

# **STATUS OF RG 1.174 AND STAFF ENDORSEMENT OF PRA STANDARDS AND INDUSTRY PEER REVIEW PROGRAM**

---

Public Meeting

Mary Drouin  
U.S. Nuclear Regulatory Commission

February 5, 2002

## **AGENDA**

---

- Status on update of RG 1.174
- Status and plan for endorsing PRA standards (e.g., ASME) and industry programs (e.g., NEI-00-02)

# PURPOSE/GOAL OF MEETING

---

- Provide status on staff's efforts and proposed plan
- Solicit input on staff's plan

Page 3

# BACKGROUND

---

- April 18, 2000, SRM indicated that the staff "should provide its recommendations to the Commission for addressing the issue of PRA quality until the ASME and ANS standards have been completed, including the potential role of an industry PRA certification process"
- SECY-00-0162 (7-28-00) response:
  - ▶ Identifies the scope and minimal functional attributes necessary to ensure the PRA is capable of providing certain results (e.g., CDF, LERF, contributors)
  - ▶ "If appropriate, the staff will endorse them [e.g., ASME PRA standard] in an update of Regulatory Guide 1.174 or elsewhere to support other risk-informed activities"
  - ▶ "The staff endorsement may take exception to or include additional specific criteria to address any identified weaknesses in the standards to ensure that PRAs used in regulatory decisionmaking will have an adequate technical basis"
  - ▶ "To strengthen this guidance [RG 1.174 and SRP 19] and thus improve the efficiency and consistency of the staff review process, the staff intends to include the information from the SECY in the next update of the guide and SRP chapter."
- October 27, 2000, SRM response to SECY:
  - ▶ The staff should proceed forward
  - ▶ The timely resolution of PRA quality requirements is necessary to support existing and developing risk-informed regulation.
  - ▶ The staff should expand discussion to include further examples of how PRA quality influences risk-informed decision-making

Page 4

# STATUS (RG 1.174)

---

- Issued draft update of RG 1.174 and SRP 19, June 2000 for public review and comment
- Four “major” changes:
  - 1 Risk-related information may be requested if new, unforeseen hazard or substantial greater prospect for a known hazard emerges
  - 2 Increase in power level/fuel burnup
    - Levels above Mwt may need to be evaluated for their impact on LERF
    - Increases in fuel burnup beyond 40,000 MWD/MT are not expected to have an appreciable effect on LERF guidelines; expert panel investigating the effects on source terms arising from higher burnup rates and the use of mixed-oxide fuel
  - 3 Identification and description of scope and minimal functional/technical attributes comprising a PRA (SECY-0162, Att 1)
  - 4 Discussion of example applications using risk insights in the decision-making process (SECY-0162, Att 2)

Page 5

# STATUS RG 1.174 (cont'd)

---

- 90 day public review and comment period
- Comments: Hazards
  - ▶ no comments received
- Comments: Power level/fuel burnup
  - ▶ No justification, plants already requesting permission to increase power levels above 3800 Mwt
  - ▶ Additional staff guidance should be provided as to whether burnup ratings pertain to core average, bundle average, or peak rod exposure
- Comments: SECY-00-0162 updates
  - ▶ Inadequate explanation or discussion as to their purpose and use
  - ▶ Inappropriate document to include info from SECY-0162

Page 6

## **STATUS RG 1.174 (cont'd)**

---

- Endorse industry standards or peer review program in separate RG than RG 1.174
- Issue RG 1.174 with following changes
  - Risk-related information may be requested if new, unforeseen hazard or substantial greater prospect for a known hazard emerges
  - Increase in power level/fuel burnup
    - Discussion ongoing to determine if and how to be updated in RG 1.174
  - Discussion of example applications using risk insights in the decision-making process (SECY-0162, Att 2)

