Fire Protection Executive Perspectives

Plenary 1

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Background

- Browns Ferry fire in 1975 demonstrated that fires can be a significant challenge to plant safety.
- Rules and guidance have been evolving since the Browns Ferry Fire.
- IPEEEs confirmed that fires can be significant contributors to risk.
- Deterministic methods have maintained safety, but some requirements may have had costs that were not commensurate with their safety

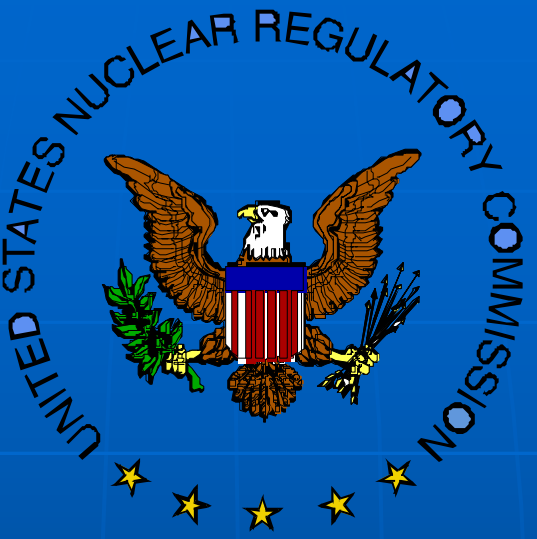
Can we do better?

Major Issues

- Circuit Analysis
  - NEI/EPRI testing found that fire induced circuit failures are likely to cause multiple spurious actuations of equipment.
- Operator Manual Actions
  - Some licensees may have used operator manual actions without appropriate NRC review and approval.
- Fire Barriers
  - NRC testing of Hemyc and MT found that they did not meet acceptance criteria.

Risk-Informed Solutions

- NFPA 805
  - NRC issued Risk-Informed Performance-Based Rule, NFPA 805, in June 2004, as an alternative to current deterministic rule.
- Office of Research is developing enabling tools acceptable to the NRC
  - Circuit failure fire testing (Carolfire)
  - Development of fire protection risk analysis tools (NUREG/CR-6850)
  - Training for NRR and Industry on risk analysis tools
  - High Energy Arcing Faults research
  - Fire Modeling (Draft NUREG-1824)



NRC Reorganization for Licensing New Reactors in the United States

Jim Lyons, Director
Division of Risk Assessment

Goal of NRR Reorganization

- To ensure sufficient focus and resources are retained on operating reactors
- To be in position to handle large new reactor licensing and construction inspection workload

U. S. NUCLEAR REGULATORY COMMISSION

Summary Estimate of New Nuclear Power Plants Based on the Design Centered Approach

(as of 7/2/06)

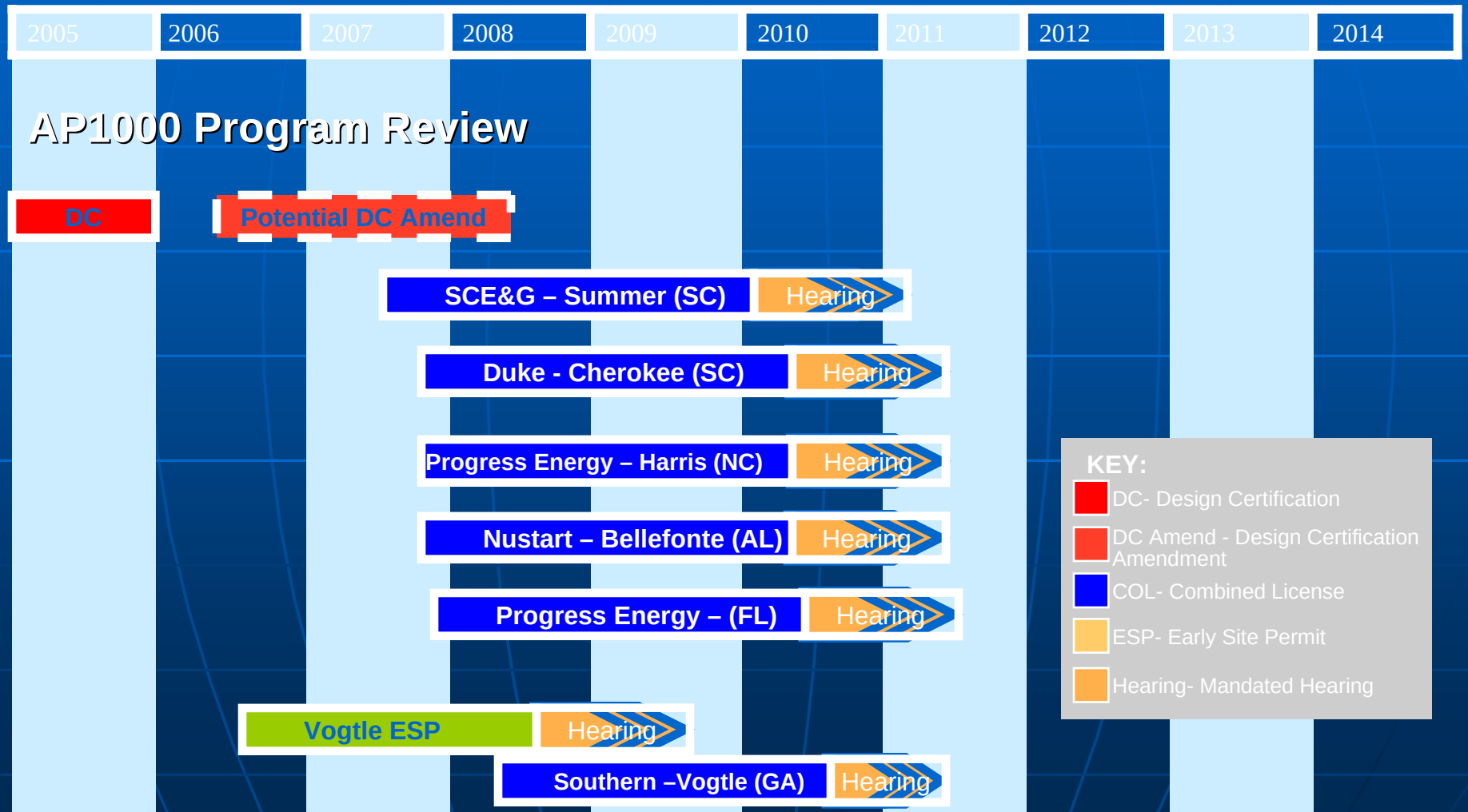
	COLs	Units
AP 1000	6	12
ESBWR	3	3
EPR	5	5
ABWR	2	4
Unspecified	3	3
Total	19	27

Number of Reference COLs: 4
Number of Environmental Reviews: 19+

U. S. NUCLEAR REGULATORY COMMISSION

New Plant Licensing Applications

Estimated Schedule (Calendar Years)



