Procedures Subcommittee; three, reconciliation of ACRS comments and recommendations; four, staff assessment of responses to NRC Bulletin 2011-01 Mitigating Strategies; and five, preparation of ACRS reports.

This meeting is being conducted in accordance with the provisions of the Federal Advisory Committee Act. Mr. John Lai is the Designated Federal Official for this portion of the meeting. We have received no written comments or requests for time to make oral statements from members of the public regarding today's sessions. There will be a phone bridge line. To preclude interruption of the meeting the phone will be placed in a listen-in mode during the presentations and committee discussion.

A transcript of portions of the meeting is being kept and it is requested that the speakers use one of the microphones, identify themselves and speak with sufficient clarity and volume so that they can be readily heard.

At this point I'll turn it over to Mr. John Stetkar which will lead us through the first briefing.

MEMBER STETKAR: Thank you, Mr. Chairman. What we're going to hear about this morning is the NUREG that we've had a long history with. We've been speaking to the staff and EPRI about this effort for almost 3 years. We had our first meeting I think in June of 2009. We've had a couple of subcommittee meetings since then. It's a report that's developed, a joint report by EPRI and the staff, and it's another good example of the cooperation that the staff has developed with EPRI in terms of a lot of these really difficult issues in the area of human reliability analysis and fire modeling. There are a number of initiatives and I personally think it's working very, very well. And this is another evidence of the success of that cooperation.

The specific topic here are guidelines for human reliability analysis with a particular focus on fire modeling or fire analysis applications because those types of scenarios impose a few unique constraints compared to some of your more traditional internal event type human reliability analyses. So, these guidelines were developed for that and I'm sure the staff will -- and EPRI will walk us through that.

And without taking too much more time, I don't know, Rich or Mark, do you want to say something as introduction?

MR. CORREIA: Yes, thank you, just briefly. Rich Correia, director of the Division of Risk Analysis and Research. Thank you, Committee, for your time today to listen to the presentation that we will give you on fire HRA. It's been a 5-year effort and we believe we've developed a comprehensible, useful set of guidelines. And if we're successful today we will be asking you for a letter.

MEMBER STETKAR: Thank you.

MR. SALLEY: Yes, and I'm Mark Salley, branch chief for Fire Research in Rich's division. Our speakers for today will be Susan Cooper from NRC and Stuart Lewis from EPRI. They were the PMS and the technical leads for this project so you should get a good story on this. Can I have the first slide?

One administrative thing for the folks who are on the phone line. The slides are in ADAMS and let me give you an ML number here real quick if you'd like to have slides in front of you. It's ML121010574. Again, that's ML121010574. Those are the slides we'll be using.

Again, today's presentation, we're going to give you a short history of This project. We're going to talk about its objectives, some of the challenges we faced. Having EPRI here as a partner we get to see the industry perspective so we'll have some good insights to the industry perspectives.

Also, with a program like this there was a number of reviews and different tests that it went through and trial applications. You'll hear in detail some of that. And finally you'll hear some uses for other HRA projects and the interface between them. Again, as Rich said, the key here to This meeting is we're going to ask for a letter.

And one last thing on that. It's kind of interesting how the ACRS goes. Sometimes we'll be here a lot and sometimes we won't see you for awhile. We've got two big projects. This one is this Fire HRA which you're going to see today. We've also got another one we've just been through subcommittee, the Fire Model Applications Guide, and we're currently looking at June to come with that one which is also another big one we've worked with John Stetkar on. So we need -- it's feast or famine. We either see you a lot or we don't. Next slide, please.

This slide's a little busy but it really kind of puts things in perspective. As Rich said, this has been a 5-year voyage or journey, adventure, I mean pick your word. When you look at research programs like this they're quite interesting having done a few of them when they get this involved. You can look at this and say, you know, we've sang Auld Lang Syne five times since the start of this project, and wow, that's a long time to do this. But on the other side when you hear some of the details of some of the things this project had to do you want to look at it and say it's pretty amazing you got it done that fast. So, it all depends on how you're looking. You know, it's the old adage, it's one thing to buy sausage, it's another thing to see it being made and this kind of puts that in perspective.

So, without too much ado I'd like to turn this over to the technical folks, Susan and Stuart on the next slide. And again, just keep your eye on a few of these points. They'll explain in detail some of this. This gives you a nice graphic of the history of this project. Susan?

MS. COOPER: Thanks, Mark. Okay, I also would like to acknowledge Jeff Julius of Scientech who is here today with us also helping Stuart Lewis here to represent the industry side of this collaborative effort. And I'm fairly certain that a couple of the rest of our team are on the phone as well, probably Erin Collins of SAIC and Kaydee Kohlhepp of Scientech. And there are others that couldn't make it.

In any case, I want to just give you a little bit more on the background of this particular project. When we first started this project back in March of 2007 the status of fire PRA was that about half of the U.S. nuclear power plants were transitioning to using NFPA-805 for fire protection. And in order to make that transition they were using another document that was a result of a joint effort, and that's NUREG/CR-6850 or EPRI 1011989. And that document provided detailed guidance on how to do fire PRA to support the transition to NFPA-805.

With respect to HRA specifically NUREG/CR-6850 provided basically two things, and that is they provided some conservative or high, let's say high value, the high values to assign to the human events in the PRA that you identified to model. It also had some discussion and identified some performance shaping factors that were considered relevant to the fire context. And there were some new, quote unquote, "new" performance shaping factors that we hadn't had to address for internal events PRA. Things like, things that you'd expect with fire like environmental hazards, smoke, toxic gases, that sort of thing. So that was principally what was in 6850 but the authors of 6850 recognized when they published that document that there still were needs in the HRA area.

And particular -- or to be very focused, those were an approach to develop better, best estimate HRA values, you know, things that were not quite as conservative. And at the same time we had the ASME ANS PRA standard being developed and that was going to be something that industry needed to consider when they were developing their PRAS. And so we needed guidance that also met that standard.

So, the objectives of the joint effort between EPRI and NRC to develop HRA guidance went hand in hand with those recognized needs. So our principal objectives in this effort had been to provide guidance on how to do quantification, detailed HRA quantification that can give you those error probabilities that are not so high and not so conservative.

And while 6850 identified some of the performance shaping factors that are important in the fire context, it didn't really tell you how to address those in HRA. How do you match up "I understand there's smoke here" and "How do I reflect that in a number?" So we needed to make certain that when we provided our guidance we had that kind of match.

And we were also very cognizant of the PRA standard requirements. And as Stuart's going to talk in a little bit that was one of our challenges because the standard was kind of evolving at the same time that we were developing our guidance.

MEMBER BANERJEE: So let me ask you about performance shaping factors, just to make this concrete. If there's smoke here it affects your performance and you have to take that into account? Is that it?

MS. COOPER: It can. We have some criteria about, you know, the proximity of the smoke and so forth as to whether or not it affects you. It also can then require or instigate people to want to put on some kind of protective gear or breathing apparatus. That can have an effect on their performance. So there are a number of different ways that those kinds of performance shaping factors can affect performance.

MEMBER BANERJEE: These are based on empirical studies? You can get these factors?

MS. COOPER: The evaluation --

MEMBER BANERJEE: How do you get them?

MS. COOPER: -- of say, let's just stick with smoke, how it affects human performance is principally a qualitative assessment, especially with respect to, for example, do you need to wear breathing apparatus, except for when we talk about the possibility of abandoning the control room. And then we do actually even go back to 6850 and use some numerical values about the density and so forth so far as when we might consider that the operators would leave the control room.

MEMBER BANERJEE: But there's a lot of experience, right? I mean, when you get a Scott out back, put it on, go out.

MS. COOPER: There is experience, absolutely.

MEMBER BANERJEE: Yes, so don't you correlate that?

MS. COOPER: Yes, mostly qualitatively, but there still can be impacts. It can -- one that can be most important is communication. So unless you have a built-in device in your breathing apparatus, communication through the device can be garbled or difficult. And so if it's important -- I mean, this is another feature of the fire context is you have many more actions that will be taking place outside the control room.

And so as a result there's some need usually for people, you know, in the control room, operators in the control room to communicate with people outside the control room. People outside control room are wearing a breathing apparatus and they need to communicate, you know, "I just did this," or "You do that." It's important. That can be more difficult if they're wearing breathing apparatus.

MEMBER POWERS: I think the question he's trying to ask is is there someplace I can go to that says I have these data points and I have taken the average, the mode, the 95th percentile of those data points and come up with this number. Is there someplace we can do that?

MR. LEWIS: No, I don't think we have that kind of data.

MEMBER POWERS: Why not?

MR. LEWIS: It really is qualitative from the perspective of --

MEMBER POWERS: I mean, that's the inherent difficulty. I mean, it's qualitative. Somebody dreamed it up. I don't have his rationale for dreaming it up, he just said well, it's difficult, so I'll put this number in. I have no idea where the number comes from.

MR. LEWIS: It tends to be less a matter of putting in a different number than it is making a judgment about whether or not the action is feasible in the first place.

MEMBER POWERS: Well, I mean the question is why is that acceptable? Why is that even vaguely acceptable?

MS. COOPER: I think the place that we're in with HRA is that the variety of contexts and fire's a really good example. The variety of different things that can be happening and what operators would need to do and the conditions under which they need to do them just doesn't lend itself to a statistical mapping between, you know, experiments or anything like that and a number.

MEMBER POWERS: How do you know that? Has anybody ever tried?

MS. COOPER: Yes. We have. Actually, we even have efforts right now in data collection. Sean

Peters, my branch chief, is here if you need him to speak to it. We have efforts right now that are principally focused in the control room where you use simulators. But when you talk about the ex control room stuff it's a little bit different. Sean, do you want to add something here?

MR. PETERS: Yes, we do have a variety of data programs that we're implementing right now. But as Susan indicated, the data programs in a control room simulator are a little bit different than what you can do, or what would be required in a fire scenario. A fire scenario requires operator actions outside of the control room and also indicates spurious actuations and whatnot.

Getting, you know, getting a statistically significant data sample for all the various human actions that are required in a fire scenario would incorporate, you know, millions and millions of dollars. We're talking on the order of a Manhattan type project to be able to encompass all the various scenarios that could come out of a fire scenario and getting a statistically significant number of data points.