Page 7

## **STAFF ENDORSEMENT OF PRA STANDARDS AND INDUSTRY PROGRAMS**

---

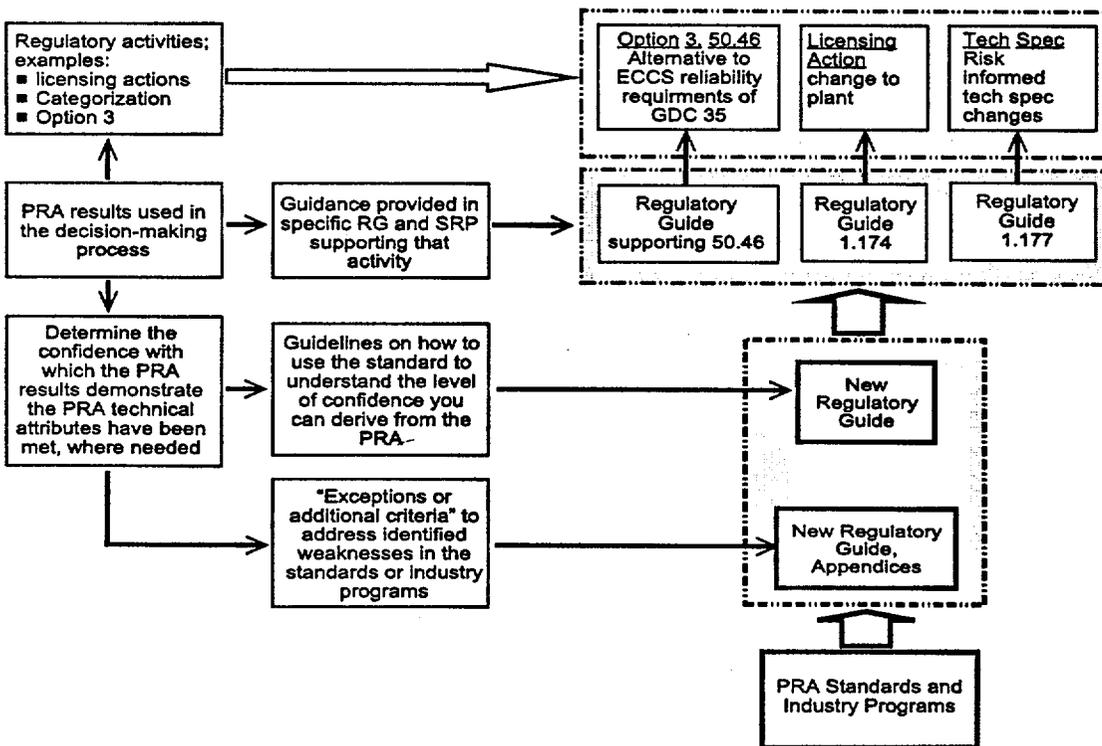
- Risk-informed regulatory activities and associated tools each use PRA information in their decision-making process
- Common dependency among activities: knowing the level of confidence in the PRA results from which the insights are derived
- PRA standards and industry program can be used to provide an understanding of the strengths and weaknesses of a PRA
- Single supporting regulatory guide that provides “An Approach for Characterizing the Quality of PRA Results Used in Support of Regulatory Applications” and accompanying SRP

Page 8

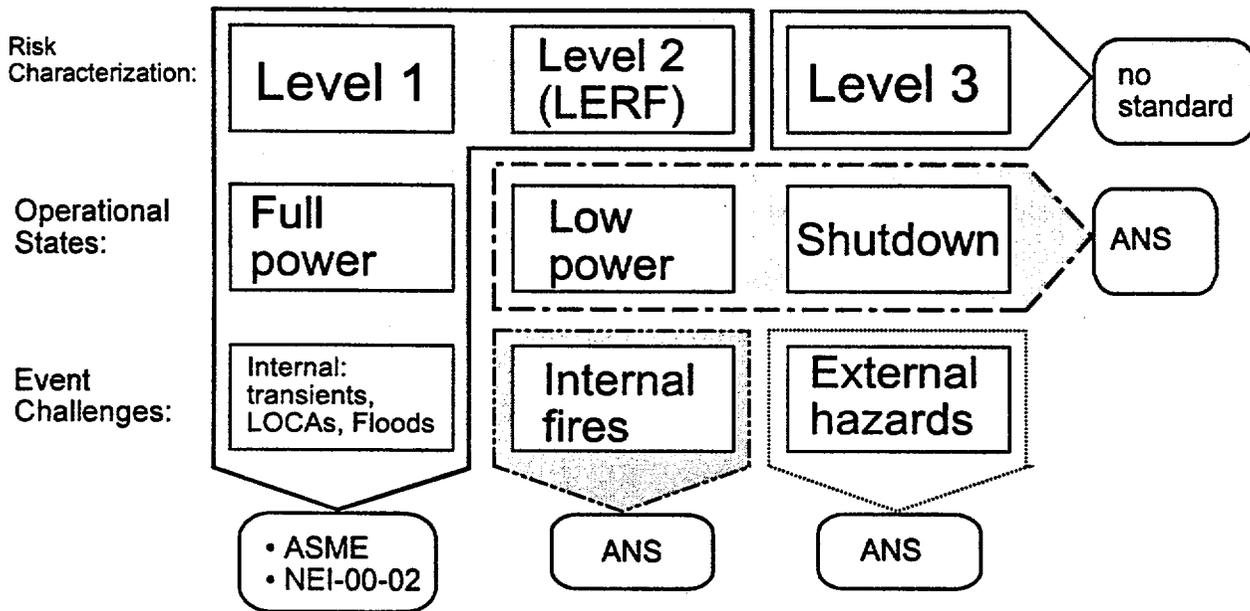
# NEW REGULATORY GUIDE STRUCTURE

- RG (Main body) provide guidance to licensees on how to use standard (or industry peer review program) to determine the level of confidence of the PRA insights/results being used so that risk insights may be appropriately used by the decision-maker
- RG (Appendices) providing staff endorsement of PRA standards (e.g., ASME) or industry program (e.g., NEI-00-02):
  - “Endorsement may take exception to or include additional specific criteria to address any identified weaknesses in the standards to ensure that PRAs used in regulatory decisionmaking will have an adequate technical basis”