U. S. NUCLEAR REGULATORY COMMISSION

New Plant Licensing Applications

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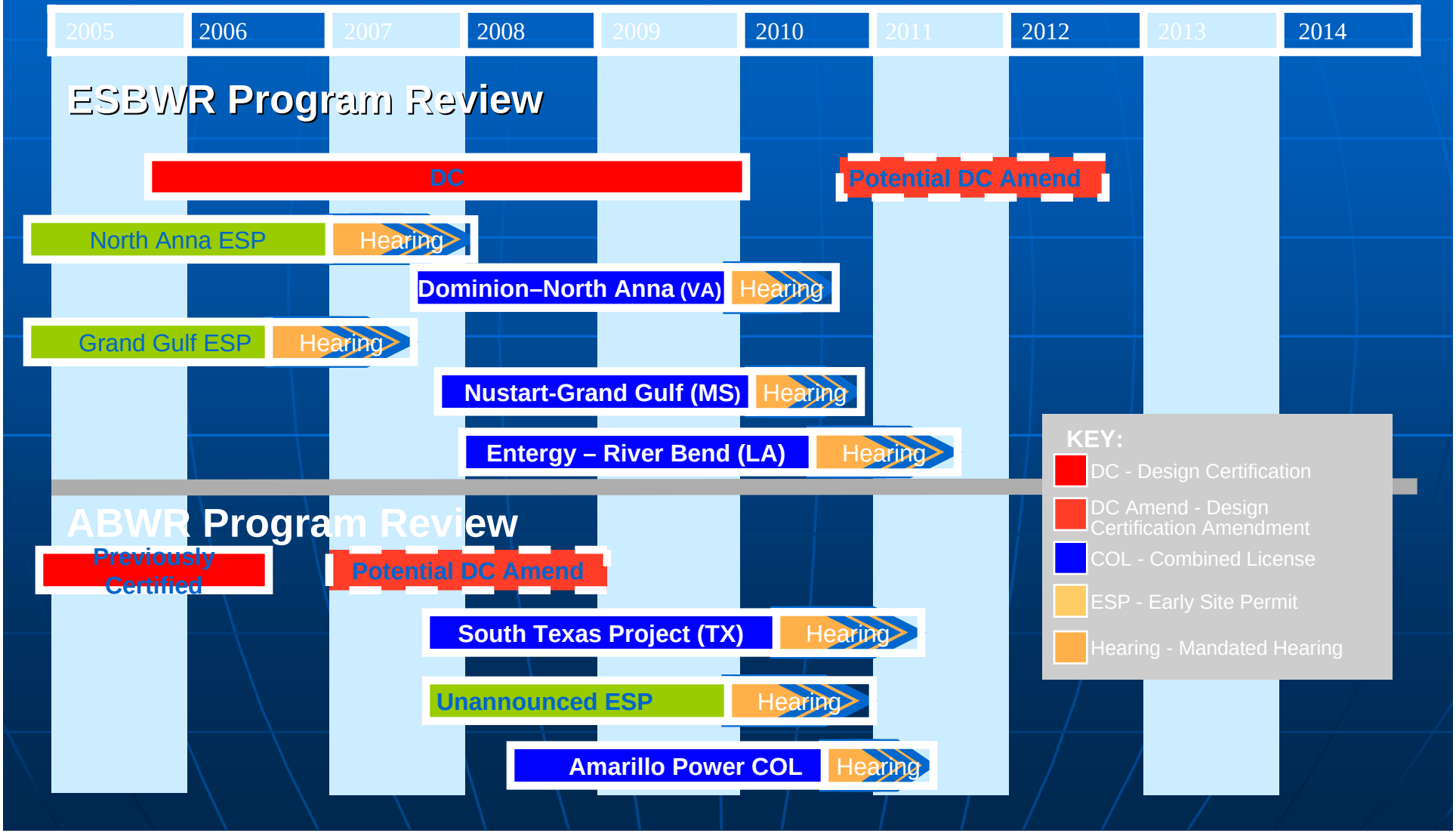

U. S. NUCLEAR REGULATORY COMMISSION

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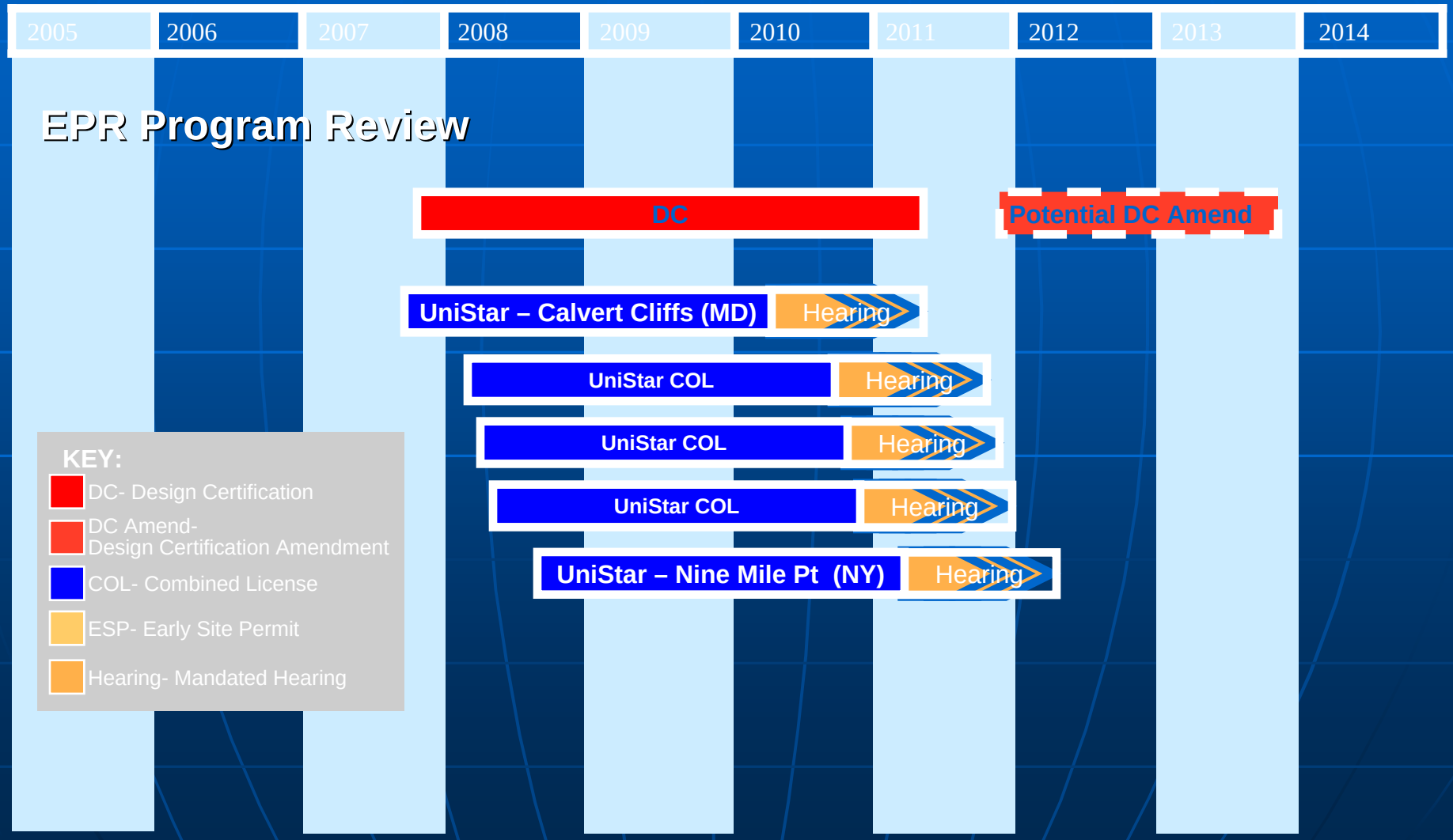