So what you have to do with an HRA is you have to collect, you know, you collect data based on human factors research, human factors literature that's out there and you try to encapsulate and qualify that data into what you would do with a qualitative analysis in HRA.

MEMBER POWERS: What you're saying is that we should never try to build accident analysis models because we could never melt down enough cores to possibly get a meaningful database. That's not the way we do it. We get data, we create a model and then we look at all the interactions and presumably put in correction factors when we find them. But you guys are throwing up your hands and saying "I can't get all the data, therefore I'll get none of the data."

MR. PETERS: We're not saying about getting none of the data. We actually have programs right now to get some of the data and we're trying to at least put certain human scenarios in and collect that data. Then we can bound all the other items, or at least interpolate all the items based upon the expert assessed difficulty of the various scenarios.

MEMBER SKILLMAN: I'm Dick Skillman. I'd be curious in the effort that you've expended in the last number of years how much time you've taken to talk with real firefighting people who have donned the turnout gear, faced the smoke, faced the lack of communication, the fear of confinement, the fear of losing their gear and battling both a physical enemy which is the fire and the emotional turmoil that these men and women face.

It seems to me that there is a body of evidence. Ships at sea have battled these fires, the Navy's battled these in compartments. Municipalities all over the country have fought deadly fires, not just electrical fires or paper/wood fires, but chemical fires. It seems that there's some real information that may be very beneficial and not so far away that provides the kind of information that Dr. Powers is talking about.

MS. COOPER: So, first of all, let me make one clarification. Within the context of fire PRA and then HRA anything related to the fire brigade and directly related to the suppression of the fire is not modeled by HRA. That -- those efforts and their success or failure are captured through data. And the HRA analyst does not have a responsibility to that. The only aspects of suppression that the nuclear power plant operator does that we model has to do with things done in the control room for, you know, maybe backing up an automatic suppression system or something like that. But anything related to the fire brigade's job of putting out the fire we do not model.

We do model the potential effect on the control room crew because they may have just lost someone to the fire brigade. We also model or consider the fact that they'll probably be talking with the fire brigade, there will be interaction between the control room crew and the fire brigade. But so far as the actual fire suppression and those activities, we don't model that.

Now, I'm going to let Jeff and Stuart speak to some of the rest of your questions, but I will say that efforts that are still not yet documented that were performed here at the NRC with respect to fire events and human performance actually contributed to this performance shaping factors in 6850. There was a group of researchers that included NRC, Sandia National Laboratories and actually I was part of that when I was not part of NRC. I was still a contractor. And we looked at a lot of different fire events.

And we had Dennis Bley who's one of your members was on the team and he brought some of his experience in from the Navy. We tried to get some cooperation with the Navy. They were not willing to share. We went out and talked to other firefighters.

Dennis went to a conference in Boston of firefighters. I mean, we did a lot of work to do some of that. That was some time ago, but that was the basis in 6850 on which we built. And although it's not done I'm still working with Sandia to try to get some of that background work that we did probably about 10 years ago now published.

So there was a basis where we did some of that but now I'm going to let Stuart and Jeff talk because they're working with utilities right now.

MEMBER CORRADINI: Just, before you do, can I just add to the -- just to address? Because I'm kind of sympathetic to what Sanjoy and Dana are asking. But you started off by saying -- maybe you didn't say it exactly this way, but what I thought I heard you say was something like it's pretty clear what we're using now are conservative.

So at the very least what I'd be curious about is what data or empirical evidence is clear that what you're using now is conservative, and what you're now going to evolve to at least gets closer to what has been empirically observed. Because I think at least that would give me some confidence you're going in an appropriate direction.

But I think you said that to begin with

and that one is the thing I remembered was -- so the data must show you're already conservative on how you're approaching this model.

MS. COOPER: So, if I could address that. The conservative screening values that were provided in 6850 are conservative as compared to the internal events PRA values for human failure events because many of those screening values are tied to those numbers in some way. In some cases it's a multiplier of the internal events number or something that's higher than the internal events number. So that's the area of conservatism and the criteria that are built into 6850 -- realize we're not talking about our document right now, though we borrowed some of this just for the beginning. But the detailed quantification is different.

But those conservative -- the criteria for doing that, you know, if you're going to use a very minor multiplier on your internal events number is that there are no spurious effects going on in the instruments. The fire damage to the cables is not causing your safety-related equipment to have any problems. For the most part the actions are just the same as if it was internal events and there's a small multiplier to add, you know, from the context of the fire. That's one set. That's the most -- that's the best you can do there.

Everything else from there is much higher and many of the -- at least two of the categories which are new events that are coming from like using the fire response procedures and things like abandoning the control room, those get values of 1.0. It doesn't get any more conservative than that. So, that's where I'm coming from.

Now, what we've done is that we've tried to back off from that very obvious conservatism by providing some tools to look at the context in a little bit more detail. So, you know, that's where we're coming from.

All right, now back to the firefighting experience. Take it away.

MR. JULIUS: I'm Jeff Julius of Scientech. So when we started the project on the industry side we went out and talked to utilities, both PWRs and BWRs and both the in control room action, the fire protection staff, as well as the operators that are performing the local manual actions to talk about what is your experience, what is your training. And a lot of these guys have background in being ex-Navy personnel and staff. So we did have an effort to go out and to get the insights that we could from those people.

MS. COOPER: I guess one last thing that I will add is that we -- early in the project Mark Salley had arranged for some folks at NIST to look at, again, what the, you know, look at the data. They did their thing. I didn't quite understand it. But the bottom line was to see if there was anything new or different in how we should understand the effects of fire on human performance. And the results were pretty much the same as what was in 6850 so we decided not to include that effort into what we're doing. It didn't seem like it was an added effect. I sense that Mark wants to add something.

MR. SALLEY: Yes. A final comment just to try to address your concern, Dr. Powers' concern on smoke. When you do these types of analysis it's which tool do you go for in the toolbox. For example, the next document that we're going to talk to you about in a couple of months, the fire modeling, you know, smoke is dynamic, okay? It's going to start small, we know it's going to get bigger, the smoke's going to get more optical challenging. It's going to get denser. Questions if you're going to use the control room purge system or not. These are the kind of things that the fire models give you, not the HRA piece.

So what I'm saying is if you want to use these tools in concert that's how you'll do a full analysis. And as a matter of fact, if you look at the Fire Model Applications Guide there's a specific example for control room abandonment where the fire modelers go through it and they go through the smoke.

And again, the two criteria they'd use there is the smoke density, can the operator see what they're doing, in when do they need to go to breathing apparatus, as well as any of the effects from the heat, if the operators physically have to leave from the heat. So that's something that happens in fire modeling that would be an input if you will to a complete HRA to make that decision.

MS. COOPER: Yes, that's a very good point. Fire PRA is -- adds a layer of complexity to all the other tasks including the HRA in the sense that there are a number of inputs that are required for the analysis that are done by other experts. And the fire modeling is a good example. So we cannot make our evaluations without input on, you know, where there is smoke and what its intensity is until we get that from someone else.

The same thing with the circuit analysis and the fire progression. We don't know anything specifically about what instruments and what equipment has failed until somebody else has done their job to a certain point and given that information to us. And then in turn now we know what the job is for the operators and then we have to evaluate all these factors and see, you know, make an evaluation as to the reliability or failure probability.

MEMBER STETKAR: Let me interject something. I think this discussion has been really, really good and I just want to kind of give a little bit of my perspective.

This NUREG, this guidance is what I consider, it's a snapshot in time of the evolving understanding of how to model human response in general. It's developed primarily to focus on fire scenarios because quite honestly existing guidance at the time that this effort was started 5-6 years ago or more in its infancy didn't treat human response in the context of severely challenging events like fires because the PRA technology up till that time had focused primarily on internal events. Internal events don't generate smoke. They don't generate large numbers of very strange indications. They don't generate the challenges for people having to communicate with outside firefighters, with inside firefighters, with people doing local actions in the plant. The technology just had not faced those types of challenges.

Now, as we're trying to model fires, they've introduced those challenges and therefore there was a need to kind of expand the state of knowledge, the state of the practice, to address those concerns. Is it perfect? No, it's a snapshot in time.

There is -- I was going to give you a chance to do some self-promotion, but there is in progress a larger project to address human reliability in what I'll call the more global sense in response to a staff requirements memorandum. That project in particular is very carefully looking at both what is an appropriate set of performance shaping factors, how can those performance shaping factors, both the definition of the performance shaping factors and how they're used, be tied back to fundamental psychological principles. And how can they be tied in terms of the scale of goodness or badness if you will of particular performance shaping factors be tied back to actuarial data which is part of the data collection effort that was mentioned and other sorts of benchmarks.

So in my perspective this particular effort is not trying to solve all of those problems. It can't. That's part of the larger effort. This is a very needed effort to address many of the very challenging situations that power plant operators face in the context of a fire that had never been addressed before in the sense of overall human reliability analysis.

It's not the endpoint in terms of, you know, the global approach to human reliability analysis which -- and I would hope that that global approach. We have ongoing meetings on that project. The goal of that global approach I believe will more completely address some of the concerns that Sanjoy and Dana and Mike have raised regarding sort of benchmarking and definition of these performance shaping factors, and using whatever data you have av to try to pin down what those scales might be. And with that I'll be quiet.

MEMBER POWERS: Well, you know, for the life of me I don't know how you assess a human reliability analysis on this. If I come in and say my performance shaping factor is 0.1 and you guys say 0.3 how in the world does that get resolved? It sounds to me it gets resolved simply by saying oh, you're not in the in crowd, therefore your number is wrong.

MR. LEWIS: We may have given you a misperception of what we're doing here. We didn't create a correlation between the influence of this factor and, for example, smoke density. It's more a matter of making a determination as to whether the conditions in the area where the action has to be taken support taking the action or are prevented. So that for example, as Mark alluded to, it doesn't take a tremendous amount of smoke to get to the point where you can't see what you're doing.

