

October 12, 2006

MEMORANDUM TO: Eileen M. McKenna
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

FROM: Joseph L. Birmingham **/RA/**
Division of Policy and Rulemaking
Office of Nuclear Reactor Regulation

SUBJECT: SUMMARY OF PUBLIC WORKSHOP ON ADVANCE NOTICE OF
PROPOSED RULEMAKING AND TECHNOLOGY NEUTRAL
FRAMEWORK TO RISK-INFORM 10 CFR PART 50 REQUIREMENTS

On September 14-15, 2006, U. S. Nuclear Regulatory Commission (NRC) held a public workshop with interested stakeholders on an Advance Notice of Proposed Rulemaking (ANPR) and a Technology Neutral Framework (TNF), working draft NUREG-1860, "Framework for Development of a Risk-Informed, Performance-Based Alternative to 10 CFR Part 50," (ADAMS Accession No. ML062120363). Various industry organizations were present at the meeting including reactor vendors, the American Society of Mechanical Engineers (ASME), national laboratories, and the Nuclear Energy Institute (NEI). A list of persons in attendance is provided in Enclosure 1. The NRC presentation viewgraphs are provided in Enclosure 2 (ADAMS Accession No. ML062630345). The industry presentation viewgraphs are provided in Enclosures 3, 4, 5, and 6 (ADAMS Accession Nos. ML062640114, ML062640150, ML062640161, and ML062640178).

The workshop was held to discuss the policy and technical issues in the ANPR and the TNF, to clarify the questions in the ANPR, and to obtain early feedback from stakeholders on the approaches for future rulemaking discussed in the ANPR. Stakeholder comments received during the workshop will be considered along with written comments on the ANPR in developing staff recommendations for a paper to be sent to the Commission in May 2007.

Opening remarks were given by Brian Sheron, Director, Office of Nuclear Regulatory Research (RES) and Jim Lyons, Director, Division of Risk Assessment (DRA), Office of Nuclear Reactor Regulation (NRR). Both speakers emphasized the importance of stakeholder comments on the ANPR in light of the expectation that reactors of diverse types would be built in the future. After the opening remarks, Mary Drouin, of RES, discussed the workshop agenda and structure with the attendees. Ms. Drouin emphasized that, to ensure that NRC evaluates stakeholder comments, the comments need to be submitted to NRC as described in the ANPR.

NRC Presentations:

Joe Birmingham, of NRR, presented an overview of the background and objectives of the ANPR as documented in various Commission papers. The Commission's goals and objectives for the ANPR are to notify stakeholders that the Commission is considering rulemaking to develop a set of risk-informed requirements for power reactors that could be technology neutral. The Commission was seeking stakeholder comment on this proposed approach and on certain policy and technical issues. The ANPR describes how the NRC would develop a new set of requirements, a "Part 53", as an alternative to the requirements of Part 50 that were developed

primarily for light water reactors (LWRs). Under this approach the NRC would undertake two major tasks:

- Develop the technical basis for rulemaking for 10 CFR Part 53, and
- Develop the regulations and associated guidance for 10 CFR Part 53.

NRC would continue current ongoing risk-informed rulemakings but would undertake new risk-informed rulemakings only on as-needed basis. The ANPR plan was discussed in detail later in the workshop.

Donnie Harrison, of NRR, discussed the major policy and technical issues contained in the ANPR and answered comments on the issues. He said the NRC was interested in stakeholder comment on the major issues in the ANPR and that they would be discussed in detail in the issue discussion sessions. The major issues in the ANPR are:

- Plan to risk-inform power reactor requirements
- Integration of safety, security and preparedness
- Level of safety
- Integrated risk of multiple reactors
- ACRS views on level of safety and integrated risk
- Containment functional performance standards
- Technology-neutral framework
- Defense-in-depth
- Single failure criterion
- Need for additional Part 50 risk-informed rulemakings

After the panel answered comments on the overview of the ANPR plan and the major technical and policy issues, Mary Drouin presented a detailed overview of the Technology Neutral Framework (or framework). She described the framework as an approach in the form of criteria and guidelines that could serve as the technical basis for 10 CFR Part 53. Detailed information on the overview of the framework is in Enclosure 2, slides 26-45. Key issues of the framework discussed were:

- The objectives of the framework
- The scope of the framework
- The relationship to existing requirements in 10 CFR
- The framework elements
 - safety, security, and preparedness expectations
 - defense-in-depth: treatment of uncertainties
 - safety fundamentals
 - design criteria and guidance
 - PRA technical acceptability
 - process for the identification of requirements

A flow chart of how the framework elements relate to each other and to the development of a proposed set of technology-neutral requirements is provided in slide 34.