U. S. NUCLEAR REGULATORY COMMISSION

New Plant Licensing Applications

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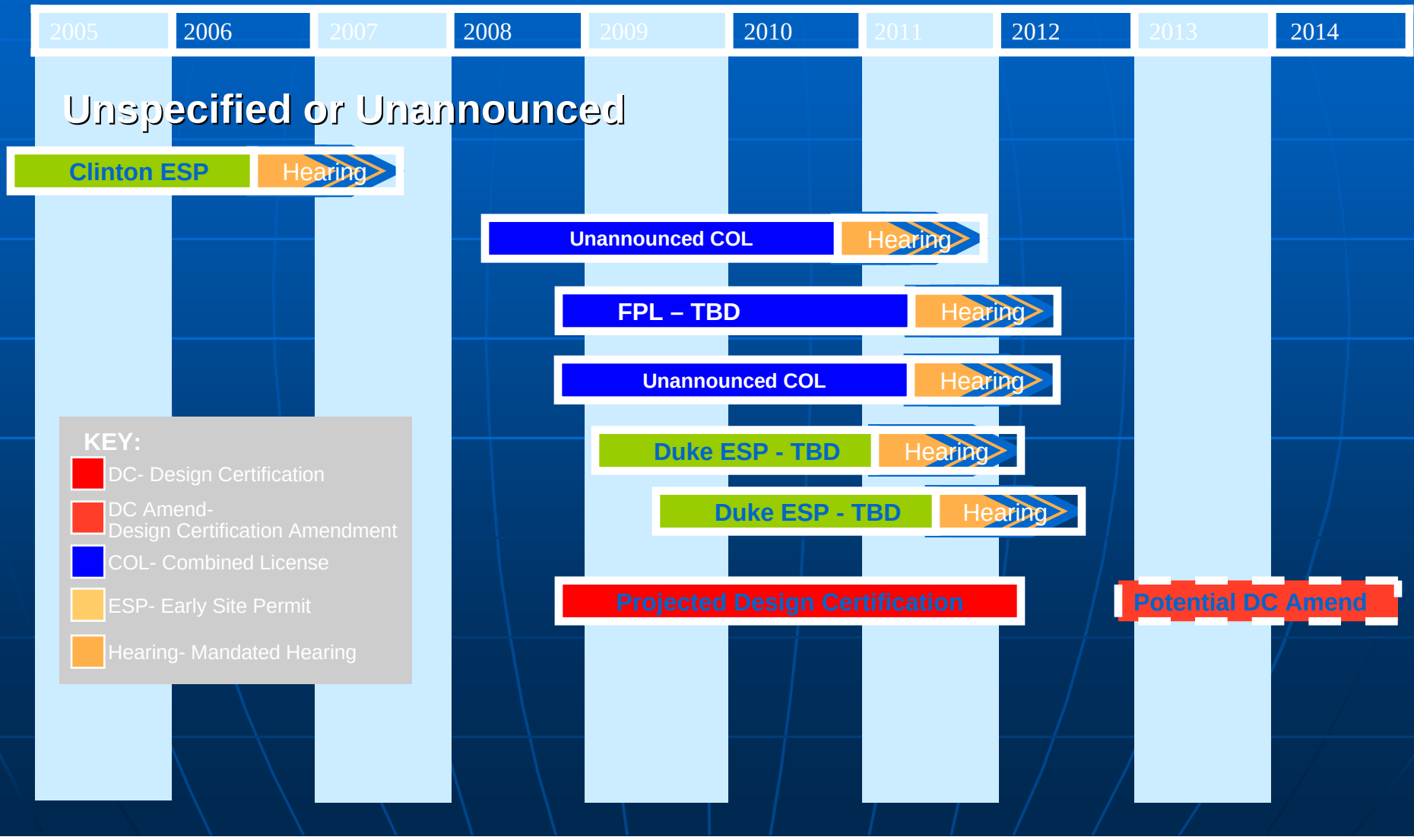
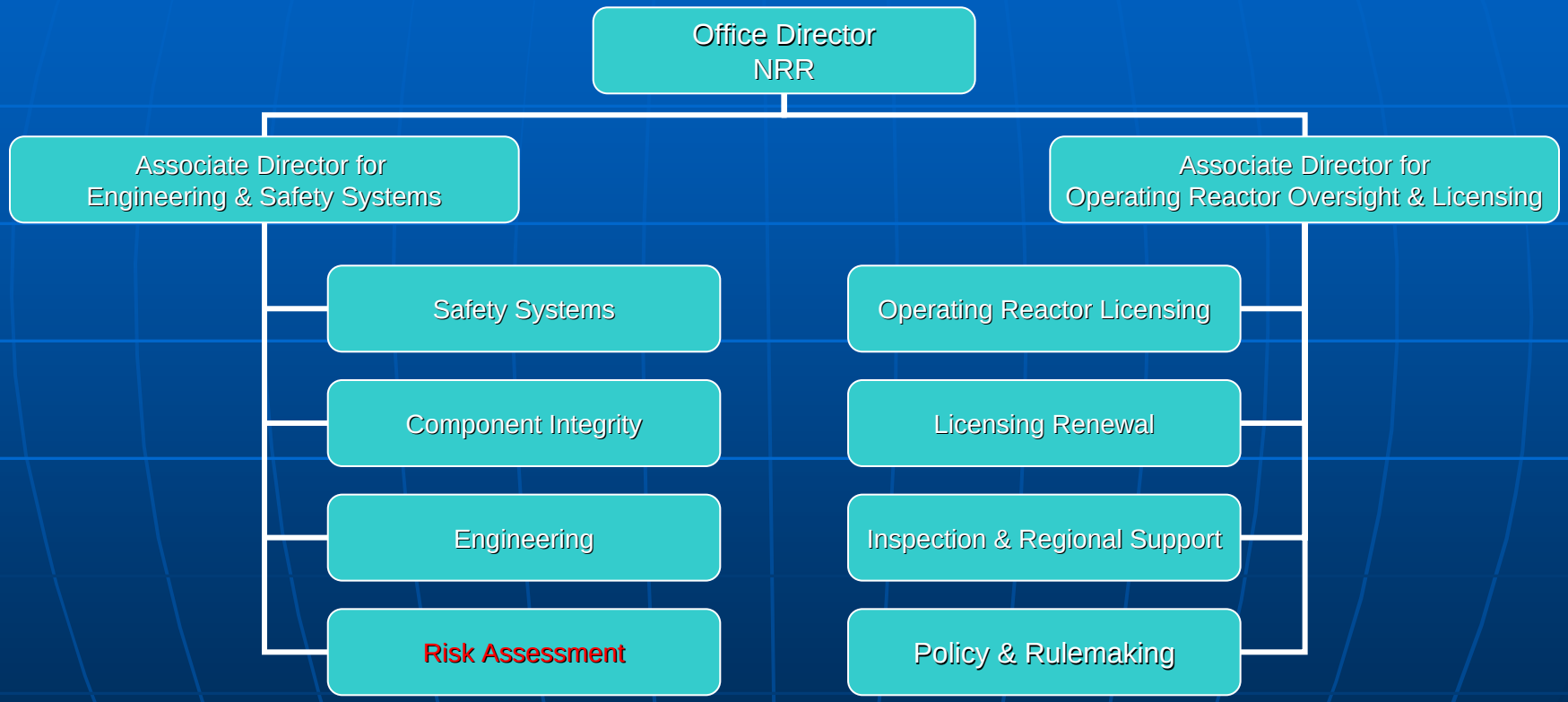


