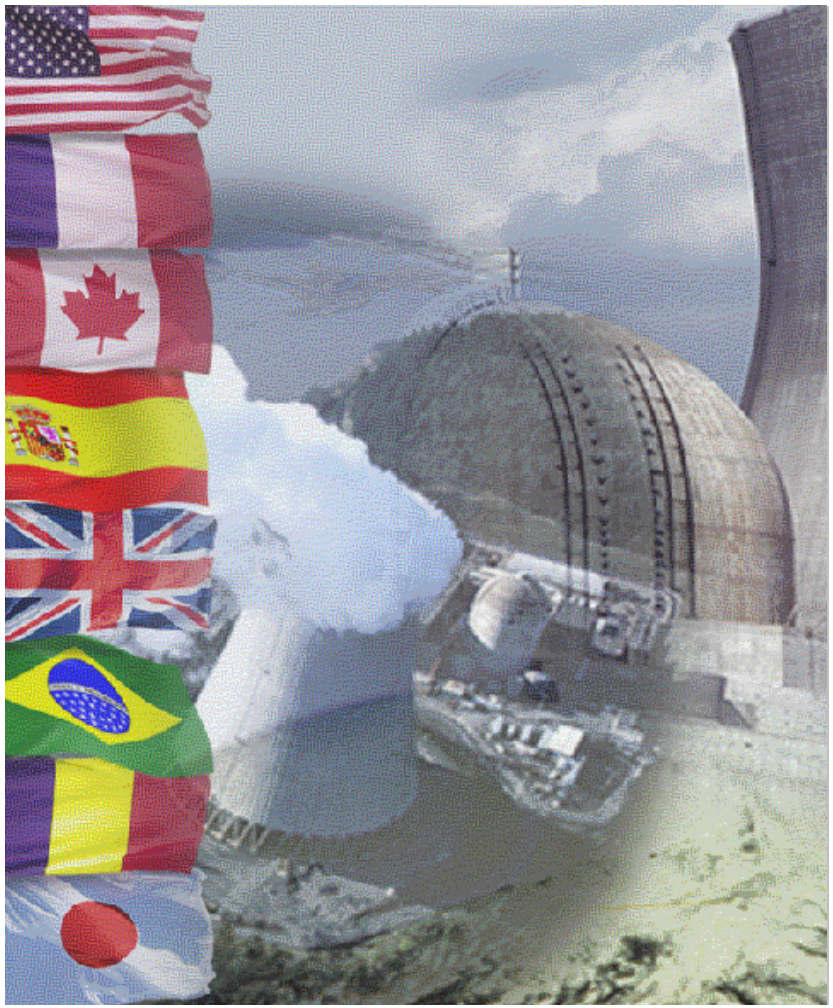


PRA Scope and Quality (PRA S&Q) Initiative

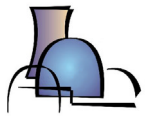
May 2004

Ken Canavan, EPRI

John Gaertner, EPRI

Objectives of this Presentation

- Importance of resolving technical issues for PRA S&Q
- Description of the PRA S&Q Initiative
- Details of PRA S&Q effort on “Uncertainty”



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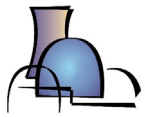
Importance of Resolving Technical Issues for PRA S&Q

- Appropriately, significant effort is being expended on development of risk-informed policy issues.

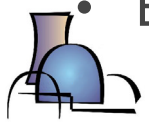
  However, another cornerstone of success is resolution of key technical PRA-related issues.

- The industry PRA Standard efforts provide:
  - Guidance on the scope of a PRA used to support risk-informed applications or decision-making.
  - Answers to the question “what to do?” but not “how to do it?”
- Critical “How to do it?” issues remain.
- Limited time and scarce resources dictate that the nuclear PRA community should participate, to the extent practical, on common issue-resolution guidelines.