Other key issues of the framework discussed were:

- Defense-in-depth framework definition
- Process for implementation of defense-in-depth
- Relationship of defense-in-depth and safety margins
- Process for licensing basis event (LBE) selection
- Risk-informed and performance-based security performance standards
- Factors in integrated decision-making for security performance standards

The framework glossary and the topics covered in the appendices were also discussed.

After the framework discussion, the NRC reviewed the questions in the ANPR on NRC's proposed plan to have a risk-informed and performance-based alternative to 10 CFR Part 50. The ANPR questions covered the following topics:

- Is the proposed plan reasonable? What alternatives should be considered?
- Are the goals and objectives of the proposed plan appropriate?
- Would the plan, as proposed, achieve the goals and objectives?
- Should the new Part 53 be technology neutral or technology specific?
- When would the new regulations need to be in place?
- Is it too early to initiate regulation for non-LWRs?
- Is there stakeholder interest in helping to develop guidance?
- Should NRC undertake new RI-rulemakings for existing LWRs?
- Is there existing regulatory guidance that should be revised? If so which ones?

Stakeholder views on these topics varied. There was a general consensus that it was appropriate for NRC to be considering rulemaking for a new Part 53 but that it should not adversely impact the licensing of reactors in the near-term. Some stakeholders commented that rulemaking should reflect when non-LWR reactors would need to be licensed and that a "test case" of licensing of a non-LWR under the existing regulations would better define the process. There was industry interest in helping to develop guidance but industry resources were currently focused on the licensing of the proposed reactors under Part 50 and Part 52 and developing guidance for the licensing of those reactors. Exceptions to this were efforts to develop codes and standards for future reactors.

Industry Presentations:

There were four industry presentations relating to various aspects of the ANPR and the framework. The industry presentation viewgraphs are Enclosures 3, 4, 5, and 6. An overview of each presentation is provided below.

ASME Presentation: Kenneth R. Balkey, ASME Nuclear Codes & Standards

The ASME presentation, "Overview of ASME General Comments on ANPR to Make 10 CFR 50 Requirements Risk-Informed and Performance-Based," was presented by Kenneth R. Balkey, Vice President, ASME Nuclear Codes & Standards. Mr. Balkey commented that ASME preliminary comments on the ANPR had been sent to NRC and that ASME would send detailed comments by the close of the comment period December 2006. The ASME presentation was divided into general comments and a set of selected area comments. Some of the general comments were:

1. NRC should maintain a high priority of supporting licensing and certifications for next generation advanced light water reactors.
2. NRC should allow use of 10 CFR 50.69 risk-informed regulation and related codes & standards to be applied for next generation advanced LWRs.
 - ASME still developing Code actions to support 10 CFR 50.69
3. Proposed 10 CFR Part 53 should be focused on early Gen IV designs such as high temperature gas-cooled reactors.
4. A phased approach to develop a new 10 CFR Part 53 should be considered; integrate with licensing and certification activities responsive to industry needs
5. Regarding planning, there is a limited amount of experienced nuclear industry human resources available to support new Part 53 given the current efforts–
 - licensing, certification, and construction of new LWRs
 - development of Gen IV designs
 - continued support of current reactors
6. The new Part 53 should address development of detailed design processes that integrate the concept of an evolving PRA and risk-informed/probabilistic design methods with traditional deterministic design approaches
7. For a new Part 53, broad changes to ASME and other nuclear codes and standards will be needed (e.g., ASME Boiler Code)
8. ASME has an initiative to move toward use of performance-based codes and standards

ASME also discussed PRA Standards Needs: encouraging continued advancement of PRA standards to support existing and near-term reactors, extending PRA standards for Advanced Reactors, and developing new standards for GEN IV reactors such as a reactor with a nuclear graphite core. The ASME presentation also discussed other topics.

Westinghouse Presentation: Charles R. Kling, Westinghouse Electric Co., LLC

The Westinghouse presentation, “Westinghouse Input to NRC Workshop on Regulatory Structure for New Plant Licensing, ANPR and Technology-Neutral Framework,” was given by Charles R. Kling, Westinghouse Electric Co., LLC. Mr. Kling began by stating that Westinghouse supports the ANPR’s risk-informed and technology neutral approach for advanced reactors and that Westinghouse is working with and supports NEI and the Pebble Bed Modular Reactor (PBMR) on the technology neutral aspects of the ANPR. He observed that the International Reactor Innovative & Secure (IRIS) project’s specific interest is for application of performance-based modifications to emergency preparedness requirements including:

- Licensing approach
- Improved margins by implementing Safety-by-Design™
- Approach to reduction in size of EPZ