## RELATIONSHIP OF NEW RG



# Full-Scope PRA: Standards and NEI-00-02



Page 11

## STATUS

- ASME
  - ▶ Final standard, ~February 2002
- NEI-00-02
  - ▶ NRC review (all applications) and submit comments to NEI, late February 2002
- ANS -- EXTERNAL HAZARDS
  - ▶ Final standard, December 2002
- ANS -- LOW POWER SHUTDOWN
  - ▶ Final standard, December 2003
- ANS -- INTERNAL FIRE
  - ▶ Final standard, TBD

Page 12

# OTHER RELATED EFFORTS

---

- **Data Analysis**
  - ▶ NRC Data handbook; provides guidance on sources of information and methods for performing data analysis
  - ▶ Includes determination of plant-specific and generic estimates for
    - Initiating event frequencies
    - Component failure rates and unavailabilities
    - Equipment non-recovery probabilities
  - ▶ Common cause failure data analysis not within scope
  - ▶ Draft for public review and comment, June 2002
  
- **Low Power Shutdown (LPSD)**
  - ▶ Update NUREG/CR-6595 to address simplified CET for LPSD
  - ▶ Draft for public review and comment, June 2002

Page 13

# PRELIMINARY SCHEDULE

---

- **February:**
  - ▶ public meeting (2-5)
  - ▶ ACRS (2-7)
  
- **March:**
  - ▶ Issue update of RG 1.174
  - ▶ Plan to Commission
  - ▶ Staff comments to NEI on NEI-00-02 (for 60 day review period)
  
- **June:**
  - ▶ Response from NEI
  
- **July:**
  - ▶ Release for 60 day public review and comment
    - draft RG (staff "endorsement" of ASME and NEI-00-02) and SRP
    - Data Handbook
    - NUREG/CR-6595, Rev 1
  - ▶ ACRS
  - ▶ public workshop to discuss above documents
  
- **October:**
  - ▶ public meeting to discuss comments and staff proposed resolution
  - ▶ ACRS
  
- **December:**
  - ▶ SECY to Commission to publish final RG and SRP, Data Handbook and NUREG/CR-6595, Rev 1
  - ▶ ACRS

Page 14

# **TECHNICAL WORK TO SUPPORT RULEMAKING FOR RISK-INFORMED ALTERNATIVE TO RELIABILITY REQUIREMENTS IN 50.46 (GDC 35)**

Public Meeting

Alan Kuritzky  
U.S. Nuclear Regulatory Commission

February 5, 2002

## **PROPOSED RISK-INFORMED ALTERNATIVE TO 50.46 (GDC 35)**

- Revise GDC 35 to provide an alternative to demonstrate that ECCS safety function can be reliably accomplished without assuming:
  - ▶ offsite power is not available, and
  - ▶ a single additional failure
- The alternative would have ECCS safety function assured by a more general reliability requirement.

Example wording could read something like --

- ▶ “Functionality shall be demonstrated by assuring an ECCS reliability commensurate with the frequency of the challenge to ECCS such that the risk to the public health and safety is not significant.”

# PROPOSED RISK-INFORMED ALTERNATIVE TO 50.46 (Cont'd)

- Two performance-based options offered in a Regulatory Guide to demonstrate ECCS reliability:
  - ▶ Plant-specific - Licensees demonstrate ECCS functional reliability commensurate with LOCA frequency
  - ▶ Generic - Staff defines, by plant group, a set of minimal equipment required to meet an established ECCS reliability

Page 3 of 11

## PLANT-SPECIFIC OPTION

Possible risk guidelines/thresholds for assessing reliable  
ECCS safety function

