COMMISSION BRIEFING SLIDES/EXHIBITS

BRIEFING ON RISK-INFORMED,

PERFORMANCE BASED REGULATION

FEBRUARY 4, 2009

Risk-Informed Regulation Industry Perspective

US Nuclear Regulatory Commission

February 4, 2009

Bill Levis, PSEG Nuclear, LLC

Tony Pietrangelo, NEI

NEI

Overview

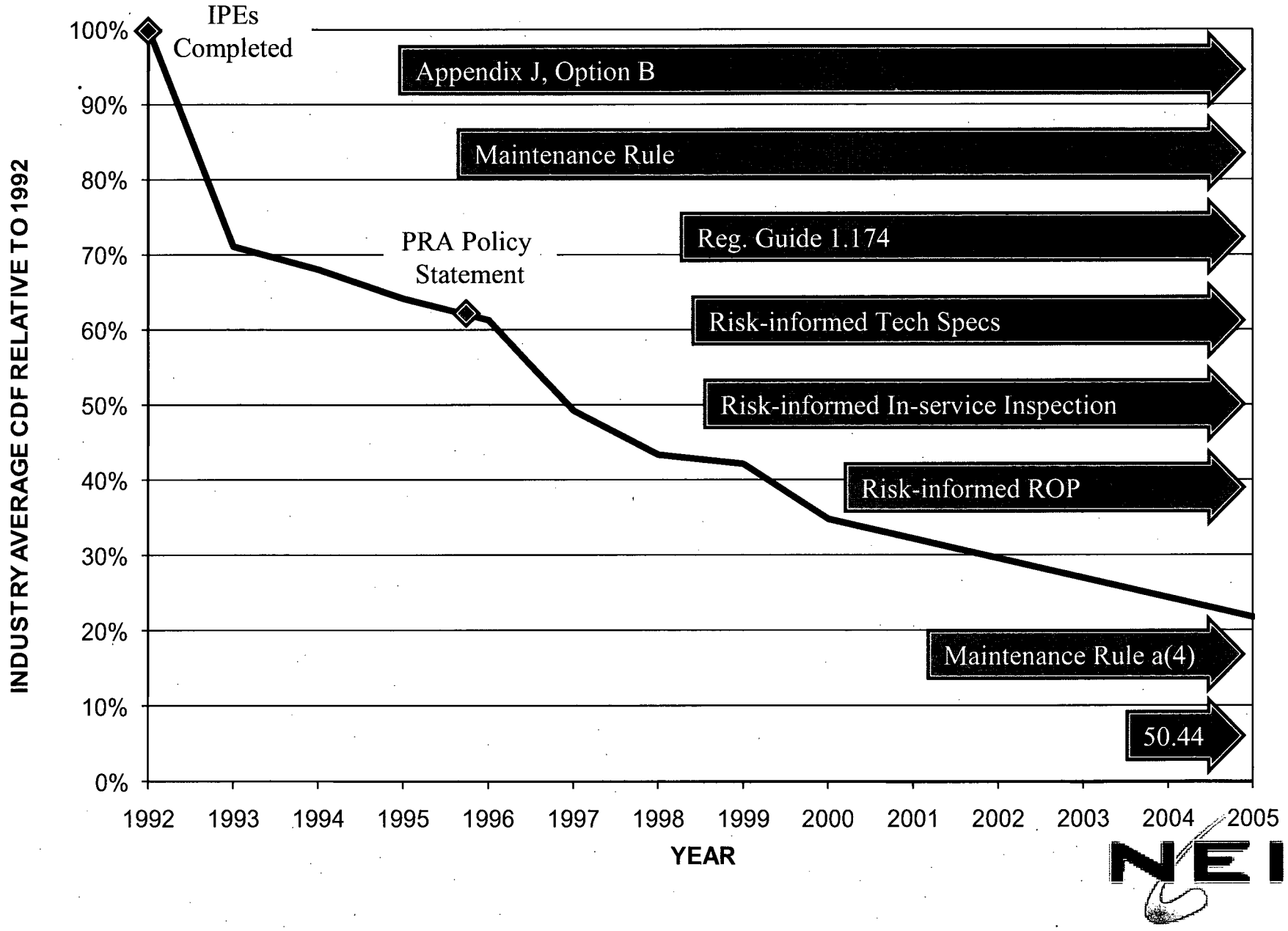
- Risk-Informed Regulation Perspective
- Successes
- Challenges
- Industry Priorities - 2009
- NRC PRA Policy Statement
- Conclusion

