CSNI Workshop on Evaluation of Uncertainties in Relation to Severe Accidents and Level II PRA
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Assessment of Phenomenological Uncertainties in Level 2 PRAs

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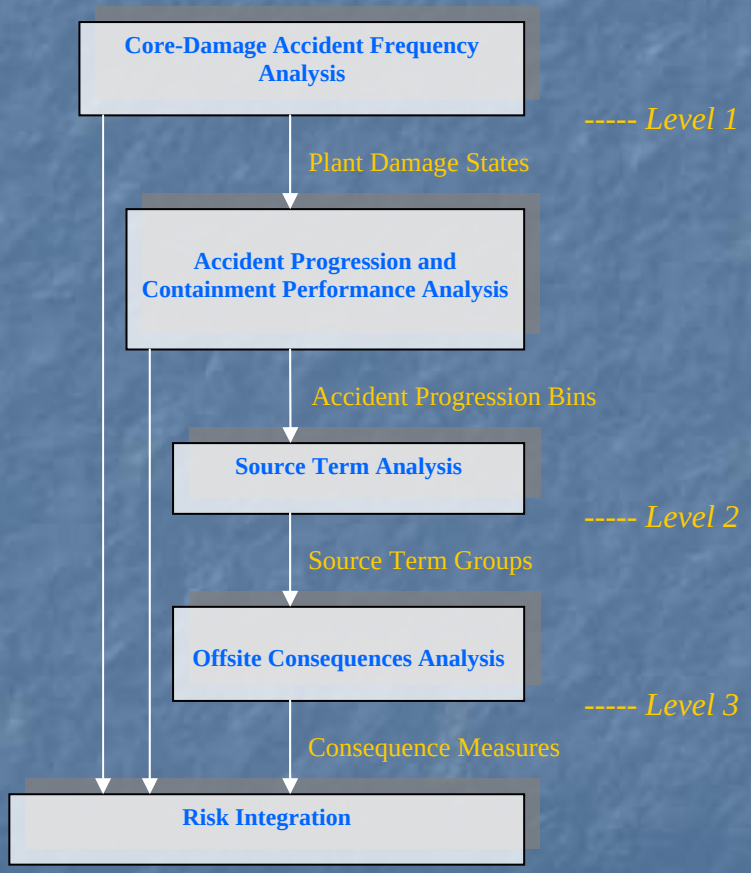
“The value of what one knows is doubled if one confesses to not knowing what one does not know”