And we wouldn't give any credit to a human action in an area where that condition existed. It's not like we'd say well, you know, if you have this much smoke you increase the probability by a factor of 2 and if you have more it's increased by a factor of 3.

We do make -- there are some situations where we might make some adjustments to a basic failure. If you're in a situation where the fire has been extinguished but there's still some smoke in the area it may be somewhat less reliable than other cases.

And you're right, we could get into those kinds of discussions but what we're really trying to do is get an understanding of whether or not that action plays an important role in the core damage frequency or other risk parameter, and then look at whether or not something else needs to be done to either reduce the uncertainty or to eliminate that contribution. We're not really very often in a situation where we would have to hang our hats on small differences in human failure probabilities, that's not the regime we typically work in. And we're not in that kind of a correlation here.

MEMBER POWERS: You haven't -- I'm going to change my question. Suppose that you say the smoke is too dense here, you cannot see what you're doing, ergo you cannot suppress this fire. And I come in and say oh yes, I can do that, this smoke is just fine. My guys can get in there, they're all operators from Susquehanna, they're perfect supermen and you would have absolutely no basis for criticizing me for saying that.

MS. COOPER: Well, again, so it's not so much -- well, as much as PRA tries to be realistic there are still rules to the game shall we say, and one of those is that we can't take credit for things that some group of guys might be able to do but not everybody can do. So, when Stuart says if the smoke's at a certain level where we don't think they can see and we don't take credit for that, that's pretty much the end of the game unless they want to talk about a different path, a different location, some time later in the event, that kind of thing.

Now, the other thing as Stuart said, and I appreciate you correcting my mis-speaking. Sometimes the fact that there may be enough smoke in the area that they have to put on equipment, that factors into the amount of time that they need to take in order to do things, and time is something that we're always keeping track of in HRA because you need to be able to know what you're going to do, get the equipment that you need to have, get to where you're going, do it, report back. All of that has to be done in some time to be useful to preventing some system failure or plant function failure. So, the time it takes to put on the equipment, the extra time it may take you to just walk around wearing it or doing things, all those things are what we take into account.

And different people react differently. We try to keep that into account too. So there's never -- that's the other reason why it's difficult to say there's a number is because --

MEMBER BANERJEE: I thought that was the way you were going to answer my question originally.

MS. COOPER: Okay.

MEMBER BANERJEE: I think -- so going back to when I was a kid in a plant working we'd have to put these Scott air packs on and find our way out and take certain actions and they would time us.

MS. COOPER: Right.

MEMBER BANERJEE: How long it took us to shut something down, do something else and get out of the plant. So you have these numbers. They vary.

MS. COOPER: We do. As a matter of fact, yes. We indicate that job performance measures and other data that the plant may take can be an input what our analysis. However, their starting point and where we may start may be different. In other words, they may start from, you know, right here, right now, I've got my equipment on, I'm going.

We start earlier. We start back in the control room when they decide they need to do this action. They call somebody up on the phone. They go and get their equipment. They go and put their gear on and then they go. So we have a different starting point. But you're right, there is information, data collection, timing information that can be used and we discuss that in our report.

And then we try to factor in the gear. There are other things we can't factor in, you know, to that data collection like the actual presence of a fire and how that affects things. Jeff, you wanted to add something?

MR. JULIUS: That's right. That was one of the major public comments in fact was that we had not recognized the body of timing data that was out there for the developing the time line. And so we've addressed that in our revision here.

And the idea is that it's not these individual performance shaping factors individually influence, it's the collective set. So it's the procedures, and the cues, and the training, and the timing. And we look at those and be able to rank those important, you know, whatever number we pick as a ranked set. And then we can go back and have the plants work on improving their procedures or training for these important actions. So whether it's a 0.1 or 0.3 through this method we see the collective set of these shaping factors and then -- so that the plants have something to go back and to work on improvements, or to reducing the uncertainty of those actions.

MEMBER BANERJEE: Okay. So you're on the path. All right.

MS. COOPER: We don't have -- separate from the slide set that you have. We had some backup slides but there isn't one there. But Jeff has the actual report on his computer if you wanted to see one of the --

MEMBER STETKAR: That's all right. In the interest of time let's -- we've had quite a bit of discussion in the subcommittee meetings regarding the concept of time lines, and addressing uncertainties in time lines. And there's uncertainty. Those time lines account for cognitive responses, they account for the actual implementation, whatever the action is and how one assesses the uncertainties in those times.

In some cases the times are developed to assess feasibility of the action. In other words, if the time available is 15 minutes before something undesired occurs and you do a reasonable analysis and you say there's only 5 percent probability that you can actually achieve what you desire within that 15 minutes you tend to basically fail the action. On the other hand, if there's a large margin then you have to still quantify the likelihood with uncertainty. So timing, many of the concerns that have been raised in the context of this discussion do translate to timing. Not all of them, but many of them do. That's what I was kind of asking whether you had the -- if you don't have the time line that's fine because it's important to get through the rest of the presentation.

MS. COOPER: Yes, we do.

MEMBER BANERJEE: There is another time line here.

MEMBER STETKAR: There is another time line. We're still okay on that one.

(Laughter)

MS. COOPER: All right. I just want to make two points before I move off of this slide. And that is that, so what then eventually really kicked off this effort then was that NRR came to the Office of Research and asked to add a task to the user need with the Fire Research Branch to say let's develop these guidelines using existing methods. And therefore it became a joint effort with industry and the NRC and I'd like -- I think Mark already mentioned but this is the third major joint effort on fire-related research projects.

So, the next several slides I'm going to pass over to Stuart to address. In particular he's going to talk about challenges that the team addressed in our development, the industry perspective and some things about review testing and trial applications.

MR. LEWIS: The first point here, in terms of the kinds of things we had to tackle in developing something advancing the state of the art in HRA for fire I think is something John already alluded to, and that is what had been done in human reliability analysis up to this point primarily focused on internal events, kind of nominal conditions in the plant, without the sorts of stressors or influence factors that a fire might produce. So trying to really understand the context for a human action when there's a fire in progress or when it's been extinguished but perhaps has had some unique effects on the plant was a major I think challenge that was faced by this project early on.

I have to say, I wasn't part of this project at the beginning until I joined in EPRI in 2009 so I've gotten to be part of the update effort, but I didn't get to --

MEMBER STETKAR: This is your plausible deniability.

MR. LEWIS: No, no --

(Laughter)

MR. LEWIS: My first, my introduction to

the project was that I served as, I think the time line that Mark went through pretty quickly. I served on a peer review panel back in 2008 when the first draft was put together. So I did have some familiarity. And I'm not trying to deny or avoid blame for anything that's in there. If we're talking about specific things that's necessary.

(Laughter)

MR. LEWIS: But the fact is that we did have a broad range of possible influences and many of these were identified in NUREG/CR-6850 that hadn't really been tackled in any depth when it came to human reliability analysis. So that really was a big challenge here.

Part of that challenge was to look at the context to understand when human actions could be feasible given that you had a fire in progress. So for example, typically we would include that if you had to take an action. I'm not talking about fighting fire. As Susan said, we treat the firefighting aspect empirically based on data collected from actual nuclear power operating experience.

But if you have to go into an area where there's been a fire and manipulate a valve, or a circuit breaker, or take some other action we have to look at whether or not it's feasible actually to take that action. If you have to don protective gear does that make the time such that it's too late to take that action for example, or are the conditions still so adverse that you wouldn't expect that a human could reliably perform the action in the first place. So we would judge the action to be infeasible.

So we spent quite a bit of time developing criteria for how to judge the feasibility of human actions. The time line plays a big role in that process. Because again, if you have insufficient time to do what needs to be done by definition the action is infeasible.

We also spent quite a bit of time developing criteria or guidance on how to evaluate whether the action was feasible in terms of walking through the action in an actual plant context, or when that's not possible at least doing a detailed talk-through of the scenario with operators and other relevant personnel to understand what would need to be done, where the operators would have to go in terms of how their transit paths might be affected, what protective gear they might have to don, and that sort of thing as part of assessing the feasibility.

For some actions plants have gone out and come as close as they can to simulating the realistic conditions. That's difficult to do. Obviously they don't start a fire in a room to see what level of smoke is generated, but to the extent that it's possible to simulate those conditions that has been done for some of the more important human actions that are considered in fire PRAS.

We've also developed guidance for how you reflect the potential that a fire can cause spurious signals or spurious actuations in the plant and how that might affect the operators in the control room. That can come into play in several ways. Among those are the fact that the operators may be directed to take an action that's contrary to what they should actually be doing because you get a spurious signal that says to, for example, block out a diesel generator to prevent damage to the diesel when in fact there may not be any actual problem, and by doing that they've defeated the function of the diesel.

More generally, we expected in some fires at least that could affect a lot of control cables you may have a number of actuations occurring more or less simultaneously. They may not have anything to do with each other because they're not tied to anything that's actually going on in the processes they monitor, but they could be distractions. The operators have to filter through the alarms and indicators and figure out what is really going on. So they have that potential for distraction that we tried to address. So that was another thing that we had to provide guidance for in the context of the HRA.

The potential errors of commission, I'm not sure how familiar you are with this concept. This refers to taking intentional acts based on the understanding the operators have in situations where those acts are actually the wrong things to do. So, it's not -- most of the things we look at in human reliability analysis for a nuclear power plant are failure to do something when it needs to be done. This is a specific case, when the operators do something they're not doing it by accident, they're doing it intentionally but they have a misunderstanding of the situation they're in. So again, this ties back to the bullet before and that is they might take these actions if they have spurious signals telling them to take the action.

So in that context it's a little bit hard to call them errors. They have a signal. They're responding according to what their procedure tells them to do, but in fact in the context of the accident sequence they're treated as errors of commission.

We typically don't look at those in detail or we haven't in PRAS up to this point. I think this is an area that the project that John mentioned to respond to the other staff requirements memorandum will be looking at in detail as we go forward. It's certainly a hole in HRA today I believe, but it is something we do tackle in a specific context in fire HRA.