Mr. Kling discussed how IRIS initial licensing could be begun under Part 52 requirements with subsequent licensing under Part 53. This approach could allow IRIS to be on an early licensing

schedule, provide greatly increased safety margins by design, and possibly benefit from reduced operating and maintenance costs including reduced requirements for the off-site emergency response plan. He discussed IRIS's, "Three Tier Safety Approach," which allows IRIS to achieve greatly increased safety margins. The three tiers are:

1. SAFETY-BY-DESIGN™

Aims at eliminating by design the possibility for accidents to occur
And eliminating systems/components needed to deal with those accidents

2. PASSIVE SAFETY SYSTEMS

Protect against the remaining accidents and mitigate their consequences
Fewer and simpler systems than in passive LWRs

3. ACTIVE SYSTEMS

No active safety-grade systems are required
But active non-safety-grade systems contribute to reducing core damage frequency

The presentation discussed how each tier contributes to increasing reactor safety margins (see Enclosure 4, slides 6-15). Also discussed was the goal of achieving a limited need for off-site emergency response under risk-informed regulation, how the design would reduce security risk, IRIS's potential as a candidate for the Multinational Design Evaluation Program, and IRIS's cooperation with the International Atomic Energy Association's Coordinated Research Project.

NEI Presentation: Adrian Heymer, NEI
Biff Bradley, NEI

The NEI presentation, "NRC Proposed Part 53 Preliminary Comments," presented by Adrian Heymer and Biff Bradley, both of NEI, gave early comments on the proposed plan and the policy and technical issues in the ANPR that were developed to support the workshop. NEI indicated that official industry comment would be submitted later per the ANPR.

Regarding the proposed plan, NEI's comments generally indicated support of developing risk-informed requirements but argued that additional testing of the approach on a non-LWR was needed to refine the approach and to confirm the technical bases. NEI felt this testing was important to determine the applicability to generic reactor technologies. NEI also felt that areas where technology specific design features could impact regulations, such as safety margins or confinement, would be better addressed in technology-specific rules or guidance.

The NEI presentation discussed the major topics in the ANPR. Some of the NEI comments were that level of safety subsidiary objectives were better addressed on a technology specific basis; containment functional performance standards could be technology neutral but the fission product barrier function should be viewed as a plant wide function and not necessarily as a pressure retaining boundary; the technology neutral framework would benefit from being tested on a technology for which the calculated risk profile, margin, and DID characteristics are well established; and that the single failure criterion could be effectively eliminated and replaced by a more general approach in which the frequency and consequences of each licensing basis event are taken into account. The presentation also commented on the other ANPR issues.

Scientech LLC.: Jim Chapman, Scientech LLC.

“Framework for Risk-Informed Performance-Based Alternative to 10CFR Part 50,” presented by Jim Chapman, Scientech LLC., gave preliminary comments on: Progress and Testing; Fundamental Quantitative Safety Principles compared to Quantitative Health Objective’s (QHOs) and the Frequency -Consequence (F-C) Function; the Licensing Basis Event Definition; Structure, System, and Component Significance; External Event Treatment; Protective Strategies; Design Strategies; and Defense-in-Depth. The presentation discussed many of the processes in the ANPR and TNF and there were many comments by attendees on the application of those processes. An example is the topic Fundamental Quantitative Safety Principles Compared to QHOs and F-C Function. The discussion of these topics showed that commenters had differing perspectives of the need for a topic or the metric used in a topic when applied to different technologies. An example is the philosophy of defense-in-depth which may be implemented differently depending on the reactor technology.

The presentation noted that the framework was an impressive draft document and that it contained the important issues to be considered to risk-inform reactor requirements. The presentation noted that the processes would benefit from a detailed test and that some issues should be clarified or examples given to better show the intent or the application.

All of the presentations were excellent and discussed different issues important to the development of risk-informed reactor requirements. Most of the presentations commented on the ANPR proposed plan to develop risk-inform reactor requirements and discussed issue specific details in the ANPR or the framework. Some presentations suggested that the process would benefit from a test application and that clarification of some issues would result from stakeholder comment. While no specific time-frame was provided for when a Part 53 would be needed, many of the presentations emphasized the need to ensure that resources for near-term COL applications were not adversely impacted .