Arthur Schopenhauer

OUTLINE

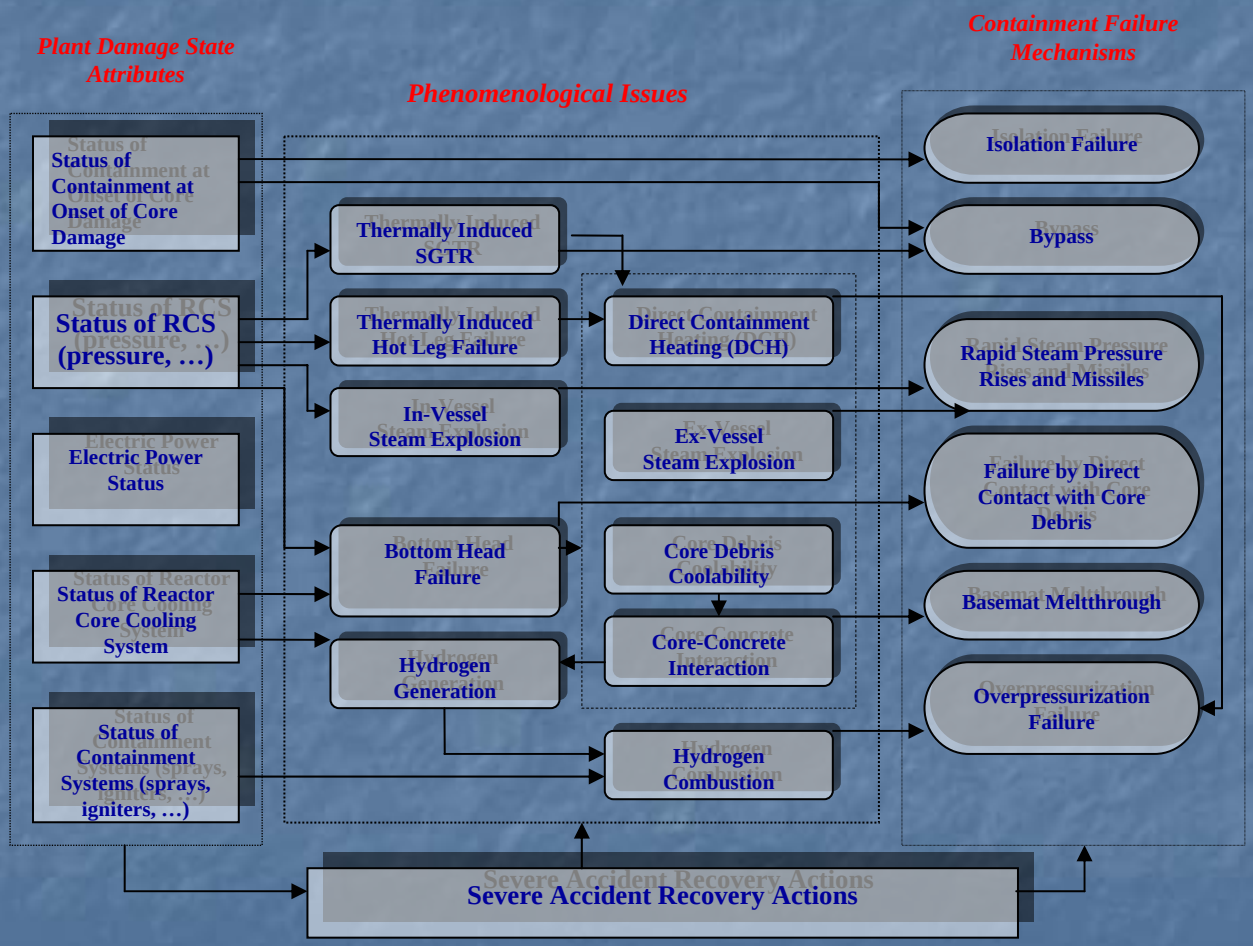
- Overview of PRA Process
- Phenomenological Uncertainties in Severe Accident Progression Analysis
- Uncertainties Associated with Source Term Analysis
- Risk Importance Measures for Phenomenological Issues