Distractions, again, you know, not only the spurious signals, but if you have to -- if the operators have to deal with what's being done to fight the fire that can add time and distraction to what it is they need to be doing to respond to the plant conditions. And then we have the whole --

MEMBER ABDEL-KHALIK: I can understand distractions and spurious signals that are caused by the fires. How do you address distractions or spurious signals that the operators are constantly subjected to as a result of deficiencies in the fire protection, fire detection system in a flame?

MS. COOPER: Deficiencies, not failures.

MEMBER ABDEL-KHALIK: Correct.

MS. COOPER: I'm not sure I know what you mean by that. Could you --

MEMBER ABDEL-KHALIK: I mean, have you looked at the health of the fire protection system in an older plant? Have you looked at the health of the fire protection program in an older plant and seen how many deficiencies there are and how many spurious indications that come into the control room so that they have to have fire watches, either hourly or shiftly fire watches all the time?

MS. COOPER: I think Mark wants to say something and I believe our industry folks want to say something.

MR. SALLEY: Do you want to go first?

MS. COOPER: Why don't you guys go ahead.

MR. LEWIS: Jeff was pointing out that with respect to the firefighting systems themselves, again, that's treated within -- separate from the context of the HRA in evaluating the reliability of those systems.

Now, if there are failures within those systems that could create additional demands for the control room --

MEMBER ABDEL-KHALIK: That is -- that's my --

MR. LEWIS: -- we haven't explicitly addressed that. I don't think that is --

MEMBER ABDEL-KHALIK: If the operators are constantly getting alarms which they know are spurious because they're caused by deficiencies in the system, are they conditioned in such a way that when a real alarm comes in they just ignore it?

MS. COOPER: That is part of some of our discussion about distractions. That, some of that discussion is a result of interactions with the subcommittee in the last few meetings. And that is that we recognize whether it's fire protection systems or other things on balance of plan, that even though the operators are trained for a fire to focus on their safe shutdown equipment and what would be needed for safe shutdown, there could be things going on that because of their prior operating experience, you know, like I've been having trouble with that rad waste system. It shouldn't matter to me right now but it's been a bug in my, you know, a bug for me for the last week and so I'm just going to take care of that instead of what I should be.

And we talk about -- this is a little bit beyond what we can do right now, but we have some discussion about how you can handle it in uncertainty space.

MEMBER ABDEL-KHALIK: But that is totally different. You know, having, you know, history of problems with a waste-handling system versus having a history of problems with the fire detection system.

MR. SALLEY: And that's an age-old question. And you know, it becomes the difference between nuisance alarms and false alarms. I believe the codes have dealt with it and the inspectors check that. Back in my NRR days I can sympathize because I know exactly what you're talking about.

But it's also interesting to see that there's a similar but different change going today with the technology. Something that I know NRR has been dealing with and we have a separate research program going on and that's the advent of the very early warning detection systems, if you're familiar with this. It's a new technology that samples the air. Like I said, we have a research program going on right now and what we're seeing with the PRAS and with the 805 applications is the licensees are finding out what really is sensitive in the plant. You know, what are the real pinch points and where do I really need to be sensitive for cabinet fires especially.

Harris, this is in part of the Harris SER if you've looked at it, but they even install brand new, state-of-the-art detection systems that work off air aspiration where they pick up the smallest points of combustion. In essence, it's really fire prevention because when the electronics start to break down before they turn into a combustible type fire, the operators are able to pick it up and go in there.

We have a program right now in Research that's looking at this. And it's interesting because a lot of the other technologies, the other sciences have gone beyond us. For example, one of the people I'm talking with a lot is NASA and NASA is using this, Department of Energy is using it, some of their facilities and we're out trying to get their experience. Also in Canada, I understand the CANDU reactors have used this in years past. So, there is newer technology for that problem.

As to the nuisance alarms, wow, your question really dances on safety culture. I mean, how serious do the operators take the alarms? And that can go for any alarm on the annunciator, not just the fire alarm.

MR. LEWIS: Clearly we needed to develop guidance related to uncertainties that can affect the human reliability analysis. If you've been exposed to other elements in PRA you know that uncertainty plays an important role in everything that we do in PRA.

We had some unique considerations, maybe not so unique, but sometimes we forget that when we draw a time line we have uncertainties in the estimates of each of the elements of that time line, and some of those are magnified a bit. Or at least the consequences are magnified in terms of the fire scenario where we may have less time margin because of other things that are going on are distractions.

MEMBER STETKAR: And in some sense -- I mean I have the time line in front of me. In some sense it -- from Said's question it doesn't address it completely, but in the context of this time line there is a starting point when the real fire really starts. And there is a delay time until the operators receive -- essentially perceive the cues to start their action. Now, their action might be to turn on a pump or to go, you know, open a valve.

In some sense, some of the confusion or distractions of inadequate or confusing fire alarms, fire detection could factor into uncertainties in that delay time. In other words, people being distracted by saying where the heck is the fire before they actually respond to the cues to maybe start the pump. It's not a complete, you know, deterministic evaluation of those actions, but I would argue it could be factored into that initial delay until they get started doing the things they ought to get started.

If it's enough of a distraction unfortunately it pervades the entire time line which is something that Susan mentioned. We've had some fairly extensive discussions about this notion of distractions and focusing on other things. And that's about all I can say.

MEMBER SKILLMAN: John, what I heard, or at least what I assumed originally was that this is an extremely wide focus on human reliability analysis relative to fire. And what I then heard based on Susan's explanation is this is really focused on how the control room behaves given a set of inputs. And so from that perspective what we're talking about this morning is that more limited discussion item. Am I accurate in that or am I missing the point here please?

MEMBER STETKAR: I wouldn't characterize it personally, and I'll speak for the staff here. I wouldn't characterize it as more limited because in terms of nuclear power plant safety the response of the control room operators and the operating crew to mitigate the effects of a fire is what we're interested in. So it's not limited at all in that sense. Plants get into trouble primarily because of the combined effects from the fire damage and perhaps personnel making errors. And those personnel are not the firefighters, they're the people responsible for operating the power plant. This is focused on the operators of the power plant.

As Susan mentioned, the extinguishment of the fire itself is factored into the global fire analysis through empirical correlations of times for fire suppression that are derived from actual data. So it is a time factor, it's a probability of suppression as a function of time, based on whether or not you have to -- you know, local firefighting, automatic, you know, those types of things. Those are treated empirically. Those aren't treated in terms of uncertainty, in terms of does the fire brigade captain, you know, forget to put his hat on.

So yes, if you -- your understanding is correct. This effort is focused on the operators of the nuclear power plant response in the context of a fire which eventually will be extinguished at some time even if it has to burn itself out.

MEMBER SKILLMAN: That's helpful. Thank you. Thank you.

MS. COOPER: But it can be and often is outside the control room that the operators are performing their actions. And that is an element that there's not much of in an internal event. So that's something that we've had. And that's actually Stuart's last bullet. But there's a bullet in between.

MR. LEWIS: So, what we've been talking about up to this point is primarily the qualitative aspects of what needs to be done to deal with the human reliability for the fire scenarios.

We also had to look very carefully at what was available to support quantifying the probabilities of failure to take appropriate action. And in the context of doing that, again, as Susan mentioned earlier we had a screening approach from the -- from NUREG/CR-6850 that was very general in context. And we had existing detailed approaches to performing human reliability analysis that we looked at adapting.

We concluded -- our team concluded somewhere along the line that an approach in between those two extremes, a fairly simplistic screening approach and a more detailed analysis would be helpful in terms of further screening actions that didn't contribute significantly to the risk results so that it didn't -- they didn't necessarily warrant really extensive resources being applied to evaluate them.

And a scoping approach was developed that's unique to this effort. The scoping approach is intended to be somewhat less bounding than the screening approach but still be something that can be applied in a fairly simple or straightforward manner without -- again, you still have to do a fair amount of work to understand the context for the action to make sure that the action is feasible in the first place and to understand some basic aspects of what needs to be done, but it doesn't require the full analysis that a detailed analysis would. So, this new scoping approach was developed along the way.

And then we looked at two detailed approaches for performing the analyses. One is comprised of methods developed by EPRI over the years and the other is the ATHENA approach that was developed by the NRC. And essentially we give analysts the choice. If they conclude they need to do a more detailed analysis they can choose either of those two paths. And there's some guidance on when one path might be more appropriate.

For example, if you get into certain cognitive actions that are particularly challenging

ATHENA may be able to handle those, some aspects in ways that the EPRI approaches can't do. But for the most part it's up to the analyst to decide which approach to follow. And then the rest of the work in the quantification arena had to do with how do you adapt those approaches to take into account the fire context along the way.

And then as Susan said, the last bullet has to do with the fact that actions would have to be taken outside the control room for the fire scenario may have some unique implications. The operators may not be able to take the path to a local area they would under normal circumstances because the fire is in an area that's in the way, or they may not be able to have access to an important area to take the action, or other aspects of taking action outside the control room. Communication becomes a greater issue, for example, so we had to address those implications for actions outside the control room.

A few more of the things that we had to face in this process, including the fact that we felt a strong need to pilot the methods in the guidance. This is something that has come up repeatedly in the context of NUREG/CR-6850 which is a very broad approach to performing fire risk assessment.

And both on the industry side and the NRC side I think it's been recognized that it would have been very helpful to have actually gone all the way through a PRA applying the guidance in NUREG/CR-6850 before people launched into production PRAS as part of the NFPA-805 transition. A lot of the more subtle gaps or challenges in 6850 weren't really recognized until a lot of people were well under way in performing their fire PRAS.

And so for the last few years we've all been scrambling to try to fill those gaps and compensate for some of the things that look fine going into the process and you don't recognize the importance of until you're actually trying to use the guidance. So we felt it was important to do an effective job of piloting this process to force out any challenges or gaps that we didn't recognize when we put the guidance together. And we'll talk a little bit more in a minute about how that was done.

Another of the challenges, and I think this was more of a challenge early on, but the fact was that the requirements in the PRA standard, the ASME ANS standard, were evolving along with the guidance that this project put together. So it was a little bit of a moving target, trying to put together guidance that would tell people how to do the things that a standard tells you you need to do when the things in the standard are changing is clearly a challenge. But I think we have -- to getting pretty close on that aspect.