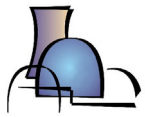
Description of the PRA S&Q Initiative

- Part of industry effort to answer the questions of what are the scope and quality expectations for a spectrum of risk-informed activities or applications.
  - Coordinated with NEI, who has leadership on NRR interface and policy
  - Diverse industry-wide participation
    - Owners Groups (WOG, BWROG, B&W OG, CANDU OG)
    - Utility sponsors
    - Other contributors invited, including NRC RES
    - NEI
  - Supplemental to PRA Standards
  - Multi-year effort
  - Multi-dimensional project
    - Technical-issue based
    - Application based
  - Interface with other industry activities and EPRI projects such as Owners Groups, NRC RES, EPRI/RES, Fire PRA Steering Committee, Structural Integrity Working Group (SIWG), EPRI Risk & Reliability Users Group, and others.
- EPRI will lead some issues and will support others, as appropriate.

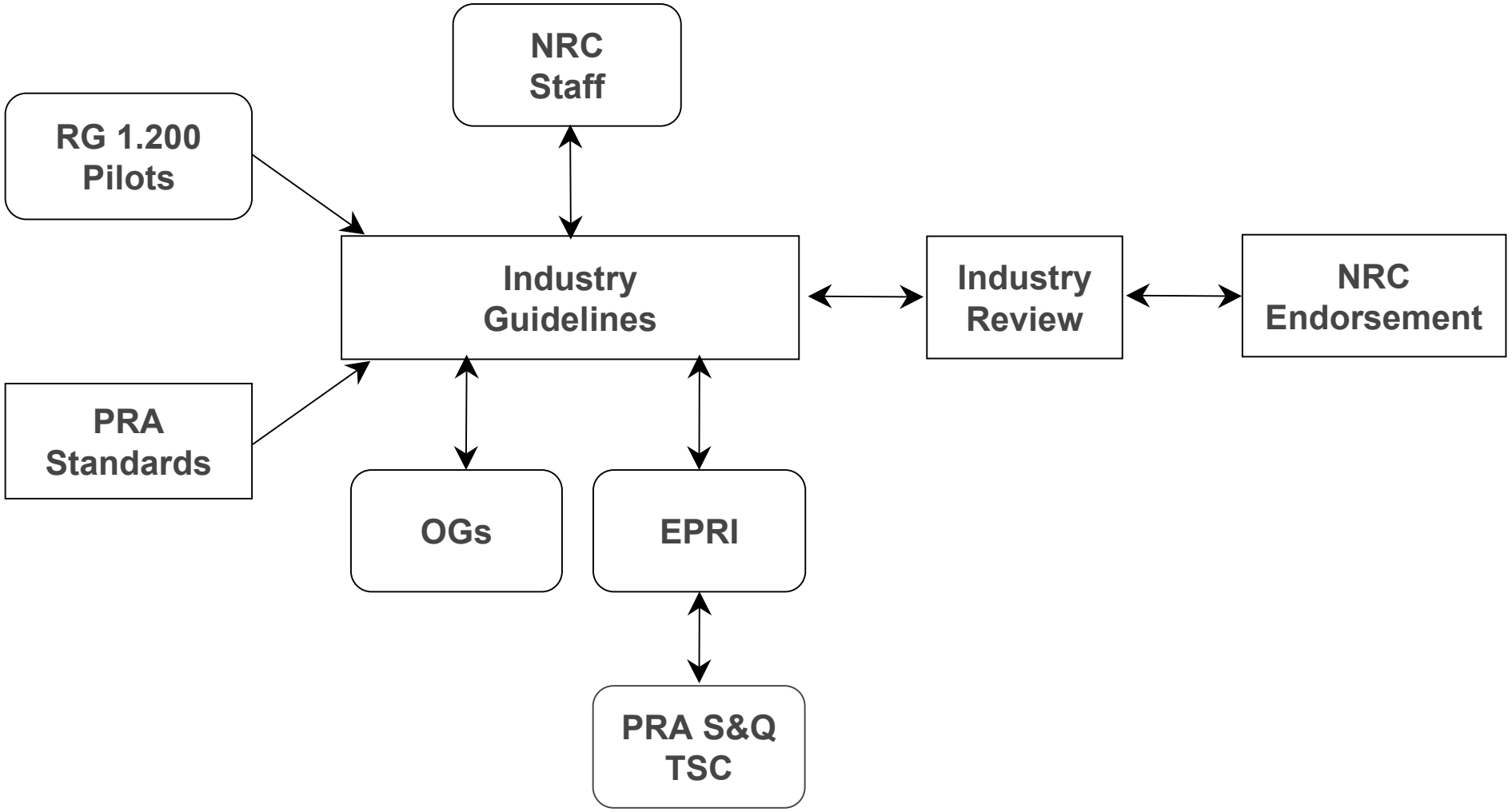


The Individual Issue Approach …

- **For example, Treatment of Uncertainty in Risk-Informed Applications**
- **Develop single issue guidance that clearly identifies the industry position on individual PRA S&Q issues.**
  - Technical basis
    - Problem Statement
    - Issue resolution(s)
  - Initially developed by the working groups (a small group of experts such as owners group risk committee chairpersons and sponsors)
  - Present to larger technical community
  - Work with NRC where appropriate
  - Incorporate industry comments and publish
  - Eventually collect into position statement



Ideal Process for Resolution of PRA S&Q Technical Issues



Guidelines for Treatment of Uncertainty in Risk-informed Regulatory Applications

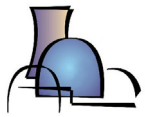
Doug True, ERIN

Paul Hijeck, Westinghouse/WOG

Motivation for Project

- ASME PRA Standard and RG 1.200 Include:
  - 13 High Level Requirements, and
  - 30 Supporting Requirements

  Related to the Treatment and Documentation of Key Sources of Uncertainties and/or Key Assumptions
- There is No Consistent, Accepted Approach to Identifying Uncertainties and Addressing These Requirements

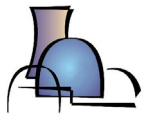


Project Objectives