Office of New Reactors

Office of Nuclear Reactor Regulation



Risk-Informed and Performance-Based Regulations

- 50.59 – Changes, tests, and experiments
- 50.72 – Immediate notification requirements
- 50.73 – Licensee event reports
- 50.55a – Codes and standards
- 50.67 – Accident source term
- 50.65 – Maintenance rule scope
- 50.69 – Special treatment requirements
- 50.44 – Combustible gas control
- 50.48(c) – National Fire Protection Association Standard NFPA 805

Summary

- NRC is reorganizing to maintain safety focus for current reactors and to be ready to license new reactors
- Fire protection for new reactors addressed by design
- Fire protection for current reactors will remain a safety focus in NRR
- NRR is preparing to review NFPA 805 license amendments

NEI Fire Protection Information Forum

NRC High Level Plan to Bring Closure to Fire Protection Issues

Plenary 2

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August 28, 2006

NRC Participation in FPIF

- Office of Enforcement
- Office of Nuclear Regulatory Research
- Regions I, II, III, IV
- NRR – Fire Protection Branch
- NRR – Inspection Branch
- NRR – PRA Branch

Outline

1. **Regulatory Strategy**
2. **Current Status – NFPA 805 Plants**
3. **Next Steps for NFPA 805 Plants**
4. **Current Status – Non-NFPA 805 Plants**
5. **Next Steps for Non-NFPA 805 Plants**
6. **Conclusion**

Regulatory Strategy

- Clarify regulatory requirements (Generic Letters, Regulatory Issue Summaries), and inspect and enforce current rule (non-NFPA 805 plants)

- Implement the risk-informed, performance-based alternative rule (10 CFR 50.48(c) – NFPA 805)

Current Status – NFPA 805 Plants

- Selected two pilot plants.
- Received intention to adopt NFPA from 41 nuclear units.
- Issued interim inspection procedure.
- Issued Regulatory Guide 1.205 which endorses NEI-04-02.
- Issued NUREGs on acceptable methods.
- Established NEI/NRC FAQ process.
- Completed two pilot observation visits, one non-pilot workshop, and three inspector workshops.

Next Steps – NFPA 805 Plants

- Continue to support pilot observations.
- Refine regulatory infrastructure (SRP, RG Update, Inspector Procedure update, Staff development).
- Address emerging issues in a timely manner.
- Receive/Review License Amendment Requests.

Current Status – Non NFPA 805 Plants

- Withdrew Operator Manual Action Rule and issued RIS 2006-10
- Issued GL 2006-03 on Fire Barriers
- Plan to issue GL 2006-XX on Circuits
- Revised enforcement guidance

Next Steps – Non NFPA 805 Plants

- Continue to clarify expectations
- Inspect and enforce per ROP
- Receive and review request for exemptions from 10 CFR 50.48
- Receive and review request for license amendments

Conclusion

- NRC is committed to close safety and compliance Fire Protection issues.

Post-Fire Safe-Shutdown Circuit Analysis - Spurious Actuations

Plenary 3

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Fire Protection Information Forum
San Francisco, CA
August 2006

Presentation Summary

- Purpose of Issuing Generic Letter
- Background Since 1997
- Basis for Generic Letter
- Issue Clarified in Generic Letter
- Licensee Interpretations of Requirements
- Requested Information From Licensees
- Summary

Purpose of Issuing the Generic Letter

- Support Agency's program to provide clarification and closure of outstanding fire protection issues
- Clarify how the NEI/EPRI cable fire test program re-affirms regulatory requirements
- Clarify regulatory expectations for plants considering transition to NFPA 805
- Respond to licensees' request to provide clarification of regulatory expectations
- Respond to Regions' request to provide clarification of regulatory expectations for circuit inspections (resumed Jan. 2005)

Background Since 1997

- Multiple LERs identified lack of consensus concerning post-fire safe-shutdown circuit analyses, which led to a moratorium on inspection of circuit issues (1997)
- NEI/EPRI cable fire tests in 2001 demonstrated that multiple spurious actuations can occur and that they can occur in rapid succession without sufficient time for mitigation.
- Staff developed risk-informed approach to inspections to focus on risk-significant configurations (based on cable fire tests) (RIS 2004-003).
- Held public meeting in Atlanta to discuss staff positions and solicit stakeholder feedback (2004).

Background Since 1997 (Cont.)

- Worked with NEI to finalize an acceptable industry guidance document for circuit analysis (NEI 00-01) (2005).
- Issued RIS 2005-30 to clarify regulatory requirements for circuit analyses. Addresses “associated circuits,” “any-and-all,” and emergency control stations.
- Draft GL issued for public comment (October 2005)
- Public meeting held (March 2006).
- Pertinent public comments incorporated into final draft GL.
- Received CRGR and ACRS approval to issue the GL.

Basis for Generic Letter

- Review of NRC regulations, generic communications, correspondence, etc., related to this issue (references are identified in the GL).
- Results of NEI/EPRI cable fire test program.
- Input from inspectors on issues that need to be addressed.

Issue Clarified in Generic Letter

- 10 CFR 50.48 and 10 CFR Part 50, Appendix A, GDC 3, require that one safe shutdown train or success path be maintained free of fire damage for any fire event.
- It has not been demonstrated that fire-induced failure of circuits will not cause multiple spurious actuations and that those actuations will not occur in rapid succession or simultaneously.
- Industry testing has demonstrated that in certain circumstances, multiple spurious actuations occurring in rapid succession is a highly probable event.
- Consequently, post-fire safe-shutdown circuit analyses must address the potential for this type of failure and protect cables accordingly.

Issue Clarified in Generic Letter (Cont.)