Elements of the PRA Analytical Process

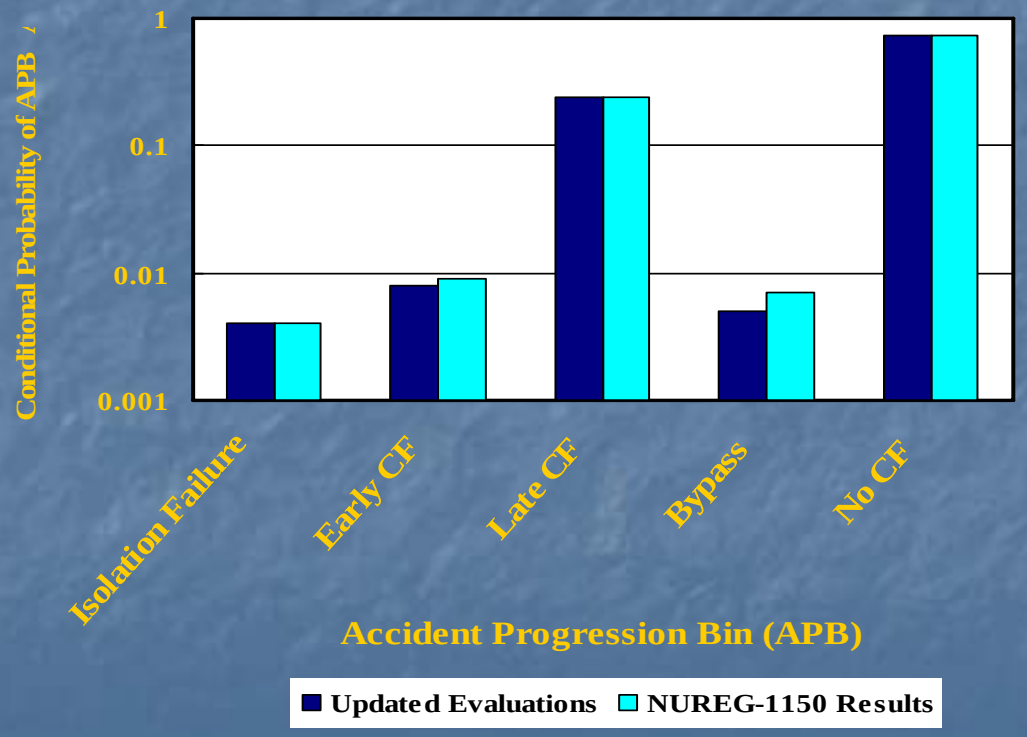


Severe Accident Progression

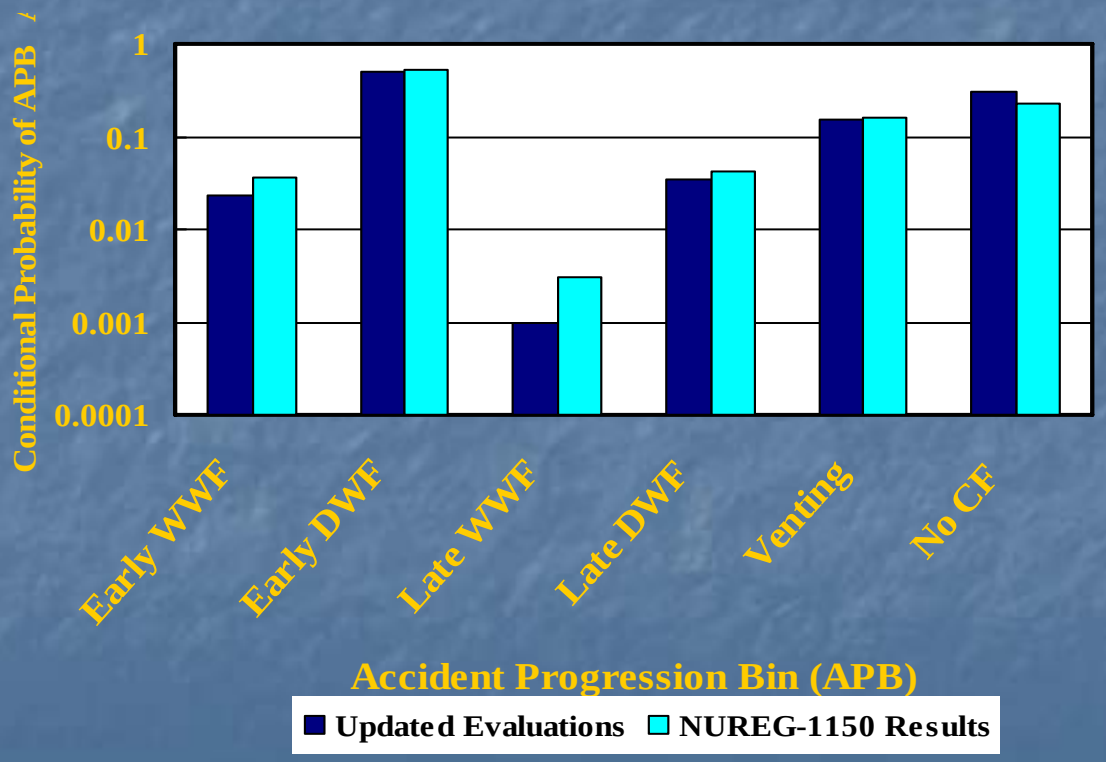
Phenomenological Issues & Containment Failure Mechanisms