Risk-Informed Regulation

- NRC has been a world leader in the use of risk methods
  - Safety goal policy statement
  - PRA policy statement
- Risk is ingrained into plant operation and culture
  - Safety benefits have been demonstrated

Successes

- Outage risk management
- Containment leak rate testing intervals
- Maintenance Rule
- Risk-informed Inservice Inspection
- Reactor Oversight Process
- Mitigating Systems Performance Index
- Technical Specifications reform
- Combustible gas control rulemaking


IPEs Completed
PRA Policy Statement
Appendix J, Option B
Maintenance Rule
Reg. Guide 1.174
Risk-informed Tech Specs
Risk-informed In-service Inspection
Risk-informed ROP
Maintenance Rule a(4)
50.44
INDUSTRY AVERAGE CDF RELATIVE TO 1992
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
1992
1993
1994
1995
1996
1997
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1999
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2003
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2005
YEAR

Challenges

- Demonstrating progress on essential rulemakings that were intended to achieve a risk-informed regulatory framework
- Expectations for PRA scope and pedigree are outpacing industry infrastructure
- Separating deterministic mindset from risk analysis

Challenges

- Ensuring NFPA 805 is implemented in a technically sound manner
  - Extremely complex risk application
  - Fire PRA technology is maturing as quickly as practicable but is still evolving
  - Need to do it once and do it right

Industry Priorities

- Meeting NRC Regulatory Guide 1.200 Revision 1 for internal events PRAs
- Developing realistic Fire PRAs suitable for NFPA 805 and other risk applications
- Achieving expected improvements in the focus of Part 50
  - Large Break LOCA
  - Special Treatment Requirements

Industry Priorities (Continued)

- Maintaining and improving current successful uses of PRA (ROP, MSPI, online maintenance)
- Ensuring adequate PRA infrastructure
  - Substantial training activities underway
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Commission's PRA Policy Statement

- *"Use of Probabilistic Risk Assessment Methods in Nuclear Regulatory Activities," 8/16/1995*
- Four main statements:
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  - Use PRA both to **reduce unnecessary conservatism** in current requirements and to support proposals for additional regulatory requirements
  - Be as **realistic** as practicable
  - Consider **uncertainties** appropriately when using the Commission's safety goals and subsidiary numerical objectives