- The staff position on multiple spurious actuations presented in the GL is consistent with Section 9.5.1 of the Standard Review Plan.
- Fire protection regulations do not limit the number or frequency of possible spurious actuations.
- Generic Letter does not constitute a backfit except for plants with SER that specifically allows deviations

Licensee Interpretations of Regulatory Requirements

- Some licensees claimed that only a single spurious actuation need be assumed per fire event.
- Some licensees claimed that multiple spurious actuations occur with sufficient time between actuations to take mitigating actions, such as operator manual actions.
- These interpretations are not permitted by the regulations and were demonstrated to be incorrect by the cable fire test program.

Requested Information from Licensees

- Within 90 days, evaluate licensing basis and information in GL regarding multiple spurious post-fire safe-shutdown circuit analyses. Conclude whether the NPP is in compliance with regulatory requirements.
  - Submit description of the licensing basis regarding multiple spurious post-fire safe-shutdown circuit analyses.
  - Include conclusion regarding compliance with the regulatory requirements described in the GL.

Requested Information from Licensees (Cont.)

- Within 6 months, submit the plan and schedule to establish compliance with regulatory requirements for the affected SSCs.
- Within 30 days, provide notification if cannot meet requested completion date (state why and proposed schedule/course of action).

Summary

- Regulations require that one safe-shutdown train be maintained free of fire damage in the event of a fire.
- Industry cable fire test program re-affirmed staff interpretation of regulatory requirements.
- The GL was issued to clarify regulatory expectations with respect to multiple spurious actuations.
- The GL is necessary to ensure that all risk-significant circuit situations are identified and addressed.

NFPA 805 Transition
Regulatory Perspective
Plenary 4

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NFPA 805 Transition

- Past
- Present
- Future

Transition Over the Past Year

- 08/05 – Pilot Kick-Off Mtg @ RII
- 08/05 – FPIF – 12 Units Transitioning
- 09/05 – NUREG/CR-6850 (EPRI 1011898) Published
- 10/05 – RII Inspector Workshop
- 11/05 – NEI 04-02, Rev. 1, Published
- 11/05 – Pilot Observation Visit @ Duke HQ
- 12/05 – ED Deadline – 41 Units Transitioning
- 01/06 – NUREG-1824 (EPRI 1011999) Draft for Public Comment
- 02/06 – RIV Inspector Workshop
- 03/06 – RIC Presentation w/ DRA, NEI, & PE
- 03/06 – 805 Public Workshop @ NRC HQ
- 03/06 – Pilot Observation Visit @ Progress HQ
- 04/06 – Revised Enforcement Policy – 3 Years Discretion
- 05/06 – Reg. Guide 1.205 Published
- 05/06 – Fire PRA Methodology Training @ NRC HQ
- 06/06 – ANS Conference in Reno, NV (Session on Fire Modeling)
- 07/06 – FAQ Kick-Off Mtg @ NRC HQ
- 07/06 – 805 Pubic Workshop @ AEP
- 07/06 – RIII Inspector Workshop
- 08/06 – FAQ Monthly Public Mtg – Conference Call

Transition - Present

- 41 Units Committed
- 30 Units Actively Transitioning
- Monthly FAQ Public Meetings
- 10/06 – Pilot Observation Visit @ Oconee
- 10/06 – Public Meeting @ Oconee
- 11/06 – Pilot Observation Visit @ Harris
- 11/06 – Public Meeting @ Harris
- 11/06 – ANS Conference in Albuquerque, NM (session on NFPA-805 transition experience)

Transitioning - Future

- Monthly FAQ Public Meetings
- Pilot Observation Visits
- 805 Public Workshops
- ANS Fire PRA Standard
- NEI Fire PRA Peer Review Guide
- NEI 04-02 & RG 1.205 Revisions
- Ongoing Research

NFPA 805 Transition
Communication is the Key
Plenary 5

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NFPA 805 Transition

- Communicate Lessons Learned
- 805 Public Workshops
- Frequently Asked Questions (FAQ) Program

Communicate Lessons Learned

- November Observation Visit Trip Report
  - Meeting Minutes, Handouts & Parking Lot
- March Observation Visit Trip Report
  - Meeting Minutes, Handouts & Parking Lot
  - Issue Summary Sheets

805 Public Workshops

- NRC HQ (3/06)
- AEP (7/06)
- In response to requests for more pilots
- Meetings at the Sites or Regional Offices
- Provide communication opportunities with Licensees and Regional Inspectors
- Discuss progress and issues

Frequently Asked Question (FAQ) Program

- Based on the MSPI Program
- Formal process w/ submittal template
- NEI Task Force pre-screens the issues
- Monthly public meetings or conf. calls
- NEI 04-02 revision w/ finalized issues
- RG 1.205 revision to endorse NEI 04-02

NRC Transition Mission

- Prepare regulatory documentation, properly communicate and assist Licensees in their transitioning to a new NFPA 805 licensing basis.

PRA QUALITY REQUIREMENTS FOR RISK-INFORMED NFPA-805 FIRE PROTECTION PROGRAM CHANGES

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NEI Forum
Plenary Session Six
August 28-31, 2006

PRA QUALITY – NFPA-805 IMPLEMENTATION GUIDANCE

- NFPA-805, “Performance-Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants,” February 9, 2001.
  - General discussion in 2.7.3.1 that “Each analysis, calculation, or evaluation performed shall be independently reviewed”
  - Discussion in (unendorsed) appendix D.5 consistent with RG 1.174, i.e., "high quality in the area of application”
- RG 1.205, “Risk-informed, Performance-based Fire Protection For Existing Light-water Nuclear Power Plants,” May 2006
  - Refers to RG 1.174, RG 1.200, and future ANS standard
- NEI-04-02, “Guidance for Implementing a Risk-informed, Performance-based Fire Protection Program under 10 CFR 50.48(c),” September 2005
  - General discussion in 5.1.3 that RG 1.174, NUREG/CR-6850, and future ANS standards should be referenced as acceptable standards and processes

PRA QUALITY PROCESS

- Acceptable quality of a PRA is determined for each application based on what is important/used to support the application
  - Quality includes scope of analyses and technical adequacy
- An independent review characterizing the PRA against a set of elements should be completed before any application (Peer Review)
- Licensees should identify the PRA characteristics supporting the specific application and resolve all important issues identified during the independent review.
- Licensees should also describe, and be ready to defend, any application specific techniques used to estimate the change in risk for each application.