1. Remove rare events from consideration
  - ▶  $\text{Freq}_{IE} * \text{Prob}_{\text{Failure}} < 1\text{E-}6/\text{yr}$
2. Total plant CDF and LERF
  - ▶  $\text{CDF} < 1\text{E-}4/\text{yr}$ ;  $\text{LERF} < 1\text{E-}5/\text{yr}$
3. CDF and LERF for impacted accident categories
  - ▶  $\text{CDF}_A < 1\text{E-}5/\text{yr}$ ;  $\text{LERF}_A < 1\text{E-}6/\text{yr}$
  - ▶ All impacted accident categories must be identified
  - ▶ Must still meet #2 above
4. Conditional probabilities of core damage and early containment failure
  - ▶  $\text{CPCD}_A < 1\text{E-}5/\text{Freq}_{\text{Initiator-A}}$ ;  $\text{CLERP}_A < 0.1$
  - ▶ NRC would specify frequency of each impacted accident type
5. Adopt Regulatory Guide 1.174 acceptance guidelines
  - ▶  $\Delta\text{CDF}/\Delta\text{LERF}$  acceptable for baseline CDF/LERF

Page 4 of 11

## **GENERIC OPTION**

- Formulating “plant groups”
- Plant groups specify minimal set of equipment necessary to meet reliability goal
- Use of plant groups by licensee will not require licensee analysis or NRC review
- Need to determine if final grouping small enough to be practical

## **TECHNICAL AND IMPLEMENTATION ISSUES**

### **LOCA Scope and Frequency**

- Need LOCA frequencies
- Available data:
  - NUREG-1150 which is based on WASH-1400 (data from the 1960s primarily from the gas industry)
  - NUREG/CR-5750 which is based primarily on nuclear industry actuarial pipe leak data
    - Concerns regarding scope and methodology
- Expert elicitation proposed to provide data in the short-term

## TECHNICAL AND IMPLEMENTATION ISSUES (Cont'd)

### Conditional Loss of Offsite Power Probability (CLOOPP)

- Need to estimate CLOOPP given a LOCA or other reactor trip
- Available data:
  - ▶ No data to estimate CLOOPP given a LBLOCA
  - ▶ “Surrogate” data: LOOP resulting from reactor trips ( $\sim 3E-3$ )
    - Data from Jan. 1984 thru Nov. 2001 (2 events pending)
  - ▶ “Surrogate” data: LOOP resulting from major ECCS actuations ( $\sim 7E-2$ )
    - Data from Jan. 1986 thru Nov. 2001
    - 14 major ECCS actuations
    - 1 consequential LOOP event (Salem Unit 2, LER 311-86-007)

## TECHNICAL AND IMPLEMENTATION ISSUES (Cont'd)

### Conditional Loss of Offsite Power Probability (CLOOPP)

- Available data (cont'd):
  - ▶ Salem Unit 2 event (August 26, 1986)
    - Maintenance error during troubleshooting resulted in Rx trip/SI
    - “LOOP” signal generated by sustained UV condition on vital buses
      - ▶ Multiple transfers between station power transformers
    - Licensee identified root cause for power distribution problems as incremental addition of permanent electrical loads without transient response analysis
      - ▶ Block loading of ECCS loads also identified as a contributor
    - Similar events at Salem Unit 2 in July and September 1986 but no SI initiation and no “LOOP” signal
  - ▶ Even without Salem event, limited data sample would result in relatively high CLOOPP ( $\sim 5E-2$ )

## TECHNICAL AND IMPLEMENTATION ISSUES (Cont'd)

### Conditional Loss of Offsite Power Probability (CLOOPP)

- Major ECCS actuation events are a good representation of the electrical challenges to the plant imposed by a LBLOCA (i.e., they typically result in Rx trip and loading all ECCS equipment onto safety buses, which can reduce bus voltage to the UV trip setpoint)
- Rx trip events are not a good representation of the electrical challenges to the plant imposed by a LBLOCA
  - ▶  $\Pr\{\text{LOOP} \mid \text{Rx Trip}\} \ll \Pr\{\text{LOOP} \mid \text{LBLOCA}\}$
  - ▶ No info on ratio of conditional probabilities
  - ▶ No credible estimate of  $\Pr\{\text{LOOP} \mid \text{LBLOCA}\}$  based on Rx trip data
- Aggregation of Rx trip and ECCS actuation data is not justified

Page 9 of 11

## TECHNICAL AND IMPLEMENTATION ISSUES (Cont'd)

### Credit for Non-ECCS Systems

- ECCS functional reliability threshold is derived from PRA CDF calculations, which may include credit for non-ECCS systems.
- May need sub-threshold to assure a minimum reliability of actual ECCS systems.

Page 10 of 11

# SCHEDULE

- February: Public meeting
- March: Public meeting (late in the month)
  - technical basis for plant-specific approach
  - status on generic approach
  - discussion on future Option 3 work
- April: Report to NRR on plant-specific approach
- May: Public meeting
  - technical basis for generic approach
  - discussion on future Option 3 workACRS
- June: Report to NRR on generic approach