Another thing I think that wasn't fully recognized at the outset was the fact that in the fire PRA itself there are a large number of different tasks, some of which iterated different points. It's by no means a linear process where you can define a point at which you need to perform certain elements of the HRA and then another point where you need to do additional things. It's very much a process of trying to screen continuously areas in the plant that could contain important fires, focusing in more and more on the areas that are important and developing more and more detailed information about the fire scenarios.

And all that information is needed to support the HRA so that you can't just define a simple point when you perform the HRA. And trying to characterize the ties between the HRA process and the broader fire PRA process was a big challenge in this whole process.

Another thing that has come up as the fire PRAS get closer to completion is the fact that the procedures in place at the plant have been improved as part of the transition process. And in many cases it's necessary to evaluate the risk as the plant will exist after these procedures are changed. And so you have a situation where you're expected to evaluate human reliability for a procedure that may not have actually been implemented in the plant yet, so you have to make some judgment about what that's going to look like. The fire procedures I think are one of the significant areas of improvement that plants going through this transition process have realized, but that's certainly not made the HRA process any easier along the way.

And finally, a challenge that we did face in terms of the schedule. Not so much a technical challenge, but the -- as many of you are aware there is a fairly extensive fire PRA course that's offered jointly by EPRI and NRC twice a year. And starting in 2010 there was a new track added to cover the fire HRA. And trying to develop a week's worth of training materials and to conduct that training and improve the materials has been a big focus of what's gone on the last 2 years. So that's been one cause for how it took us this long to get to where we are. It's just a fact of life, but that's something that the team who was putting the report together had to deal with in parallel.

MEMBER SKILLMAN: Has that training course been well attended?

MR. LEWIS: Very well attended. I think it's been on the order of 20 to 30 students, the HRA part of the course, 20 to 30 students each of the four times it's been offered. It was offered twice in 2010 and twice more in 2011. So there must be somewhere in the neighborhood of 100 people who have gone through that class.

MEMBER SKILLMAN: Are these primarily PRA practitioners from the fleet?

MR. LEWIS: It's a mixture of PRA practitioners, a fair number of NRC inspectors and others who are going to be reviewing NFPA-805 submittals have attended. Other interested parties have come. So it's -- one aspect of the way this material has evolved is that many of the plants that are performing their fire PRAS have already had to deal with much of the HRA before they had the chance to attend the training. So that's -- it's been somewhat less beneficial from that standpoint unfortunately. The timing wasn't ideal anywhere along the line. But it has helped quite a bit with some plants' HRA or fire PRA efforts.

MR. SALLEY: The training is split pretty much. It's interesting, we had a very good attendance as far as not just the industry and the consultants that we open it up to, because we treat it as a free public meeting. But we also get our inspectors.

Our inspectors are actually starting to use this for some of their qualification. Remember, the fire PRA is bigger than 805 and the things that we learn in here and the original roots of 6850 were for the fire re-quantification which was for the SDP process. So you know, that's a big part of it. The training does continue to expand.

Another interesting fact is when you look out there, where can you get this kind of training? And every year that we do this we tend to get somewhere between 10 and 13 different countries that are sending their people, both their consultants and their regulators, here. So this is kind of a cutting edge program, this training.

We've also, like Stuart said, we expanded it. It originally had three modules: fire PRA, circuit analysis and basic fire dynamics. The fourth track is this HRA that matches up with this NUREG. We've also added a fifth track that we started last year which is the fire modeling and advanced fire modeling. So the training is thriving.

We take turns with it. This year is the NRC's turn. There will be two sessions of it up here in the greater D.C. area and next year EPRI will have it again.

MEMBER SKILLMAN: Thank you.

MEMBER SCHULTZ: Stuart, I understand the importance of the fifth bullet with regard to the PRA practitioners and the inspectors, and so forth. The fourth bullet there, continuing improvements in fire procedures in plants. Is this not the key focus of why we're doing this in the first place is to develop an understanding of where improvements can be made to the fire procedures? Perhaps more importantly, where it's not feasible to develop improvements to the procedures.

MR. LEWIS: Absolutely. It is an important focus, probably the most important focus of this work. The reason it's here, listed here as a challenge, it's just that when this process started we had a set of existing procedures. We tried to write guidance to address how you evaluate human reliability in the context of those procedures. Many of those procedures have been very fundamentally changed through the last few years and so our guidance has had to adapt and accommodate those changes in the procedures. So that's where the iteration comes back.

MEMBER SCHULTZ: I didn't mean you didn't understand it as a good thing, but in terms of the practice, the focus of the overall effort should be to assure that the improvements aren't being made to the procedures in those areas where they can have the most impact, the most effect.

MS. COOPER: I would agree. Some of the discussions we've had in the training sessions, we've had some very interesting comparing of notes of different procedure formats, what works best here. Even we had some folks from the Spanish regulator show us some procedures from some of their plants and how they differently attack the problem.

So yes, it's good that this is coming up and the HRA is playing a role here, it's just that, you know, this is again sort of the delta against internal events. For decades now we've been looking at EOPs and only EOPs, and now we're looking at an entirely different beast. And it's evolving and we're providing the input. So, anyway. John's giving me high signs that we need to --

MEMBER STETKAR: Yes, to have some hope of meeting this time line we do need to try to get through the remainder of the presentation.

MR. LEWIS: I'll try to quickly give you a little bit of perspective on what it was we were trying to do.

MEMBER STETKAR: By the way, I told you there would be interest.

MR. LEWIS: Yes -- in terms of our participation in this project. Certainly the most important thing that we had to deal with was that we have -- we needed to provide clear and consistent guidance on how to perform an HRA for fire PRAS so that our users could do a good job of implementing this aspect of the analysis, and that this wouldn't be a tremendous obstacle to completing the fire PRA. We also wanted to make sure that along the way we provided adequate review and iteration on the guidance as it evolved.

But I do want to make a couple of points about what we view as important attributes of the approach that exists now in NUREG-1921 or EPRI 1023001. First of all, it does -- as it's constituted now it does have the capability to address a broad range of fire response strategies because not every plant uses exactly the same approach to responding to a fire, and provides detailed guidance for how to evaluate and address those strategies. This guidance coordinates I think much better than it did in the early days with the way actual fire PRAS are conducted. So it provides the right level of information, when inputs are available and when the outputs are needed for the fire PRAS. Although I think we couldn't claim that the results have an extremely high degree of accuracy, just as we can't claim in any human reliability analysis. We do think that the studies can produce useful insights into where actions are important and what might be done to improve procedures or other aspects of the scenarios to reduce risk.

And we think that the guidance is producing results that are consistent with the way human reliability analysis is performed for internal events, but taking into account the fire HRA -- fire context.

I mentioned one of our challenges early on was to ensure that we did a sufficient amount of testing and piloting of this process. And the fact is we didn't have a full set of guidance that then went all the way through a PRA and then we made some tweaks and published the report. We did have to do the piloting and testing along the way, but we did enough of that that I'm confident that we've tested all the aspects from this guidance sufficiently.

Starting with, you mentioned the peer review that I participated in back in 2008 before I was at EPRI. In 2008 there were also pilot applications that focused primarily on this new scoping method conducted at a PWR, Diablo Canyon and a BWR, Nine Mile Point, to provide some feedback. And the scoping approach was modified as a result of that experience.

It was also piloted in 2009 by the PWR Owners Group and they provided quite a bit of feedback to help improve the guidance.

MEMBER SHACK: All the guidance or focused on the scoping stuff?

MR. LEWIS: That was all the guidance at that point. In December of 2009 a draft version of NUREG-1921 was published for public comment and we received comment from primarily four entities, both of the owners groups, the PWR and BWR Owners Groups. Exelon -- on a set of guidance, and then the EPRI -- we have a human reliability analysis users group that supports our software development and other activities. And they provided quite a few comments as well. And so much of the time, aside from developing training materials, much of the time in the last 2 years or so has been spent making sure that we properly account for those comments and make revisions to the report that reflect what we learned from that.

We've also, perhaps at least as importantly as any of these aspects, the guidance has been in use over the last few years. Some of our team members, including Jeff from Scientech and SAIC, are actively involved in performing fire PRAS as part of this transition to NFPA-805 and they've used this guidance to support those PRAS. So even though it wasn't published in final form they had a little bit of an inside track on the guidance and were able to provide feedback to allow us to further improve the guidance.

And finally, Susan mentioned that we did get quite a bit of comment and feedback from the students who came to our training classes in order to the experience. Those who had actually participated in HUMAN RELIABILITY ANALYSES for fire PRA up to that point had feedback that was helpful to the process. And that, it continued through the two courses last year. I was only at the ones in 2010 so I can't speak directly to what happened last year, but I believe that was very useful.

And of course as John said at the outset, we've had a number of interactions with the ACRS subcommittee through the years and quite a bit of useful feedback from John and others on that subcommittee.

So again, we're pretty confident that we've tested everything maybe not in the ideal format but in at least as thoroughly as we need to to have confidence in what we've got.

I'll quickly go through some of the things that have changed. I may not hit all of these bullets in the interest of time, but a lot of the work that we did in response to the testing and the reviews that were conducted affected the qualitative analysis. The qualitative analysis captures all the important aspects of the context for the action we're assessing, the timing procedures and all the other things we look at. And it's a really crucial first step in getting -- setting the stage for all the rest of the work we do in the human reliability analysis. And we did make quite a bit of modification to that process as it was originally formulated as a result of the feedback we got.

Made some changes to the scoping approach.

I won't get into any details there. We did refine the way we would reflect the timing considerations, especially as it's applied in the scoping approach. And some of the other guidance for things like walk-throughs of the scenarios and how to perform an adequate talk-through.

An important aspect of what we've addressed in our revision was looking at the potential for spurious actuations or spurious equipment operations along the way. And then we made some changes to the way we characterized some of the pieces, the specific pieces, including treatment of recovery, the dependency among human actions and the uncertainty analysis. So all of this, all this review and testing that we did really did make substantive improvements to the guidelines as we went along. With that I think we can turn it back over to Susan.