ROUTINE STAFF PRA QUALITY REVIEWS

- Peer review reduces but does not eliminate the staff review of PRA
  - Staff will normally request licensee submit all observations (including self assessment or gap observations) and resolution of these observations
  - Submitting only those observations thought to apply to the submittal may result is a request to review the justification for excluding some observations
- Given that a peer review has been completed, the staff review concentrates on:
  - Reasonableness of resolution of review observation emphasizing those that might affect the regulatory decision
  - Reasonableness of PRA model parts that might be highly important to a specific decision even if there are no review observations
  - Acceptability of specific methods used to evaluation the change in the CDF and LERF estimates that affect the regulatory decision

DEMONSTRATING PRA QUALITY FOR NFPA-805 APPLICATIONS

- All applicants except the two pilot plants will have to perform an independent review of the PRA analyses used to support NFPA-805 risk-informed applications
- Upon endorsement of ANS standard, Licensees should have their fire PRA analyses Peer Reviewed by an independent team against the ANS standard
- If NEI guidance is developed and used that is not consistent with the endorsed version of the ANS Standard, a self-assessment of the difference will eventually be necessary (as with internal events)
- It has not yet been determined whether the review of NFPA-805 license applications will be similar to the current review process or will, for example, involve a site audit for each submittal

NEI Fire Protection Information Forum

Fire Protection Enforcement Discretion

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August 28-31, 2006

Enforcement Discretion

- NRC Enforcement Manual Section 8.1.7.1, Fire Induced Circuit Failures
- Discretion granted with the withdrawal of the Post-Fire Operator Manual Actions Proposed Rule (71FR11169)
- NFPA 805 for plants which adopted NFPA 805, before December 31st 2005 (71FR19905)(NRC Enforcement Policy)
- NFPA 805 for plants which adopt NFPA 805, after December 31st 2005 (71FR19905)(NRC Enforcement Policy)
- Discretion considered with the proposed issuance of the GL on Circuits

Section 8.1.7.1 of Enforcement Manual

- Applicable to circuit issues and operator manual actions relating to circuit issues
- Applicable to NFPA 805 plants and Non-805 plants
- Provides discretion, if the licensee adopts compensatory measures
- Will be terminated in September 2006

Discretions Granted With the Withdrawal of the Operator Manual Actions Rulemaking

- Non-compliances must be entered in the corrective action program by Sept 6, 2006
- Corrective actions must be initiated by September 6, 2006
- Corrective actions must be completed by March 6, 2009
- Does not apply to NRC identified (after September 6) non-compliances unless the plant is transitioning to NFPA 805

NFPA 805 Discretion For Plants Which Adopted NFPA 805, Before December 31st 2005

- Addresses existing and self-identified or NRC identified non-compliances during the three year transition period.
- Continues during staff review of license amendment request
- Does not apply to Severity Level 1 and willful violations or potentially RED SDP findings
- Does not apply to non-compliances that should have been identified by routine licensee efforts such as normal surveillances or quality assurance activities

NFPA 805 Discretion For Plants Which Adopt NFPA 805, After December 31st 2005

- Self-identified or NRC identified non-compliances during the three year transition period.
- Continues during staff review of license amendment request
- Does not apply to Severity Level 1 and willful violations or potentially RED SDP findings
- Does not apply to non-compliances that should have been identified by routine licensee efforts such as normal surveillances or quality assurance activities

Conclusion

- Fire Protection Enforcement Discretion is in place to provide licensees a reasonable amount of time to identify noncompliances, implement compensatory measures and initiate and complete corrective actions
- NRC is committed to resolve safety and compliance fire protection issues.

10 CFR Part 50.48(c) TRANSITION INSPECTION

FIRE PROTECTION INFORMATION FORUM 2006

PETER KOLTAY NRC

REACTOR INSPECTION BRANCH

Topics

- Inspection Procedure 71111.05TTP
- Inspection Procedure 71111.05T
- Assessment Discretion

Inspection Procedure 71111.05TTP

- Change in Scope
  - Circuit Configurations
  - Manual Actions

What will be inspected 71111.05TTP?

- All Infrastructure
- Administrative Programs
- Shutdown Capability (Including Alternate Shutdown)
- Compensatory Measures
- PI&R

What Will Not Be Inspected?

- Cable/Circuit Separation
- Circuit Analyses

Inspection Procedure 71111.05T

- Change in scope:

  Integrate inspection guidance for Manual Actions

- What will be inspected:

  Feasibility of Manual Actions implemented as compensatory measures while the underlying performance deficiency is corrected

Compliance with 10 CFR Part 50, App. R, IIIG2, or other plant specific licensing requirements

Assessment Matrix Discretion

- NFPA 805 In Transition
  - IMC 0305.06.06.a.2
    - Tracking process
      - NOT RED
      - Operability evaluation
      - Compensatory Measures

Discretion Type	805pre 12/05	805post 12/05	Not 805
805 3Year Transition Period	Yes	Yes	No
Pre-existing 805 Issues	Yes	NO	NA
Manual Actions first 6 months	Yes	Yes	Yes
Manual Actions Next 2 ½ years No Multiple Spurious	NA	NA	NO
Manual actions Next 2 ½ years Multiple Spurious	NA	NA	Maybe GL

Operator Manual Actions

Plenary 10

Daniel M Frumkin
Fire Protection Branch/NRR
NEI Fire Protection Forum

August 27-31, 2006

Objectives

- Background
- Closure Plan
- Enforcement Discretion
- Compensatory Measures
- Operator Manual Actions Criteria
- Next Steps

Background

- Why was rulemaking initiated?
  - Efficiency and effectiveness by reducing exemption requests for the use of operator manual actions.

- What was rule making canceled?
  - Claims that the requirement for fire suppression in the proposed rule will still require numerous exemptions and would not meet our rulemaking purpose of efficiency and effectiveness

Background (Continued)

- SECY-06-0010 sent to Commissioners (ML053350238)
- February 2006 - Commissioners issued the staff requirements memorandum (SRM-SECY-06-0010) (ML060390744) approving withdrawal of the proposed rule
- What did the SRM say?
  - commission continues to support risk-informed, performance-based option for closure to FP issues
  - directs the staff to engage industry regarding their plans for exemption requests
  - agrees that enforcement discretion is appropriate for licensees who initiate corrective actions within 6 months of the withdrawal of the proposed rule provided they complete the actions no later than 3 years from the date of the rulemaking withdrawal FRN (March 6, 2006)
  - staff should update SRP 9.5.1 Fire Protection

Closure Plan

- Elements of the closure plan:
  - Regulatory Issues Summary (RIS)
  - IP71111.05T revisions
  - Enforcement discretion
  - Scheduled inspections
  - New NUREG
  - SRP section 9.5.1 update

Closure Plan (Continued)

- Regulatory Issues Summary (RIS)
  - compliance expectations with respect to operator manual actions
    - Appendix R plants
    - non-Appendix R plants
  - means to achieve compliance
    - III.G.2 (a), (b), or (c)
    - III.G.3
    - 10 CFR 50.48(c) - NFPA 805
    - Exemptions
  - termination date for the current EGM (See Enforcement Manual Chapter 8.1.7.1), September 6, 2006
  - replace with new EGM

Closure Plan (Continued)

- IP 71111.05T revisions
  - remove references to manual actions rulemaking
  - use of manual actions in lieu of III.G.2. (a), (b), or (c) without requesting exemption does not correct the underlying performance deficiency and will not be accepted as final corrective action. Therefore, in accordance with the existing process, the inspectors will characterize the underlying performance deficiency and apply the appropriate SDP steps to determine significance
  - keep operator manual actions inspection criteria for inspector determination of feasible manual actions used as compensatory measures
  - a manual action that does not meet the criteria of IP 71111.05T is not an acceptable compensatory measure

Closure Plan (Continued)