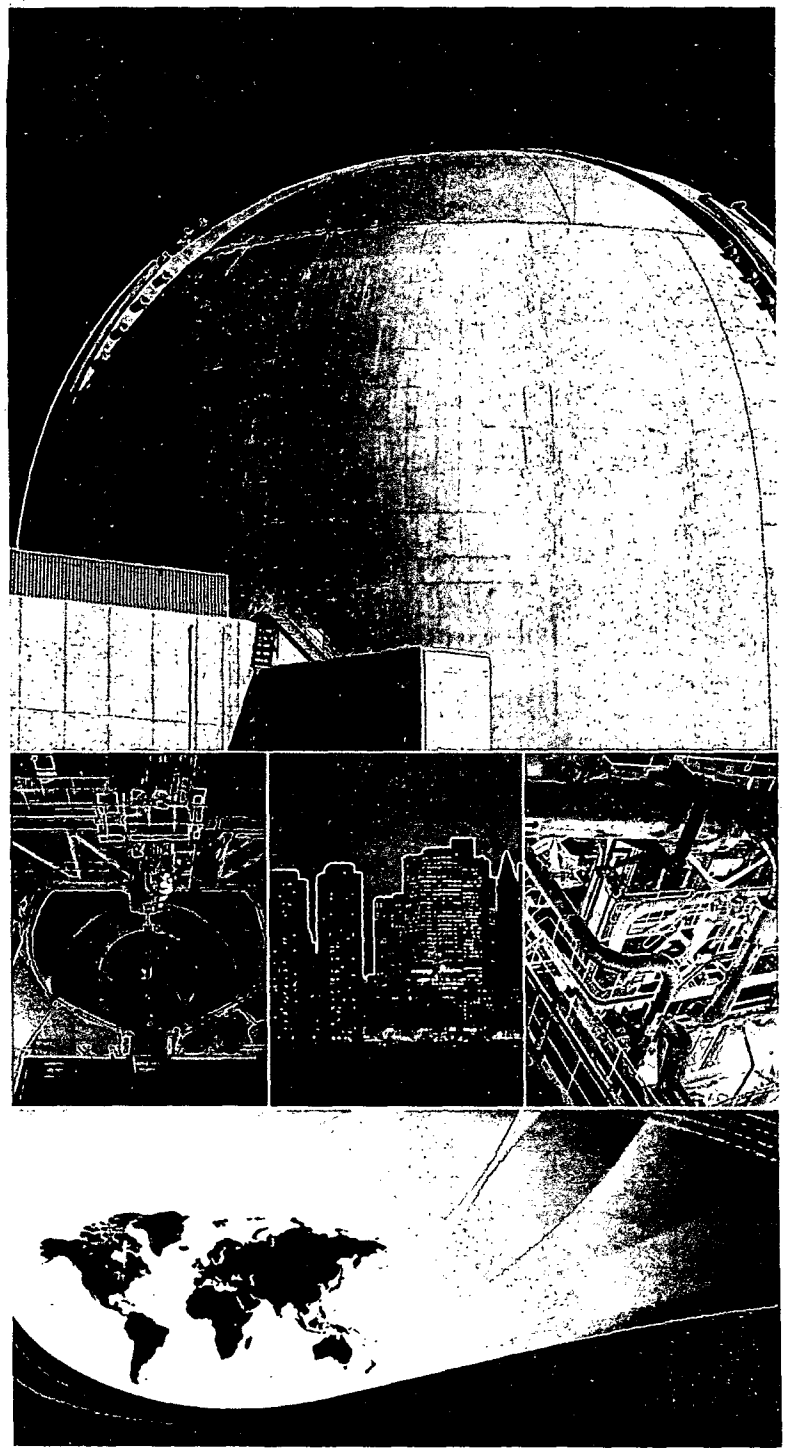
NEI

Conclusion

- We're not done
- Without risk-informing Part 50 itself, improvements to safety will be limited
- Commission leadership is essential to achieving significant improvements in risk-informed regulation

Acronyms

- PRA – Probabilistic Risk Analysis
- ROP – Reactor Oversight Process
- MSPI – Mitigating Systems Performance Index
- NFPA – National Fire Protection Association



EPRI | ELECTRIC POWER RESEARCH INSTITUTE

Socialization of Risk Technology

NRC Commission Briefing
February 2009

Ken Canavan
Senior Program Manager

Risk Technology – The Tool

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  - Has specific uses
  - Can be misapplied or misused

- Risk technology is best used to identify gaps in the traditional safety analysis approaches. Where traditional safety analysis approaches:
  - Don't address all aspects
  - Are not tenable
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Risk Technology – Status

- Risk technology is "newer" than safety analysis
  - Some areas mature
  - Other areas are still evolving
  - Not widely understood
- Safety analysis is mature and socialized
- Socialization of risk technology is desirable to foster appropriate application
  - Use of risk-informed versus risk based
  - Use where risk results are fully understood
  - Use of appropriate tool, e.g., detail and conservatism

Risk Technology and Conservatism

- Compound conservatism is a misapplication of risk technology that can lead to erroneous conclusions
- Conservative: results of the cases are comparable
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Risk Technology and Conservatism