- Provide Guidelines for Meeting the Requirements of Reg. Guide 1.200 Related to Key Assumptions and Key Sources of Uncertainties.
- Include Evaluating the Impact of Uncertainty in the Application of Quantitative Acceptance Guidelines that are Part of the NRC's Risk-informed Regulatory Processes.

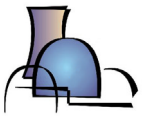
Guidelines are intended to be complete, practical, and robust.

- Goal is to Receive NRC Endorsement for Use in RIR Applications



Types of Uncertainty

- Reg. Guide 1.174 Identifies Three Types of Uncertainty
  - Parametric
  - Modeling
  - Completeness (Scope and Level of Detail)
- Standards and Peer Reviews Help Address Completeness
- Focus of the Project is on Parametric and Modeling Uncertainty



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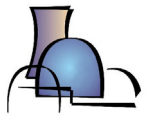
Reg. Guide 1.200 Definitions

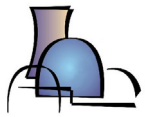
- A *key source of uncertainty* is one that:
  - is related to an issue where there is no consensus approach or model
    AND
  - where the choice of approach or model is known to have an impact on the PRA results in terms of
    - introducing new accident sequences,
    - changing the relative importance of sequences, or
    - affecting the overall CDF or LERF estimates that might have an impact on the use of the PRA in decision making.
- A *key assumption* is one that is made in response to a key source of uncertainty.

Ref. Reg. Guide 1.200, Footnotes 3 & 4, Page 1.200-9



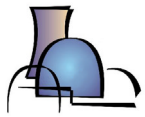
Considerations in Addressing Parametric Uncertainty

- Many PRA Calculations are Based on Point Estimate Analyses. All importance Measures are Based on Point Estimate Results.
- In Some Cases, Point Estimates May Not Be A Good Estimate of the True Mean Value
- Previous EPRI report (TR-1008905) on Uncertainty Impacts on 50.69 Categorization Provides a Starting Point
- Need for Additional Guidance on:
  - The use of Point Estimate Calculations for mean value comparisons
  - Treatment of the “State of Knowledge” Correlation



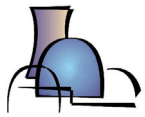
Considerations in Addressing Modeling Uncertainty and Key Assumptions