- Scheduled inspections
  - continue with triennial fire protection inspections to verify compliance with the regulations
- New NUREG
  - out for public comment
  - internal staff guidance for determining feasible and reliable operator manual actions when credited and approved as part of future exemption requests
  - takes advantage of the criteria developed as part of the proposed rule and as detailed in the draft RG
  - expect a draft in fall 2006 for public comment
  - final in 2007
- SRP section 9.5.1 update
  - revision referencing new NUREG
  - circuits (RIS 2005-30 and GL 2006-xx)
  - final in 2007

Enforcement Discretion

- Enforcement discretion
  - SRM ”...enforcement discretion is appropriate for licensees that initiate corrective actions within 6 months of withdrawal of the proposed rule...”
  - FRN “...NRC expects timely completion...not to exceed three years from the date of this Federal Register Notice”
  - FRN: terminate EGM 98-02, 6 months from the date of the FRN
  - ‘initiate corrective actions’.....propose and prioritize the corrective action(s), develop an action and implementation plan, and place the actions in the corrective action program and schedule

Compensatory Measures

- Operator Manual Actions Used as Compensatory Measures
  - IP 71111.05T
  - RIS 2005-07
  - in many cases a manual action, which has received a proper licensee evaluation, is a better compensatory measure than is use of an hourly fire tour

Operator Manual Actions Criteria

- Universe of criteria
  - DG-1136 (withdrawn rulemaking)
  - IP 71111.05T (compensatory measures)
  - NEI 04-02 (NFPA 805 plants)
  - Fire Protection SDP (failure probability)
  - New NUREG (future licensing actions)

Next Steps

- Continue with inspections - ‘transitioning to NFPA 805' plants or traditional plants
- Maintain the course; we do not intend to create a third option for compliance
- Enforcement discretion changes
- Issue GL on circuits (August 2006)
- NRR is planning resources for potential exemption requests

Current Fire Research Activities at US NRC Office of Nuclear Regulatory Research (RES)

Plenary 11

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Major Areas of Fire Research

- Fire Modeling
- Fire PRA
- Low-Power Shutdown-Risk
- Operator Manual Actions
- Electrical Cable Response to Fire (CAROLFIRE)
- International Projects

Why is Fire Modeling Important?

- The use of fire models is becoming increasingly important in a risk-informed, performance-based regulatory environment
- NFPA 805 Section 2.4.1.2 (10CFR50.48(c))
  - "The fire models shall be verified and validated."
  - "Only fire models that are acceptable to the authority having jurisdiction shall be used..."
  - "Fire models shall only be applied within the limitations of that fire model."
- Significance Determination Process may use deterministic models in Phases II and III
- Deviation/Exemption requests from licensees may use deterministic models

4 Major Fire Modeling Activities

1. NRC/RES and EPRI conducted a verification and validation (V&V) study for selected state of the art fire modeling tools
   - NIST is also an important partner
2. Preparing to develop Fire Modeling User's Guide for nuclear power plant applications
3. Developing cable damage sub-models in conjunction with cable testing (CAROLFIRE)
4. Preparing to develop a Phenomena Identification and Ranking Table (PIRT)

Fire Model V&V Study

- Partnered with EPRI and NIST
- 5 models
  - NRC's NUREG-1805, FDT^S
  - EPRI's FIVE-Rev.1
  - EdF's MAGIC
  - NIST's CFAST
  - NIST's FDS
- 13 parameters, 26 different experiments
- ASTM E1355
- Draft NUREG-1824, Vols. 1-7
- Final report in Early 2007

Fire Model V&V (cont.)

- This study IS a systematic evaluation of predictive capabilities of models using specific experimental data
- This study IS a resource to be used when evaluating modeling analyses
- This study IS NOT a model user's guide or technical manual
- This study IS NOT a checklist for reviewers/inspectors
- Advancing the "state of the art"
  - Quantified accuracy of models relative to experimental data
  - Quantified uncertainty in experiments and model input
  - Identified errors and areas for improvement in each model

Fire Modeling User's Guide

- Partner with EPRI, with involvement from NRC Office of Nuclear Reactor Regulation (NRR)
- Starting point is current EPRI Report 1002981 "Fire Modeling Guide"
- Provide guidance that addresses unique construction/hazards of NPPs
  - Selecting the right tool
  - Making the right assumptions
  - Identifying model limitations
  - Documenting a fire modeling analysis
- Examples of how NUREG-1824 should be used
- Integration of fire modeling in NUREG/CR-6850 analyses
- Work to be performed in 2007

Reducing Fire Model Uncertainty - Cable Thermal Response Model

- Cable tests conducted to determine likelihood of hot shorts for certain configurations (RIS 2004-03 Bin 2 items)
- Performed as a sub-task in CAROLFIRE
- Large amount of experimental data on temperatures, heat fluxes, and circuit conditions
- Data will be used to develop model of cable response and failure during fire exposure
- Reduce uncertainty in predicting cable failures resulting from fires
- Final report in Early 2007

Fire Model PIRT

- Phenomena Identification and Ranking Table (PIRT)
- Structured expert-elicitation process
- Focus on important scenarios
- Identify fire phenomena present in those scenarios
- Determine level of knowledge of the phenomena
- Rank the phenomena in terms of importance and level of knowledge
- Use to prioritize future research
- Major meetings will be held in public forum
- Project performed in 2007

Fire PRA

- NUREG/CR-6850 EPRI 1011989 “Fire PRA Methodology for Nuclear Power Facilities”
  - Joint NRC/RES and EPRI Project
  - Completed Two Public Workshops
  - Plan to Update Report (on as-needed basis)
    - User Lessons Learned
    - Advancements in State-of-the-Art
- ANS Fire PRA Standard
  - RES Participating in Process

Operator Manual Actions

- Draft NUREG-1852 “Demonstrating the Feasibility and Reliability of Operator Manual Actions in Response to Fire”
  - Make expectations clear with respect to Operator Manual Actions
  - Expected to be available Summer/Fall ’06 for Public Comment period
  - Expect Final NUREG to be Issued in 2007

Low Power Shutdown Risk

- NRC/RES and EPRI joint project
- Project just starting
- Attempt to Maximize Industry Database for Shutdown Conditions
- Developing both Quantitative and Qualitative Methods
- Project expected to be performed in 2007

Cable Response to Live Fire (CAROLFIRE)

- Goals of the Project
  - Resolve Bin 2 Items of RIS 2004-03
  - Reduce Uncertainty of Electric Cable Response to Fire Conditions in Fire Models
- Approximately 125 Fire Tests
  - Small Scale Testing of Individual Cables
  - Intermediate Scale Testing of Grouped Cables in Cable Tray Configurations

CAROLFIRE (cont.)