Discussion Sessions:

Although breakout sessions were planned to discuss the policy and technical issues, the group agreed to discuss the issues as a single group. The discussion sessions were:

Session 1. ANPR Topics -

- I. Single Failure Criterion: (ANPR questions 60-63)
- G. Framework: Probabilistic Design Criteria: (ANPR questions 42-47, NUREG-1860, Chapter 6, Appendix E)

Session 2. ANPR Topic -

- G. Framework: Development and Implementation: (ANPR questions 31-34, 50-54, NUREG-1860, Chapter 8, Appendices G-K)

Session 3. ANPR Topics -

- C. Level of Safety: (ANPR questions 13-20, NUREG-1860, Chapter 3, Appendices C&D)
- D. Integrated Risk: (ANPR questions 21-23, NUREG-1860, Chapter 3, Appendices C&D)
- E. ACRS Views: (ANPR question 24)

- Session 4. ANPR Topics -
- F. Containment Functional Performance Standards: (ANPR questions 25-30, NUREG-1860, Chapter 4)
 - G. Framework: Defense-in-Depth: (ANPR questions 35-41, NUREG-1860, Chapter 4)
 - H. Defense-in-Depth: (ANPR questions 55-59)
- Session 5. ANPR Topics -
- B. Integration of Safety, Security, and Emergency Preparedness: (ANPR questions 8-12, NUREG-1860, Chapter 3)
 - G. Framework: Security Performance Standards: (NUREG-1860, Chapter 6)
- Session 6. ANPR Topic -
- G. Framework: PRA Technical Acceptability: (ANPR questions 48-49, NUREG-1860, Chapter 7, Appendix F)

The issues were often discussed vigorously by the participants. Comments focused on how the topic/philosophy should be implemented in a risk-informed regulatory environment and how implementation could vary based on the technology it was applied to. An example is the defense-in-depth session where participants discussed the merits of the proposed definition in the framework, what level of risk defense-in-depth should be expected to achieve, how many barriers were appropriate, whether barriers should be diverse, the concept that a strong initial barrier such as the microspheres in a pebble bed reactor could lessen the need for a robust outer containment barrier, that barriers need not involve a pressure retaining function, and that time could be a barrier for some technologies.

The panel gave a summary of the workshop discussions, expressed great appreciation to those who made presentations and participated in the discussions. The panel also reiterated that comments should be submitted by any of the methods described in the ANPR. Having covered all the topics on the agenda, the workshop was ended.

Enclosures:

1. NRC presentation viewgraphs
2. ASME presentation viewgraphs
3. Westinghouse IRIS presentation viewgraphs
4. NEI ANPR viewgraphs
5. NEI/Sciencetech Framework viewgraphs

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Enclosures:

1. ML062630345
2. ML062640114
3. ML062640150
4. ML062640161
5. ML062640178

Distribution: See list *via email

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List of Attendees for September 14-15, 2006
Workshop on ANPR and TNF for Risk-Informed Reactor Requirements

<u>NAME</u>	<u>ORGANIZATION</u>
Jim Lyons	NRC/NRR
Brian Sheron	NRC/RES
Farouk Eltawila	NRC/RES
Joseph Birmingham	NRC/NRR
Eileen McKenna	NRC/NRR
Mary Drouin	NRC/NRR
Donald Harrison	NRC/NRR
Farshid Shahroki	AREVA
Jim Chapman	Sciencetech LLC
John Flack	ACRS
David Fischer	NRC/ACRS
Gareth Parry	NRC/NRR
Les Cupidon	NRC/RES
Marty Stutzke	NRC/NRR
Ben Beasley	NRC/RES
Stuart Rubin	NRC/RES
John Monninger	NRC/RES
Howard Benowitz	NRC/OGC
Biff Bradley	NEI
Jim Clifford	NRC/NRR
Edward Burns	PBMR Pty. Ltd.
Adrian Heymer	NEI
Charles Ader	NRC/RES
Sud Basu	NRC/RES
Adel El'Bassioni	NRC/RES
N. P. Kadambi	NRC/RES
Mark Rubin	NRC/NRR
Gerry Gears	DOE
Thomas O'Connor	DOE
Gerardo Martinez-Guridi	Brookhaven NL
Alan Levin	AREVA
Bruce Mrowca	ISL, Inc.
Tom King	ISL, Inc.
Charles Kling	Westinghouse
Frank Schaaf	Sterling Refrigeration Co.
Karl Fleming	PBMR Pty. Ltd.
Bryan A. Erler	ASME Nuclear Codes & Standards
Kenneth Balkey	ASME Nuclear Codes & Standards
Ronaldo Jenkins	NRC/RES
Ron Schmitt	NRC/NSIR
Todd Hilsmeier	NRC/NRR
John Lehner	Brookhaven. NL.
Vinod Mubayi	Brookhaven. NL.

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D Harrison	J Lyons	F Eltawila	J Clifford	J Flack	P Kadambi
B McDermott	B Beasley	M Stutzke	D Fischer	R Jenkins	T Hilsmeier
G Parry	R Schmitt	L Cupidon	M Rubin	C Ader	W Borchardt
D Matthews	H Benowitz	J Lubinski	M Marshall	J Clifford	