- Modeling Uncertainty Can Impact Any Aspect Of a PRA
- Rigorous Treatment of All Uncertainty Contributions is not achievable.
- Need for Guidance on:
  - Identification of “key sources of modeling uncertainty” and “key assumptions”
  - Methods for treating different types and sources of modeling uncertainty
- An on-going WOG effort is an important basis for this part of the guidelines



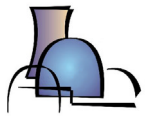
WOG Project - Methodology for Assessment of Modeling Uncertainty

- Project focuses on ACRS/NRC concerns regarding modeling (epistemic) uncertainties in PSAs
- Specific Project Objectives
  - Establish methodology for assessment of Modeling Uncertainties
  - Develop Modeling Uncertainties for Focused Set of Events as a Trial Application
    - LOCA Initiating Event
    - LOOP Initiating Event
  - Expand to Generic Process



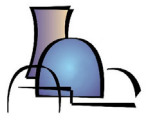
WOG Project - Identification of Sources of Uncertainty

- Uncertainties arise from the existence of assumptions inherent within the PSA Model. Many assumptions captured in PSA documentation, but not all.
- Assumptions identified via decomposition of key elements in event sequences
  - Thermal-hydraulics and phenomenology (embedded assumptions impacting timing, success, event description, process assumptions)
  - Operator / Plant Actions (procedural guidance, errors of commission, assumption with respect to recovery, etc.)
  - Origin and applicability of PSA model input data
  - PSA specific modeling assumptions / simplifications
- Basis for issue status/assumption identified, appropriate documents referenced.



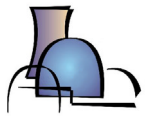
WOG Project - Categorization of Uncertainties and Prioritization of Risk Impact

- Process for categorizing and prioritizing based on Columbia Generating Station Ranking Report for EDG Applications
- Uncertainty Categorization Elements
  - Lack of knowledge
  - Degree of realism
  - Plant specificity (use of generic information)
  - Level of detail
- Impact Prioritization
  - Treatment Strategies (Consensus model, sensitivity studies, etc.)
  - Significance (High, medium, low, application dependent and unknown)



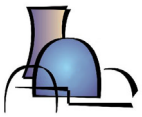
WOG Project – Guidance for PRA Key Assumptions

- **Related WOG Project**
  - Develop Guideline on Key PRA Assumptions
    - Voluntary Recommended Practice Format
    - Suggested process for identifying and evaluating impacts of Key Assumptions
  - Focus on assumptions for which reasonable alternatives would affect PRA insights for risk-informed decisions, or substantially affect CDF/LERF
  - Provide examples of categories of key assumptions
  - Develop a “running” compendium of specific examples of key assumptions by PRA element



Examples of Potential Modeling Uncertainties

- Human Reliability Model Applied
- Common Cause Failure Model Applied
- Functional Success Criteria
- Screening/Grouping Of Events
- RCP Seal LOCA Model
- Raw Data Analysis Methods
- Accident Sequence Phenomena