- Testing variety of Cable Types used in Industry
- Cable Selection Criteria
  - Thermoset and Thermoplastic Cables
  - “Best” “Worst” “Most Common” Cable Construction of each Cable Family
- Testing in Process at Sandia National Labs
- Final Reports expected early in 2007

International Fire Research Projects

- Continuing to participate in International Collaboration Fire Model Project (ICFMP)
- Continuing to participate in OECD Fire Events Database Project
- Participating in the Start-Up of an International Program to Study High Energy Arching Faults (HEAF)

Conclusion

- NRC/RES has a number of ongoing Fire Research Programs that support the Agency in accomplishing its Mission
- NRC/RES partnering with National and International Partners when possible to accomplish these Projects.
- NRC/RES Fire Research Program benefit's all Stakeholders.

Fire Protection for New Reactors

Plenary 12

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August 2006

Presentation Summary

- Regulatory requirements for new reactor fire protection programs
- Current status of fire protection program reviews
- Guidance document for COL applications
- Focus of staff review of new reactor fire protection programs
- Risk considerations for new reactors
- Fire PRA requirements
- Summary

Regulatory Requirements for New Reactor Fire Protection Programs

- Current fire regulations and guidance will apply – enhanced per SECY-93-087/90-016
- SRP 9.5.1 and RG 1.189 are being revised to include guidance for new reactor FPPs – planned to be issued for use and comment in 1st quarter of 2007
- Safe shutdown definition will be amended to include plants with passive shutdown systems

Enhanced Fire Protection

- Required for all new LW reactors
- Ensure safe shutdown assuming all equipment in any one fire area (excluding control room and containment) will be rendered inoperable by fire and that re-entry is not possible for mitigation
- Ensure that smoke, hot gases, or the fire suppressant will not migrate into other fire areas to the extent that safe shutdown could be adversely affected

Current Status of FPP Reviews

- Standard Designs have been certified by the NRC for the ABWR and AP600 reactors
- Standard Designs for AP1000 and ESBWR are in review process
- Others, including EPR and US-APWR, are expected

Guidance Document for COL Applications

- DG-1145, “Combined License Applications for Nuclear Power Plants (LWR Edition)”
- Have held 6 public workshops on development of DG – 7th scheduled for September 6-7th
- Planned to be issued in 1st quarter of 2007
- Format follows NUREG-0800, SRP

NFPA 804 – Standard for ALWRs

- Provides acceptable guidance when used in conjunction with NRC regulations and guidance – not formally endorsed by NRC
- Deterministic approach to FPP
- NFPA 806 is in preparation for risk-informed, performance-based FPP for new reactors

Focus of NRC Review of New Reactor FPPs

- Train separation is the most important protection against fire
- Consequently, staff review will focus on:
  - Identification of post-fire SSD equipment and circuits and assignment to specific trains
  - Definition of separation and design assumptions
  - Design, certification, installation and maintenance program for separation barriers
- CIP will verify that design is implemented properly (e.g., cable routing and penetration seal installation and closure)

Risk Considerations for New Reactors

- Overall maturity of fire protection regulation, nuclear plant operation, and analysis methods and the opportunity to incorporate the benefits in the original plant design will greatly enhance new reactor plant safety
- Enhanced fire protection concept and fully-separated 4-train designs reduce the safety significance of fire detection/suppression systems, fire brigade response, and other aspects of the fire protection program
- Use of fiber optics will greatly reduce risk of hot shorts and spurious actuations as well as reduce combustible loading

Risk Considerations for New Reactors (Cont.)

- Use of digital control systems greatly reduces the number and size of electrical cabinets in the control room.
- Enhanced fire protection approach should greatly reduce the importance and scope of contentious fire protection issues such as operator manual actions and multiple spurious actuations.
- The concept of alternative/dedicated shutdown systems widely used in current reactors, should be virtually eliminated for new reactors (except for a control room fire).

Risk Considerations for New Reactors (Cont.)

- Reactors with passive shutdown systems have reduced combustible loading, reduced ignition sources, and reduced potential for fire-induced equipment failure.
- ABWR and ESBWR design plants have no external reactor coolant pumps, eliminating a major fire hazard inside containment
- The increased level of passive protection reduces the potential risk due to delaying application of water to electrical fires

Fire PRA Requirements

- A detailed fire PRA is not necessarily required for a new reactor
- However, if a licensee references a certified design and if that certified design developed a fire PRA, then the COL applicant, per proposed 52.80(a), is to use that PRA
- A licensee that has a risk-informed, performance-based fire protection program or that plans to evaluate plant changes using a risk-informed approach must have a detailed fire PRA
- The minimum requirement for fire risk assessment for a new reactor that does not need a detailed fire PRA is a FIVE type analysis. If fire is a significant contributor to plant risk, then a detailed fire PRA is required.

Summary

- Current regulations and guidance, with enhancements, are applicable to new reactor FPPs
- DG-1145 will provide guidance for COL applications
- NRC review will focus on train separation
- New reactor fire risk should be greatly reduced
- Fire PRA will be required for most plants

Current Compliance

Plenary 13

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August 2006

Presentation Summary

- Current compliance
- Risk implications
- Future issues
- Summary

Current Compliance

- Each licensee has an approved fire protection program, and fire protection licensing basis.
- Generic communications or new research information does not change the current licensing basis.
- In cases where the current licensing basis is incomplete or unclear, the staff will pursue new issues to the extent permitted by the regulatory process.

Current Compliance

- Information is being collected or has been collected on the following issues:
  - Circuit failure modes and likelihood
  - Manual operator action feasibility and reliability
  - Hemyc and MT fire barriers
  - Energetic electrical faults
- This information will be considered in staff reviews and inspections

Risk Implications

- With many plants performing fire PRAs in support of 10 CFR 50.48(c), NFPA 805 transition, additional plant vulnerabilities may be identified.
- The same inspectors that inspect NFPA 805 plants inspect non-805 plants.
- Risk significant vulnerabilities at non-805 plants may be identified by inspectors and entered into the Reactor Oversight Process (ROP)

Future Issues

- Other fire protection issues are likely to come up, for example, US and international research is ongoing.
- Current fire protection programs have the capability to manage new issues.
- Although NFPA 805 is intended to allow new issues to be dealt with more efficiently, NFPA 805 is not required

Summary

- Knowledge gained from NFPA 805 PRAs will be applied to non-805 plants to identify vulnerabilities.
- New issues will arise that are not considered under CLB.
- CLB is able to manage new issues, although perhaps not as efficiently as 805 licensing basis.

NEI Fire Protection Information Forum

The Future:

Is There a Stable and Predictable Regulatory Process for Fire Protection?

Plenary 14

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August 28-31, 2006

YES, If

- NFPA 805 Pilot Process is used to identify, disposition, and document emerging issues.
- NRC continues to identify areas where regulatory expectations are not clear, and continue to use the the appropriate regulatory tools and processes to clarify and enforce those expectations.

YES, If (continued)

- NRC staff seeks solutions to emerging issues with a concern on undue burdens to licensees.
- Licensees propose solutions to emerging issues with a recognition of NRC's commitment to safety.
- NRR, Regions, and Licensees continue communications to have a common understanding of regulatory expectations.

Yes, If

- ?
- ?
- ?
- ?
- ?

Conclusion

- NRC is committed to close safety and compliance Fire Protection issues and establish regulatory stability for all plants.