MS. COOPER: Thank you, Stuart. That leads into the next and last topic, and that is to say that we believe that the guidance that we provided for fire HRA also provides a useful guidance that can be used for other projects moving forward. In particular, at the NRC we mentioned the new HRA development from the SRM M061020. And then also the Office of Research is beginning on a project to do site-wide level 3 PRA. So both of those projects in particular we believe will be benefitted by this work.

In addition to some of the examples that I'm going to give you, there has -- one of the other benefits is that team members for the fire HRA guidelines overlap many of the other projects at the NRC, both the two that I mentioned here and then ones in the past like some of the international and U.S. benchmarking efforts where we've been looking at the strengths and weaknesses of HRA methods.

You know, a lot of the focus that we have in the NUREG-1921 on qualitative analysis is a direct result from some of the insights from those early international benchmarking efforts that was then reinforced in the U.S. benchmarking efforts.

So, I'm just going to give you some examples of some of the things that we think that will be very important to other HRA efforts, development efforts or application efforts. The first thing is that we have in 1921 comprehensive guidance for all steps in the HRA process. That doesn't sound like much, but for the most part when someone's come up with something new they're focusing on the quantification aspect of it only. And so we've talked a lot about the qualitative analysis, but another aspect that's very important is the identification and definition of human failure events to put in the model to begin with. And for internal events we can get pretty lazy in a sense because there have been so many of them done you can more or less say well, it's going to look something like this. I don't have to dream up something new.

For fire, in the fire context we couldn't do that. We had to look at a different set of procedures that had different actions that hadn't been modeled before. We had to look at actions that were outside the control room. So there was a significant effort that has to be made on identifying and defining human failure events to put in the PRA model. And we've got guidance on that written down.

We mentioned several times that we've written these guidelines to match the standard. Of course, this -- you know, we're looking specifically at the fire PRA standard, but in order to satisfy the fire PRA standard you have to also satisfy the internal events standard. So, you know, we find that to be a useful thing to be able to know how to write some guidance that would meet those kinds of requirements.

Stuart has mentioned a few different times that in the context of a fire PRA there are lots of different tasks going on with different experts who are feeding information, providing inputs, generating input at different times in the project. And we've tried to address some of this information flow and some of the problems associated with it in our document.

Now, we had to write the HRA process as a serial set of steps, but we discuss how those steps can be iterated and how you might have to wait to do certain things and so forth. So, we've tried to address that, that aspect of how you really do a PRA in our documentation.

Stuart mentioned something about this new scoping approach that we've developed. This provides an example of how you can develop a simple HRA approach that is very traceable, and where the number comes from, and what kinds of judgments you made in order to get at that number.

Another aspect that we've talked about some is the notion of feasibility. And we have an extensive discussion in our qualitative analysis section on feasibility assessments. What are the criteria, how do you assess feasibility and how do you transition then from feasibility into making reliability assessments.

Again, this is very important when you're talking about new actions, but for the most part when you're talking about internal events, PRA, things happening in the control room, using the OPPORTUNITIES, we have decades of experience that show that those things ought to be -- you ought to be able to do them unless something really strange is going on. We now have a brand new set of actions for which we have no -- we may not have any prior experience or limited experience in showing that they can actually be performed. So we've -- we've got specific guidance on how to make those kinds of assessments.

MEMBER STETKAR: And I think that's important. We're, again, short on time, but to address some of the concerns that were raised earlier. If you ask Hero Ralph, "Can you do this?" Hero Ralph always says, "Well, yes, I can and it'll only take me 10 minutes to do it." Guidance for an evaluator of Ralph that specifically enforces a discipline to ask questions about timing, about stress, about distractions is really important because in many cases Hero Ralph if you ask him can always do something perfectly in the amount of time that's required. So that I think is very important, as Susan mentioned, this guidance for an objective evaluation of just the feasibility, can it be done within the available time, is important.

MEMBER SKILLMAN: Let me pile on because in that particular instance is to me the -- a very critical piece of this. So, Hero Ralph will say I can do it and a normal fire is out in, what, 22 minutes? They're fairly short. But you send Hero Ralph out. The fire's extinguished. He comes back and he said, "Boy, that's the best 20 minutes effort I ever put in," and they say "You've been out there for 3 hours and 26 minutes."

MEMBER STETKAR: Yes, that's right.

MEMBER SKILLMAN: Because I know in these circumstances one's mind loses track of the time line and you're so committed to task that the world can change around you.

MS. COOPER: Right.

MEMBER SKILLMAN: That is an awkward issue but it gets back to this performance shaping that Dr. Banerjee asked about and Dr. Powers asked about. But this to me is the heart of this whole thing, how we can somehow capture those types of issues and communicate them in a quantifiable way so that the industry and the agency really win this one. Because this to me is one of the most important things we're talking about. Thank you.

MS. COOPER: Yes, thank you. Yes, it is important. And as John said, having that discipline, having it written down, you know, having some discussion about the pitfalls is very important.

I'm remembering something I think that Jeff and others at Scientech ran into. There was some kind of valve that you had to access by climbing a ladder and it was a big thing and so-and-so said, you know, Charlie said he could do it and it turns out that even Charlie couldn't do it. But you know, who knew until you actually went and walked it down and checked it for real. I'm sorry.

(Laughter)

MEMBER STETKAR: We know Charlie well enough. He could have done it.

MS. COOPER: All right. So, and that feeds into the notion, you know, the ex control room actions, not everything's going to be in the control room when we're looking at something outside of the internal events PRA context. And then there can be some environmental effects, you know, outside the control room that you wouldn't have to worry about.

And we think that this is a useful

framework for looking forward to things like seismic PRA where again we might be sending people out to do things outside the control room. Accessibility may be an issue, so on and so forth. So we think we, especially with the notion of feasibility and looking at things outside the control room, that we have, you know, we have a stepping-off point for going into the future.

We mentioned some about the notion of spurious cues and distractions. Typically in the internal events PRA process we make assumptions that the instrumentation is good and reliable and it's there. There have been a few studies where we've looked a little bit beyond that, but that's been the predominant thing and certainly that's what the PRA standard says.

So, here in the fire context we've had a chance to move out of that comfortable place and start looking at things, situations where the instruments can be giving you wrong information and can be distracting or leading you onto a bad path.

With respect to timing we've had a lot of discussion about that. We also have a lot of discussion in the report about certain aspects of time that you need to be concerned about, how to develop timing information. Worrying about uncertainties in timing. You know, some of the more recent interactions we've had with the subcommittee suggested that we provide guidance on don't just develop or look for point estimates. Try to get an idea about the range of times, those sorts of things. So we have quite a bit of different developed that can help any HRA I believe in that area.

We've talked some about the notion that this is -- we've developed guidance on how to do HRA for procedures other than EOPs and that's been our comfortable space for decades and decades. There are differences in the procedures, fire response procedures, throughout the industry but we've tried to capture some of the aspects and some of the things that people need to be cognizant of when they're making their evaluation.

And we -- it's, as Mark mentioned we're going to be doing the training again this year, hosted here in the D.C. area. We have training materials now for all of the HRA process steps. We do have some focus on fire of course, but there are other aspects, again, with identification, definition, qualitative analysis that we've developed materials on.

MEMBER STETKAR: Susan, you mentioned

something in passing that I think is important, just worth noting. And that is consistency with the ASME PRA -- ASME ANS PRA standards. And this guidance if I'm not mistaken has been developed with a focus of trying to meet capability category 2, sort of those standards. Is that correct? That's sort of the general focus.

We don't have time -- for those of you, the committee members who aren't familiar with these, there are different capability categories in terms of, if you will, scope and level of detail of the analyses. It's important to understand, capability category 2 is kind of -- it's more than a middle level. It's a really good level of detail, but it's not full scope if you will PRA.

It's important because in many cases, in particular the treatment of spurious actuations within the context of that capability category are assumptions built in. And this, this guidance in particular, the way it's formulated right now are consistent with those assumptions. Capability category 3 which is beyond the scope essentially of this effort expands those assumptions in terms of things that need to be considered. I think that's worthwhile just mentioning.

I wanted to get it on the record for this meeting. It's stated pretty well in the document itself, but it's important for the committee's understanding to know that this isn't trying to solve all of the problems or a capability category 3 or even beyond type analysis.

MS. COOPER: That's absolutely correct and we actually even identify some areas up front where we think, you know, if there was interest or concerns that we could go further. That's actually one area where the standard changed while we were making our -- developing our guidance. We did at one point in time have the beginnings of some guidance on how to treat lots of spurious indications that might, you know, combine to cause a wrong decision. But we shifted when the standard did.

Okay, we made it. So, in conclusion we believe that the project objectives have been satisfied. We have comprehensive and useful guidance for fire HRA and we have, some of the authors at least have used it and find it to be so. And we have feedback from others.

We've refined our approach as a result of testing, public comments, applications, even feedback from training. And we think that elements of these guidelines are also valuable to future and current HRA research and development.

And to reiterate from what Mark said, the team would like a letter, requests a letter. And that concludes our presentation unless Mark or Rich or any of my colleagues here want to say anything.

MR. SALLEY: We're ready to publish this and the last step of course is to check with you. This is a new, innovative way of doing it which is the whole purpose of coming here. And we're ready to publish this and move on with the next project.

MEMBER STETKAR: Any other comments, questions from the members? If not, thank you very much. You've covered an awful lot of material. You made it. I wasn't worried. I had 4 minutes in the bank from yesterday.

(Laughter)

MEMBER STETKAR: And with that, Mr. Chairman, back to you 36 seconds late.

CHAIR ARMIJO: Okay. Thank you, John. Let's take a break for 15 minutes and reconvene at 10:15.

(Whereupon, the foregoing matter went off the record at 10:00 a.m. and went back on the record at 12:59 p.m.)

CHAIR ARMIJO: Okay, we're reconvening and we're now on the subject of mitigating strategies and Said will lead us through that presentation.

MEMBER ABDEL-KHALIK: Thank you, Mr. Chairman. Bulletin 2011-01 requiring licensees to verify compliance with 10 CFR 50.54(hh)(2) was issued by the NRC on May 11th, 2011.

The ACRS was briefed on the subject during our 584th meeting in June of last year. We did not write a letter on the subject. However, we requested that the staff brief us after the responses provided by the licensees are collected and analyzed. And the staff is now ready to provide that briefing and I call on Ms. Kim Morgan Butler of the NRC staff to begin the presentation.