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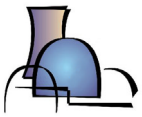
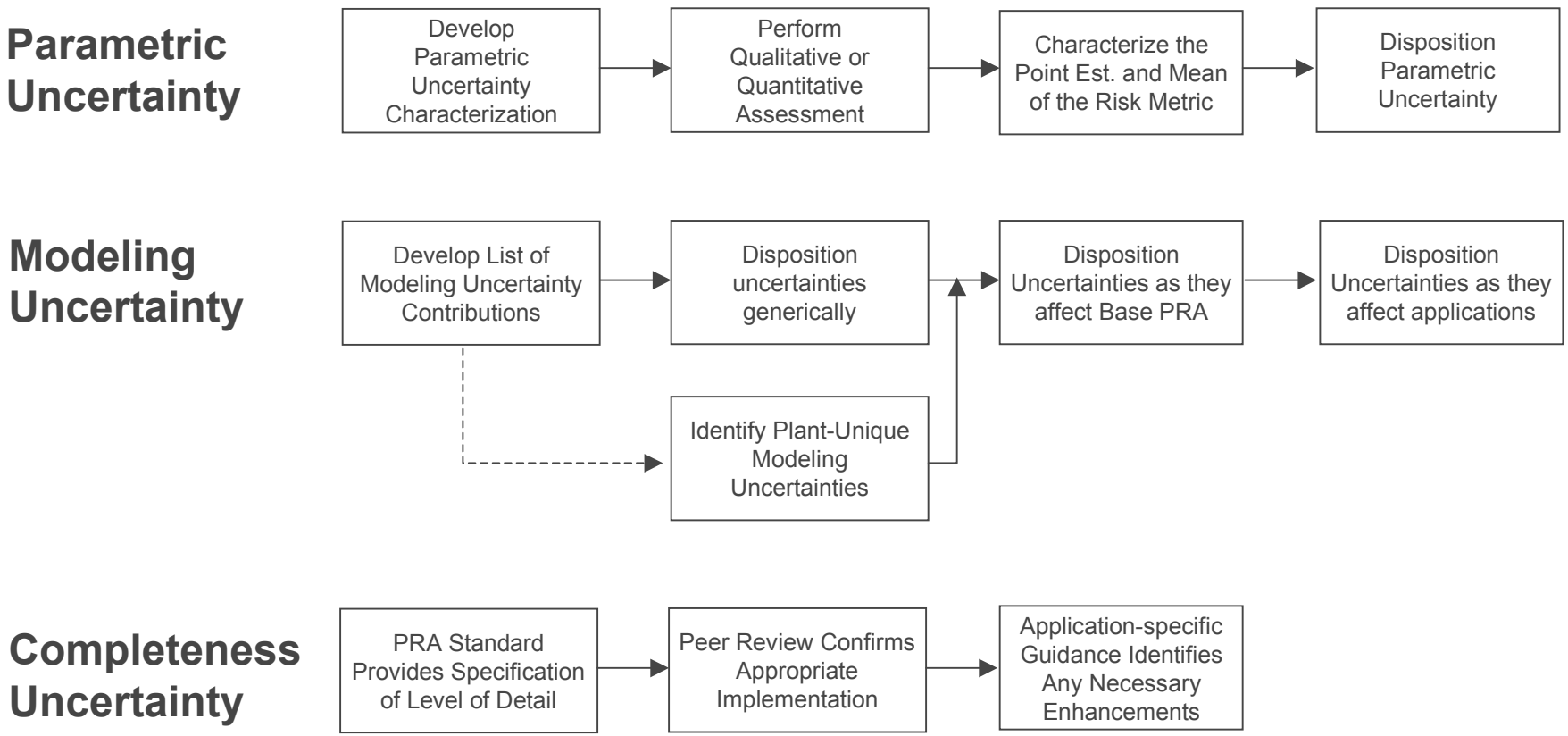
Additional Considerations

- PRA Mean Values Represent High Percentile Values. Generally, Higher Uncertainty Leads to Higher Percentiles.
- Existing Quantitative Guidelines Set Conservatively to Account for Uncertainty.
- Well Chosen Sensitivity Studies Can Characterize Modeling Uncertainty
- Defense-in-depth and Safety Margins Are Antidotes To Uncertainty, But Criteria Do Not Exist.
- Quantification of Total Uncertainty is not Required in Current Guidance Documents (RGs 1.174 & 1.200).

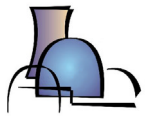


High-Level Process for Addressing Uncertainty



Key Project Milestones

• Draft High-level Framework	May
• Revised High-level Framework	July
• Draft Technical Reports on Parametric & Modeling Uncertainty	September
• Draft Treatment Guidelines	October
• Final Reports & Guidelines	December



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Conclusions for Uncertainty Project

- Project Aimed at Supporting Implementation of RG 1.200 and the ASME Standard
- Input from WOG and RG 1.200 Pilots will be critical
- Coordination with NRC Activities Warranted and Desired
- Further Interactions Will be Scheduled as Work Products are Developed
- Schedule Established to Support Next Revision of RG 1.200 & Staff Plan on PRA Quality
- Endorsement by NRC Considered an Essential Element