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- Another one of EPRI's roles is to foster the understanding of the benefit gained from risk-informed approaches, i.e., socialization

Risk Technology Socialization

- Concept is to provide training that begins the process to "socialize" risk technology
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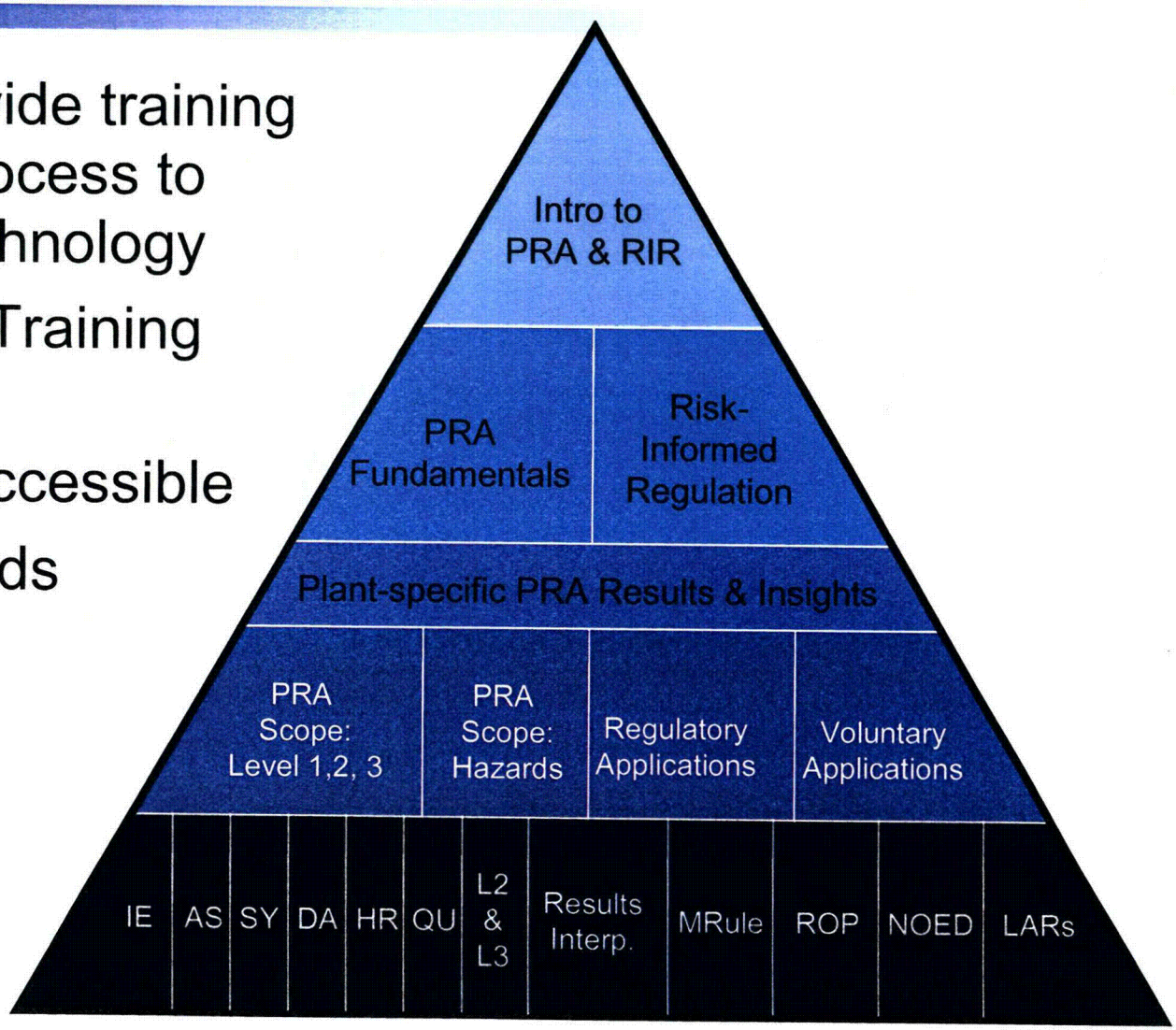