MS. MORGAN BUTLER: Thank you. Good afternoon, my name is Kim Morgan Butler. I am the acting branch chief of the Generic Communications Branch within the Division of Policy and Rulemaking in the Office of Nuclear Reactor Regulation.

I'm here on behalf of DPR management to introduce Mr. Eric Bowman. He's going to give us the details and the updates on Bulletin 2011-01. He's going to first start with the purpose and explain some of the requests that we've made, the responses to those requests and then give us an overall view of the effectiveness of this bulletin.

And without further ado I'll pass it on to Eric.

MR. BOWMAN: Thanks, Kim. Good afternoon. As Kim said I'm Eric Bowman. I'm the staff lead in the Office of Nuclear Reactor Regulations for the mitigating strategies required first under B.5.b of the ICM order of 2002 and then codified as 10 CFR 50.54(hh)(2). I'm also the staff lead for the mitigating strategies order that was issued on March 12th, the order A 12-049. That is not going to be the subject of this presentation, however.

Bulletin 2011-01 was issued, as Said said, in May of 2011. The reason we issued it was to once again achieve a comprehensive verification of compliance by all licensees with the mitigating strategies requirements that were then in force. We did that through asking a certain -- two questions that were due within 30 days. We had further information that we were gathering to determine if we needed to make any changes to the requirements.

The 30-day request that I mentioned were these two questions essentially. Is the equipment there and available and capable of performing its functions. And are the strategies as proceduralized and as the staff were trained capable of being accomplished.

MEMBER SKILLMAN: Eric, a brief question. Each of those questions is answerable with a yes or a no. Was that purposeful in the development of those questions?

MR. BOWMAN: Yes.

MEMBER SKILLMAN: Thank you.

MR. BOWMAN: And in fact, in general all the responses we got were a little bit wordier than yes or no, but ultimately they just verified that they were indeed in compliance. We got all yes answers to those set of questions.

CHAIR ARMIJO: Sorry, could you go back to that last slide? I didn't finish reading it and I wanted to check something. Did you ask specifically whether there were any deficiencies that they found?

MR. BOWMAN: We did not in this question, in this set of questions. The follow-on questions we did ask for reporting of any deficiencies they found.

CHAIR ARMIJO: Okay.

MR. BOWMAN: We did have one or two licensees that reported that they had a deficiency that was corrected at the time that they made the report that compliance was verified.

CHAIR ARMIJO: Okay. Thank you.

MR. BOWMAN: Onto the 60-day request which was the gathering of information for -- to assess whether or not we needed to make any further changes to the requirements. There were five questions that we asked in this section of the bulletin. These are the first three that concentrate on the equipment itself, the maintenance, inventory control and testing of the equipment. I'll give you a minute to read these questions. In the bulletin itself there are examples that were provided to further beef up or specify the information we were looking for.

MEMBER SKILLMAN: Curiosity question. Your slide 4 indicates all licensees verified compliance. May we interpret that to mean even those plants that are 95003 or in Manual 0350?

MR. BOWMAN: They all verified compliance With that regulation, yes.

MEMBER SKILLMAN: One hundred and four plants?

MR. BOWMAN: Yes.

MEMBER SKILLMAN: Thank you.

MEMBER ABDEL-KHALIK: So, how do you reconcile that with the results of the inspections that were done immediately after Fukushima and found nearly 2,000 violations?

MR. BOWMAN: I don't believe they were characterized as being violations per se.

MEMBER ABDEL-KHALIK: Non-compliances.

MR. BOWMAN: There were different levels of compliance. This was -- as, any time is a -- it's a snapshot in time of the level of compliance. On the date that they signed it and sent in that letter they were in compliance.

And there are admittedly some areas, and that's why we asked these questions, to see how the maintenance of the compliance with the regulation is being accomplished on a going-forward basis.

The other two questions we asked dealt with configuration control for the plant, ensuring that the mitigating strategies themselves get updated if there are changes in the configuration of the plant. And also that the training and so forth are carried forward for the staff to ensure that everybody is capable of performing the strategies. And finally, the last question we asked dealt with the offsite support that was necessary for compliance. The question on the offset support was prompted in part by anecdotal reporting of lapsed memoranda of agreement, and so forth.

MEMBER STETKAR: Eric, that number 4. You said something that I didn't interpret when I read the words. You said training. Is that the intent? Because until now this has been very hardware-centric and if the operators don't know how to use the hardware.

MR. BOWMAN: Exactly. The first three were intentionally hardware-centric. It also included in the first three the maintenance of the hardware, so that's a little bit of --

MEMBER STETKAR: But that's still --

MR. BOWMAN: Number 4 dealt with the capability of performing the -- and it got into training, as I mentioned, by the examples that we provided to the types of information we were looking for.

MEMBER STETKAR: This is the source of my question. And this does not have anything to do With a U.S. plant but I'll give you an example.

An unnamed plant in a foreign country several years ago that I was working with had in place a fire truck and connections to hook up that fire truck for an alternate water supply. None of the operators at the nuclear power plant knew how to run the pump on the -- they knew how to drive a fire truck obviously, but none of them had been trained on actually how to operate the pump. And if, I guess a fire truck, you know, it sounds like it might be easy to operate but apparently it's not. When we asked them they said no, we have to call the local fire department to get somebody to come and operate our truck for us.

And that's the sense of what I mean by real training. The truck was there, it had gasoline in it, it had the connections, it's just nobody knew how to use it. And they actually hadn't thought about it.

So that's the sense of what I was asking. Was the purpose of that number 4 to follow up at that level of implementation? In other words, do the people really know how to use the equipment, despite the fact that it's there?

MR. BOWMAN: The purpose of question number 4 was indeed to address that need. The training for the programs that were set up were done using the systematic approach to training. And outside of the scope of this briefing of course but the recent emergency preparedness rulemaking also makes the 50.54(hh)(2) guidance and strategies part of the evaluated drills and exercises that are conducted periodically. So that we actually see them go and try and start the fire pump for those plants that use fire pumps. Other plants have different types of pumps.

MEMBER STETKAR: But I mean, that's the whole notion of --

MR. BOWMAN: That is.

MEMBER ABDEL-KHALIK: Question 4 is really a configuration management.

MEMBER STETKAR: Well, that's why I asked. But Eric, when he described it mentioned the word "training" which is what triggered my question to him.

MR. BOWMAN: The bulletin itself, I'll read you the examples that we included in there. It's guidance management is more where we see the training as being included. And we included as a subpart of that examples of the types of information to include when providing the responses to question 4 were (a) measures taken to evaluate any plant configuration changes for their effect on the feasibility of the mitigating strategies, (b) measures taken to validate the procedures or guidelines developed to support the strategies can be executed. These measures could include drills, exercises or walk-throughs of the procedures by personnel that would be expected to accomplish the strategies, (c) measures taken to ensure the procedures remain up-to-date and consistent with the current configuration of the plant, and (d) a description of the training program implemented in support of the mitigating strategies and of the manner in which you evaluated --

MEMBER STETKAR: Okay, so that's -- that captures it.

MR. BOWMAN: So, that's what we were going for. And when we do onsite inspections of the mitigating strategies requirements for this particular set of requirements they're accomplished on a triennial basis under the fire protection inspection program. And we do walk-throughs of the various procedures With the plant personnel. And they do demonstrate that they can, for the strategies that are selected since that's just a sampling type of inspection, they can indeed accomplish the strategies.

MEMBER STETKAR: But thanks. Those examples clearly, clearly show that that covers the area that I was questioning. Thanks.

MEMBER SCHULTZ: Eric, is there a similar broadening of definition with regard to item number 5? You mentioned letters of agreement, a memo of understanding.

MR. BOWMAN: There is.

MEMBER SCHULTZ: -- want to see those but presumably from what you've said here for item 4, item 5, there may be opportunity for, or there should be opportunity for the demonstration of the availability and the communications and drills and exercises or something like that.

MR. BOWMAN: For item 5 what we asked is clarifying information for what would be the information we were looking for in that brief description. A listing of the offsite organizations they rely on, measures taken to ensure continuity of the memoranda of agreement or understanding, or other applicable contractual arrangements, including a listing of periods of lapsed contractual arrangements. And finally, there was also a listing of any training or site familiarization provided to the offsite responders.

I've got a copy of the bulletin with me. I didn't bring multiple copies. I can leave it With you there.

MEMBER SCHULTZ: That's fine. I appreciate the additional information.

MEMBER BROWN: I had a question on question 4. The -- somehow something arrived in my inbox in preparation for this which was called a Summary Report. And under question 4 it listed summary of training and other types of information like these standard industry practices for stuff. But a bunch of asterisks were noted that for maintenance 43 of the 65 sites did not address training. In other words, there was no response.

So I'm just following up on your thought about what's done relative to training. Forty-seven of the sites out of sixty-five don't provide anything at all to general employees. And there was I guess, I don't know who made the assessment, I guess it was Mega-Tech, the services company provided the basis. Well gee, they don't do that because most of these people would be under direction of somebody else. Therefore, they don't know, they don't have to know anything else. It's kind of a broad conclusion.

I was kind of surprised that after all of these there was almost -- I couldn't find any deficiencies anywhere.

MR. BOWMAN: In large part the guidance that we have and the regulatory requirement itself, the guidance is not that specific as to who needs to get trained, how often they need to get trained, and so forth. So it's very difficult to come up with a specific deficiency in the training area because the B.5.b effort that led to this regulation was a performance-based effort. The sole requirement that we really have is that they develop and implement the guidance and strategies to maintain or restore core coolant containment and spent fuel pooling.

MEMBER BROWN: Doesn't that call into question somewhat the whole strategy of using a performance-based requirement which it doesn't set any requirements and just leaves it up to anybody to do what they want to do?

MR. BOWMAN: It makes the inspection of it less of a "go and be sure they check the box everywhere." And it makes it more helpful for us that the EQUIPMENT rulemaking included that in the drills and exercises that are evaluated. And that's also why on the reactor oversight process inspections of the programs we go out in the field and we randomly select on a risk-informed basis strategy and have the operators actually walk through the strategy to demonstrate that they can do it.