Conditional Probability of Accident Progression Bins for Internal Events at Zion



Conditional Probability of Accident Progression Bins for Internal Events at Peach Bottom

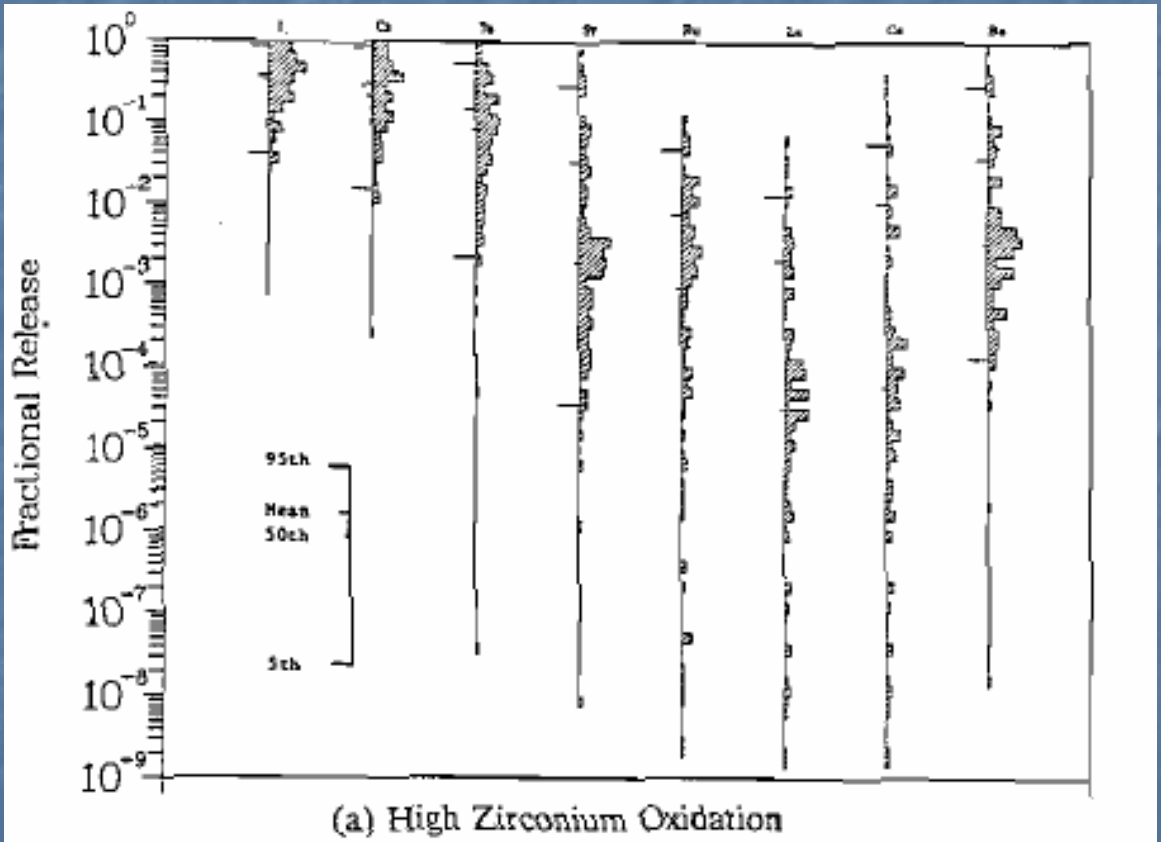


Source Term Analysis

Source Term Issues and In-Containment Removal Mechanisms

Uncertainty Distributions for Early In-Vessel Releases into the Containment

PWR, Low RCS Pressure (NUREG/CR-5747)



Risk Importance Measures for Phenomenological Issues

- It is desirable to assign some ranking of “risk importance” among various phenomenological issues that are considered in a plant PRA model.