EPRI ELECTRIC POWER RESEARCH INSTITUTE

UCS Views on Risk-Informed Regulation

February 4, 2009

Dr. Edwin S. Lyman
Senior Staff Scientist
Union of Concerned Scientists

Overview

- **UCS position on risk-informed regulation**
- **A "single-edged sword"**
- **A cautionary tale**
- **Use and misuse of Level-3 PRA**

UCS Position

- **UCS is not opposed to the concept of risk-informed regulation in principle**
- **But its application must be consistent, appropriate and rooted in sound science and engineering**

PRA

- A prerequisite for any regulatory use of risk information (including backfits, SAMAs, SAMDAs) should be a complete PRA that includes
  - all LPSD modes and external events (including seismic)
  - Level-3 analysis
  - a rigorous uncertainty analysis

PRA

- **And is**
  - **executed in accordance with the highest quality assurance standards**
  - **comprehensively peer-reviewed (not only by industry but also by NRC and qualified independent groups)**
  - **fully validated with data from experiment and operating experience (i.e. reactors based on new designs should NOT be allowed to pursue risk-informed initiatives until significant operating experience is acquired)**

PRA

- **To this end, efforts to develop standards for PRA technical adequacy (DG-1200) and treatment of uncertainties (NUREG-1855) are crucial**
- **Until these standards are fully developed and ready for use, risk-informed activities should be suspended except *to address excessively high risks***

A "single-edged sword"

- **The credibility of risk-informed regulation depends on its use not only to reduce "unnecessary" regulatory burden but also to identify and reduce undue severe accident risks**
- **On this score, risk-informed regulation has failed**
  - **Industry will not voluntarily adopt risk-informed procedures that increase regulatory burden**
  - **NRC staff are constrained by backfit rule for mandatory enhancements**

Case in point: 10 CFR 50.44

- In 2000, Staff proposed risk-informing 50.44 ("Combustible gas control") by
  - Reducing unnecessary burden (e.g. eliminating hydrogen recombiners)
  - Enhancing safety (requiring backup power for hydrogen igniters at plants with ice condenser and Mark III containments)
- The safety benefit of the backup power was seen as significant enough to warrant consideration of mandatory action (GSI-189)

GSI-189

- **What is at stake? A 20 to 100% likelihood of early failure in the event of a SBO for ice condenser and Mark III containments**
- **Failure of defense-in-depth (which cannot be quantified and should not be subject to the vagaries of cost-benefit analyses)**

10 CFR 50.44

- In 2001, the staff presented two rulemaking options to the Commission
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  - 2. Demonstrate a "balanced approach" by deferring rule change pending resolution of GSI-189 for affected plants
- The Commission chose the "unbalanced approach" but required "expeditious resolution" of GSI-189

The sad tale of GSI-189

- Analysis indicated that backup power to the igniters was cost-beneficial
- In 2003, the ACRS recommended rulemaking to resolve GSI-189, and the staff agreed
- Licensees strenuously protested
- In 2005, NRR reversed its decision, based on a questionable revision of the cost-benefit analysis that assessed the incremental benefits relative not to the status quo but to the implementation of voluntary measures by the licensees

GSI-189

- Said voluntary measures are still not fully implemented at all ice condensers and Mark IIIs, nearly a decade after the first technical report was issued calling attention to the danger
- And because the measures are "voluntary," licensees are not obligated to provide official documentation of their effectiveness

Watts Bar Inspection Report, 7/08

- **"The inspector was unable to determine, by official record, that the movement of the power supply and connection of necessary fittings and cables to provide backup power to the igniters could be completed within three hours. Additional information was received that showed training and timing achievements gathered in 2004 when the 2MW diesel generator was first procured ...was part of the personal notebook belonging to the project manager ... The licensee responded that because this issue was beyond the design basis, components and activities were not treated as safety-related or under the quality assurance program. Hence, no official documentation was required, and none was generated."**