MEMBER BROWN: Normally I would expect for a performance-based requirement that you have a ladder or some type of acceptance criteria that would, regardless of the methods they used, they have an endpoint, end result that would -- and there was no mention of that in any of this. That's -- I was just trying to get a handle on the comments and the way the thing read.

I mean, I kind of drew a conclusion from all this, maybe I'm wrong, is that they went out and they answered your bulletin and they came back and said Everything's okay.

MR. BOWMAN: I'll get into a little bit more specifically about what we were looking at there. And just give me a couple of slides.

MEMBER BROWN: No, that's fine. I was just trying to give you -- after reading the summary report of what Mega-Tech reported back it seemed to be -- go inspect, make sure everything's okay and they come back and said it is. And Mega-Tech said yes, they told us it was okay and therefore it's okay. And it just seemed like the bulletin didn't have a whole lot of -- they're good questions, but there were no metrics associated with them. I've really ever seen when you can't go to a place and inspect things and find out that they don't --

MR. BOWMAN: I don't want to get too far ahead.

MEMBER BROWN: I'll wait.

MR. BOWMAN: The wording that was chosen, the guidance that was issued and endorsed is susceptible to interpretation in varying degrees. What we accomplished here was we got the licensees to document what they are doing.

MEMBER BROWN: Okay, thank you.

MR. BOWMAN: In the process of reviewing the responses we got to the bulletin we bounced the listings of the equipment and the offsite responders and so forth against the information that the licensees had supplied during the submittal process for the B.5.b licensing effort to ensure that they covered all the equipment that was reportedly relied on to meet the requirements originally.

We did notice some deltas between the earlier submittals and what was reported in the bulletin responses, and we wound up with 53 RAIs out of 65 sites for various small things. Some of them as minor as an offsite responder organization that was cited with a different name because they changed their name. But we went back and verified that they continued to use those offsite responders or they've updated it. And that all the equipment that they cited they would rely on was actually covered under the maintenance program, et cetera.

MEMBER REMPE: Would you, I mean, you indicated something is a minor RAI. What was the major grouping of something that's maybe perhaps more important?

MR. BOWMAN: If we could have characterized something as being a deficiency that would have made one or more of the mitigating strategies unavailable then that would have been something that would have been more than minor.

MEMBER REMPE: And did you find -- is that any of the --

MR. BOWMAN: No.

MEMBER REMPE: What's more significant in the 53 RAIs that you identified?

MR. BOWMAN: As I mentioned there were differences between the listing of the offsite responders and the offsite responders that they had told us before. Omissions of certain pieces of equipment that had been listed before. Some of the pieces of equipment that were listed did not list maintenance things that were accomplished for them. Things of that nature.

And we -- part of the effectiveness of the bulletin is that where they had not documented a formal maintenance program for things like inspections of spray nozzles, that if they were fire hose spray nozzles under the fire protection program would have specified maintenance requirements under the National Fire Protection Agency standards. Some sites didn't have those for these particular fire hose nozzles because they weren't under that program and they have since entered them in their correction action programs and are implementing maintenance of the same nature.

MEMBER REMPE: Thank you.

MR. BOWMAN: You're welcome. Okay. As I mentioned, a lot of the motivating factors for the group of questions that we asked in the 60-day responses were due to the limited amount of detail in the guidance that's out there for compliance with B.5.b and 50.54(hh)(2). That guidance takes the form of a Safeguards document that was issued in February of 2005 as well as the endorsed industry guidance of NEI 06-12 Revision 2.

The requirements, or what we endorsed as being an acceptable means of meeting the requirements for maintenance, testing and control of the equipment referred to the use of standard industry practices for acquisition and maintenance of the equipment, and gave no better definition of just what standard industry practice is.

I had forwarded the document that you got on your desk. The summary report was the analysis that we had done by our contractor, Mega-Tech Services, to try and discern just what "standard industry practices" could be interpreted to mean. It also goes into the questions 4 and 5.

For the offsite support, on a one-time basis during the phase 1 effort for the B.5.b development process we verified and evaluated the adequacy of the memoranda of understanding and agreement with the offsite responders and so forth. This was a look at how the licensees are maintaining that type of support on a going-forward basis.

MEMBER SKILLMAN: Eric, typically how many offsite responders are there per site?

MR. BOWMAN: It varied. Some of the licensees rely on things like statutory requirements for their state or local area as opposed to listing individual memoranda of agreement. Typically we saw local law enforcement agencies, firefighting organizations, hospitals, things of that nature.

MEMBER SKILLMAN: EMTs, hospital, that kind of stuff?

MR. BOWMAN: Yes, exactly. But the numbers of them of course vary from site to site because some sites are a lot further away from other offsite responding organizations.

MEMBER SKILLMAN: Are there any -- let me ask the question differently. What is the strangest memorandum of understanding that you came across from the licensees?

MR. BOWMAN: Strange in what way?

MEMBER SKILLMAN: I can understanding firefighting, law enforcement, EMTs, ambulance service. Did you find any that required a helicopter? Any that required a tank or an armed vehicle?

MR. BOWMAN: No tanks or armored vehicles. There were listings of agreements with local airports for things like firefighting foam. I don't really consider those to be strange based on the context that we're in here.

There wasn't anything that was really all that strange in the context of a response to a bulletin. There is of course a hesitancy to list things that you don't want to be held to maintaining in the future. So, essentially the responses we got were restricted to things that were requirements and things that made sense.

MEMBER SKILLMAN: Thank you.

MR. BOWMAN: The evaluation of the

responses to the first three questions on the maintenance and control of the equipment resulted in the synthesis of a listing of what might be considered to be standard industry practices. The contractor looked at frequencies of performance of the various maintenance items and so forth, taking into account things like if hypothetically the industry were indeed developing standards what would the resulting standard look like.

The more solid thing that we can look to as a result is what were the various licensees and sites taking into consideration in developing their maintenance programs and that was essentially the manufacturer's or vendor's recommendations for the equipment, differences in the uses of the equipment from their intended purpose to the purpose they would be put into use for in the mitigating strategies and also industry standards such as the National Firefighting Protection Association standards for fire protection.

Because it's a sister art to the mitigating strategies many of the pieces of equipment that were procured, like fire hoses and nozzles, fire engines and fire pumper trucks were purchased by the licensees in order to meet the requirement for a portable pumping source. So there's a set of standards that are out there that are not directly applicable but are useful in reference to understand the types of things that are done for This kind of equipment.

Those are the sorts of things that licensees looked at in developing their maintenance programs and that is more what we see as being the standard industry practice in that regard.

The responses for question 4 pretty much followed along the same boilerplate language as to what was looked at for maintaining configuration control. That is the evaluation of configuration changes in the plant's procedure validation, the design change process and use of the systematic approach to training.

And the question 5 results, we did have a number of sites that cited prior lapses in memoranda of agreement. They had all been corrected of course by the time we got the response as well as documenting the methodology they're using on a going-forward basis to ensure that their memoranda or whatever contractual arrangements they have going forward remain current.

And to a certain extent our desire is -- with the bulletin was to document and ensure that on a recurring basis the licensees are capable of implementing the mitigating strategies and calling on the offsite support. We weren't looking with this bulletin to identify deficiencies per se as non-compliances and enforce those.

Finally, the effectiveness of putting the bulletin out. As I said, we had no instances of non-compliance that would warrant enforcement. We were -- we have a lot of lessons learned on the value of using phrases that are undefined such as "standard industry practices" or "maintenance."

We are in the process right now of developing the Interim Staff Guidance and the industry guidance for the mitigating strategies order. And we're taking this into account in what's going to be documented as the programs going forward for the strategies under that order.

One of the purposes of the bulletin had been to assess whether or not the inspection program needs to be modified or enhanced. After looking at the results of the bulletin and the temporary instruction inspection that preceded it we feel that the ROP realignment process is adequate to handle any changes to the inspection program.

MEMBER ABDEL-KHALIK: You're referring to the triennial fire inspection?

MR. BOWMAN: That's where it resides now. And as I mentioned, further regulatory actions are ongoing. Rather than taking the NTTF recommendation to order reasonable protection of the equipment for other beyond design basis external events, we've got an entirely different set of mitigating strategies being developed that we're developing guidance for.

And that ends my presentation subject to your questions.

MEMBER ABDEL-KHALIK: Thank you. Are there any questions for Eric?

MEMBER BROWN: Can I ask just one?

MEMBER ABDEL-KHALIK: Please.

MEMBER BROWN: I don't want -- I'm just seguewaying a little bit from the other question. The comment was made that the compliance -- I understand you weren't looking for deficiencies or to issue non-compliance stuff like that, but who did the -- the way I read this, and the way I read the summary that you gave me was that the vendors -- excuse me, the licensees did the inspection. They wrote the response. It wasn't like you had region people sitting down with them and going through these various areas to ensure that they were in compliance. Is that correct?

MR. BOWMAN: The sequence of events as it happened, after Fukushima all of the licensees went out on a voluntary initiative to re-verify their compliance. There was an INPO Level 1 IER that asked for certain information. There was our bulletin that asked for certain information. And there were -- say again?

MEMBER BROWN: Who looked over their shoulder to say that they were -- were there inspectors that made sure they were --

MR. BOWMAN: Resident inspectors were going along and in parallel with this effort they were -- there were two temporary instruction inspections, TI 2515/183 and 184 that dealt with this action, management guidelines. The TI 183 had the resident inspectors going over the subject matter that was covered by this bulletin.

MEMBER BROWN: Okay, thank you.

MEMBER ABDEL-KHALIK: Are there any other questions for Eric? Well, thank you very much. We appreciate it.

MR. BOWMAN: Thank you.

MEMBER ABDEL-KHALIK: Thanks. Back to you, Mr. Chairman.

CHAIR ARMIJO: Okay. Thank you, Said. Let's take 15 minutes, come back at quarter of 2 and we'll start on letter-writing. We've got an awful lot of stuff to do. We're adjourned.

(Whereupon, the foregoing matter went off the record at 1:31 p.m.)