- Risk importance measures for phenomenological issues can be useful for assessing potential accident management strategies as well as for developing research priorities to reduce the overall uncertainty.

Risk Importance Measures Commonly Used for Ranking PRA Basic Events or SSCs

Risk Achievement Worth, RAW $RAWi = R_i^+ / R_0$

Fussell – Vesely, FV $FVi = (R_0 - R_i^-) / R_0$

Risk Reduction Worth, RRW $RRWi = R_i^- / R_0$

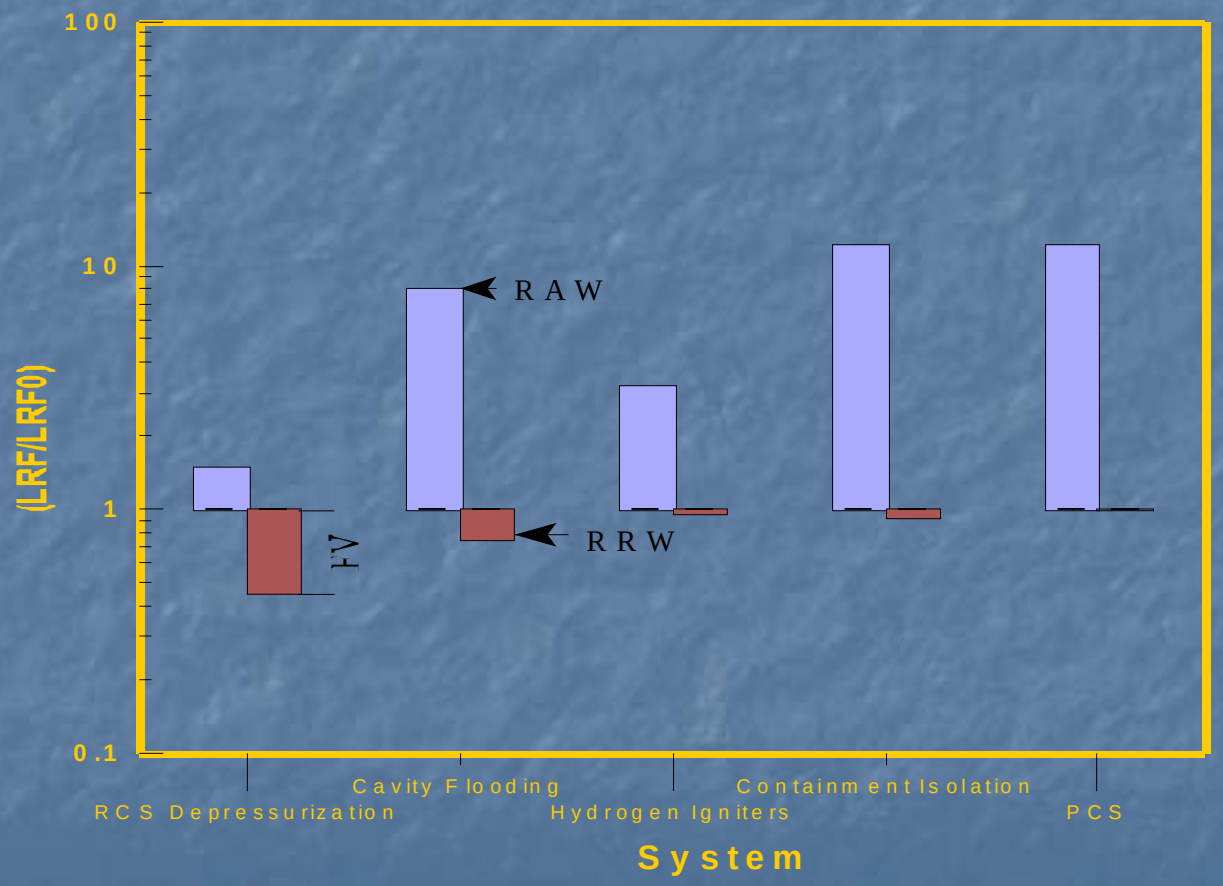
where:

R_i^+ = overall risk with the probability of basic event i set to 1 (the event has occurred or the equipment is failed),

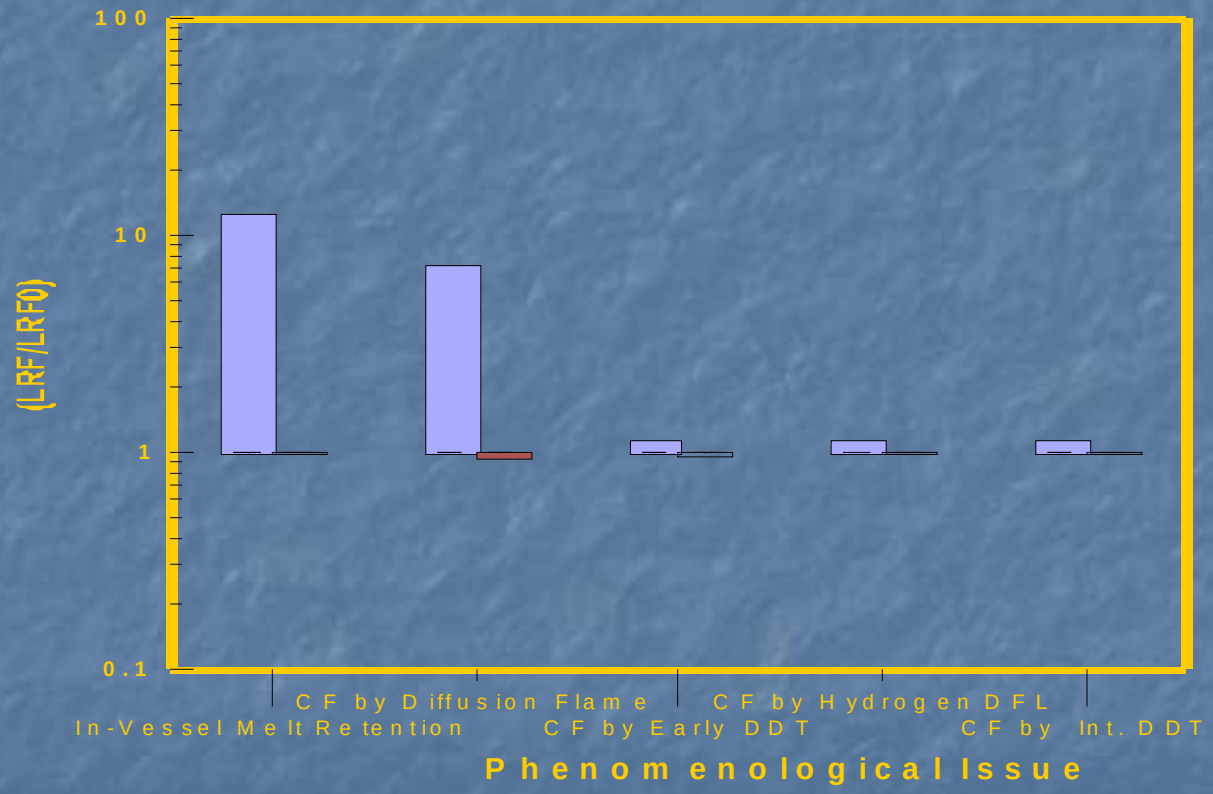
R_i^- = overall risk with the probability of basic event i set to 0 (the event is impossible or the equipment is totally reliable), and

R_0 = overall base-case risk

Risk Importance Measures for Post Core-damage Mitigation Systems in AP1000 Design



Risk Importance Measures of Severe Accident Phenomena in AP1000 Design



Summary

- An assessment of the phenomenological uncertainties associated with Level 2 PRAs was presented.
- Development of risk importance measures for phenomenological issues was also discussed.