A cautionary tale

- Don't "risk-inform" a rule if you don't fully understand all the risks
- Example: Effort to risk-inform 10 CFR 50.46 to remove excess conservatism
- We now know that the LOCA acceptance criteria in 50.46(b) are not conservative for high-burnup fuels
  - No information is publicly available that demonstrates that high-burnup fuel in U.S. nuclear plants will be able to withstand a LOCA without embrittlement of the cladding

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- Thus it is unknown whether the current rule provides margin that would allow for "more demanding reactor operating conditions that may further stress the fuel" (SECY-07-0082)
- In light of this, UCS does not agree with the Commission's decision to reject the opinion of the ACRS and the staff that the 50.46(b) rulemaking should be finalized before risk-informing 50.46(a)

Use and misuse of Level 3 PRA

- To fully and accurately assess severe accident risks to the public, quality Level III PRAs must be performed
- Level III PRA information is currently being used in a variety of applications, including the cost-benefit analyses in SAMAs, SAMDAs and backfit evaluations

Level 3 PRA

- But regulatory guidance for use of Level 3 PRA information, based on mean values, does not properly account for the large uncertainties inherent in such analyses
- Example: variations in meteorological conditions can result in significant variations consequences such as total number of latent cancer fatalities
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Level 3 PRA

- For example, the 2005 revised regulatory analysis for GSI-189 found for Mark IIIs that the cost of mitigation exceeded the benefit (based on mean-value meteorology) by as little as a factor of 2
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List of acronyms

- **ACRS: Advisory Committee on Reactor Safeguards**
- **GSI: Generic safety issue**
- **LOCA: Loss-of-coolant accident**
- **LPSD: Low-power and shutdown**
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Acronyms (cont.)

- **PRA: Probabilistic risk assessment**
- **SAMA: Severe accident mitigation alternative**
- **SAMDA: Severe accident mitigation design alternative**
- **SBO: Station blackout**
- **UCS: Union of Concerned Scientists**

STATUS OF STANDARDS SUPPORTING RISK-INFORMED and PERFORMANCED-BASED ACTIVITIES

February 4, 2009

N. Prasad Kadambi
Chair, ANS Standards Board
Bryan Erler
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ASME
SETTING THE STANDARD

AMERICAN NUCLEAR SOCIETY

Topics

- Background and History
- Status PRA Standards
- Current Developments
- Future Work
- Summary

ASME
SETTING THE STANDARD

AMERICAN NUCLEAR SOCIETY
A N S

Background/History

- ANS and ASME working cooperatively to develop required nuclear plant standards
- Follow-up to August 2, 2007 NRC Briefing meeting commitments and look forward
- ANS and ASME are building on risk-informed and performance based (RIPB) approaches for the nuclear industry

ASME
SETTING THE STANDARD

AMERICAN NUCLEAR SOCIETY

Status of Combined PRA Standard

- RA-S-2008 Combined PRA Standard
  - Extends Level 1 PRA to include External Events and Fire
  - Published
- Addenda RA-Sa-2009
  - Addresses issues identified by NRC and users
  - Reformats and restructures to meet needs of technical users and allow future expansion
  - Approved by ANSI

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SETTING THE STANDARD

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Current Developments

- Low Power/Shutdown Standard
- Level 2 & 3 PRA Standards
- PRA requirements for new LWR plants and advanced reactors
- RIPB safety classification
- Probabilistic design developments
- Incorporating RIPB applications to new plants

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Future Planned Work

- RIPB Application standards
- Develop training for broader use and application of the PRA standards
- Standards for other facility types
- Standards for security risk management
- Standards for specific technical issues, e.g., uncertainty analysis or human reliability analysis

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Summary

- ASME and ANS are working to develop RIPB approaches for regulatory and industry needs
- Current commitments are on track
- Significant progress achieved, but much more is needed for realizing tangible benefits from RIPB policies
- Need to establish path going forward to incorporate safety benefits of RIPB programs into current and new plants and to address a broader range of issues

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BRIEFING ON RISK-INFORMED, PERFORMANCE-BASED REGULATION (Public Meeting)

Wednesday, February 4, 2009
1:30 pm

Slides for Panel 1:

Tony Pietrangelo, Vice President, Regulatory Affairs, NEI
Bill Levis, Chair of NEI Regulatory Process Working Group and President of PSEG Nuclear

Ken Canavan, Sr. Project Manager for Risk and Security Management, EPRI

Edwin Lyman, Union of Concerned Scientists

Bryan Erler, VP ASME Nuclear Codes and Standards
N. Prasad Kadambi, Chairman, ANS Standards Board

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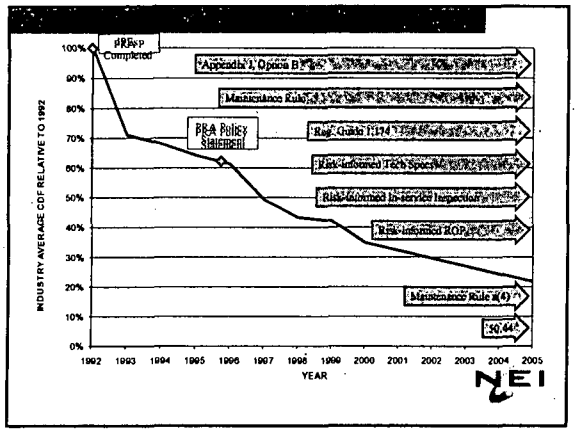

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7

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8

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9

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11

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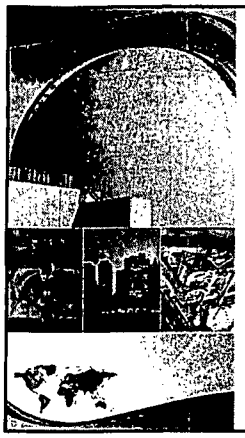

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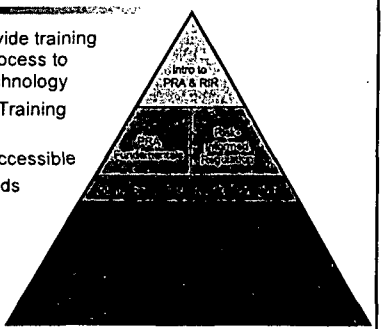

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Case in point: 10 CFR 50.44

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February 4, 2009

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Chair, ANS Standards Board
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1

Topics

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- Status PRA Standards
- Current Developments
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- Summary

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- Follow-up to August 2, 2007 NRC Briefing meeting commitments and look forward
- ANS and ASME are building on risk-informed and performance based (RIPB) approaches for the nuclear industry

3

Status of Combined PRA Standard

- RA-S-2008 Combined PRA Standard
  - Extends Level 1 PRA to include External Events and Fire
  - Published
- Addenda RA-Sa-2009
  - Addresses issues identified by NRC and users
  - Reformats and restructures to meet needs of technical users and allow future expansion
  - Approved by ANSI

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4

Current Developments

- Low Power/Shutdown Standard
- Level 2 & 3 PRA Standards
- PRA requirements for new LWR plants and advanced reactors
- RIPB safety classification
- Probabilistic design developments
- Incorporating RIPB applications to new plants

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5

Future Planned Work

- RIPB Application standards
- Develop training for broader use and application of the PRA standards
- Standards for other facility types
- Standards for security risk management
- Standards for specific technical issues, e.g., uncertainty analysis or human reliability analysis

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6

Summary

- ASME and ANS are working to develop RIPB approaches for regulatory and industry needs
- Current commitments are on track
- Significant progress achieved, but much more is needed for realizing tangible benefits from RIPB policies
- Need to establish path going forward to incorporate safety benefits of RIPB programs into current and new plants and to address a broader range of issues

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7