



Risk Evaluations and Regulatory Applications

Sonia Burgess
Dave Passehl
Laura Kozak

August 2, 2006

Region III Reactor Program Arenas

■ Incident Investigation

- Events and Degraded Conditions
- Management Directive 8.3

■ Reactor Oversight

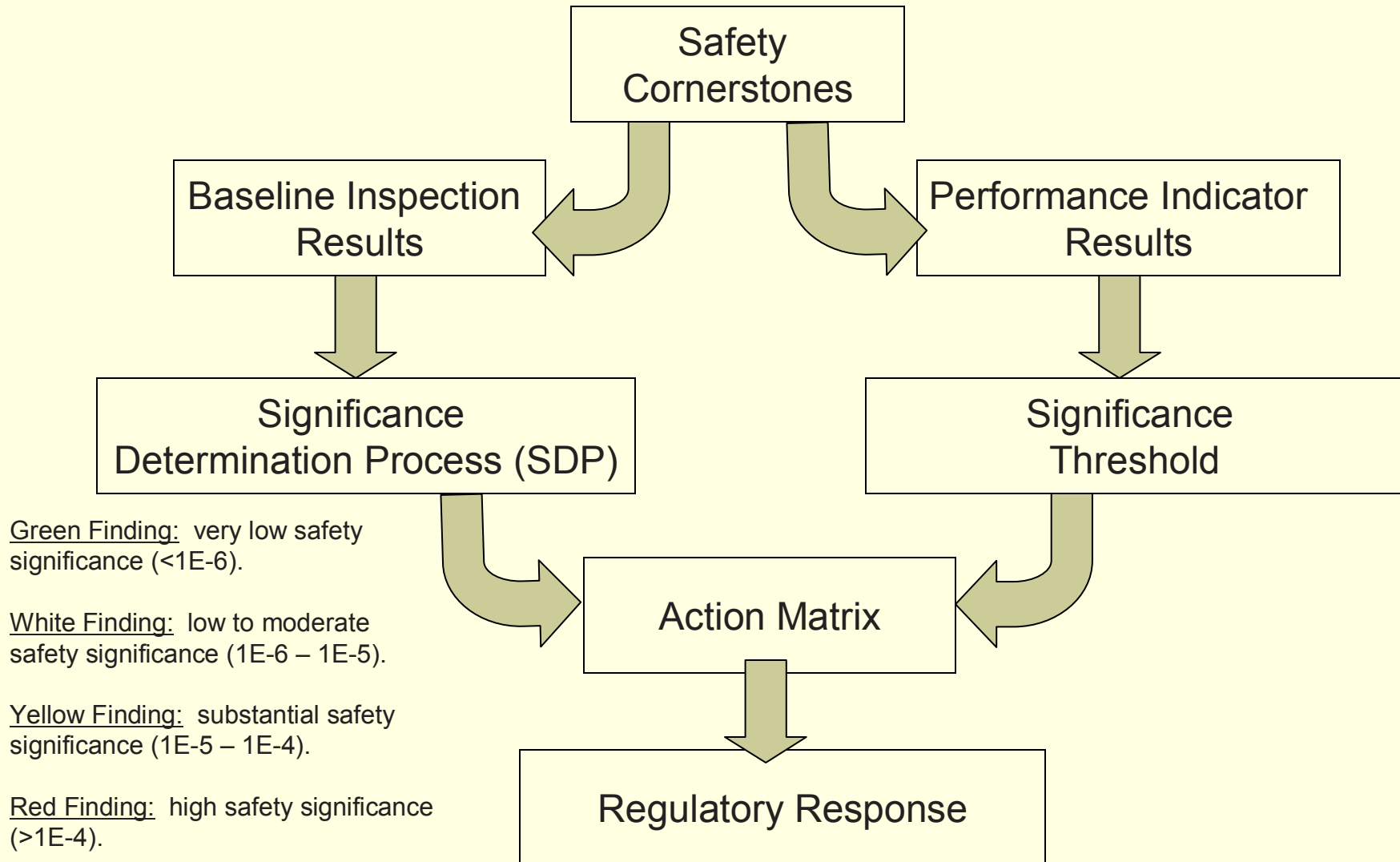
- Significance Determination Process
- Inspection Planning
- Notice of Enforcement Discretion

Incident Investigation

- Obtain Factual Information about Events and Conditions
- Decision to Initiate is Risk-Informed
- Risk Guidelines in Management Directive 8.3
- NRC Decides How to use Discretionary Inspection Resources
- Licensee MAY be asked for Assistance and/or Risk Characterization if Time Permits

Reactor Oversight Process

Strategic Performance Areas



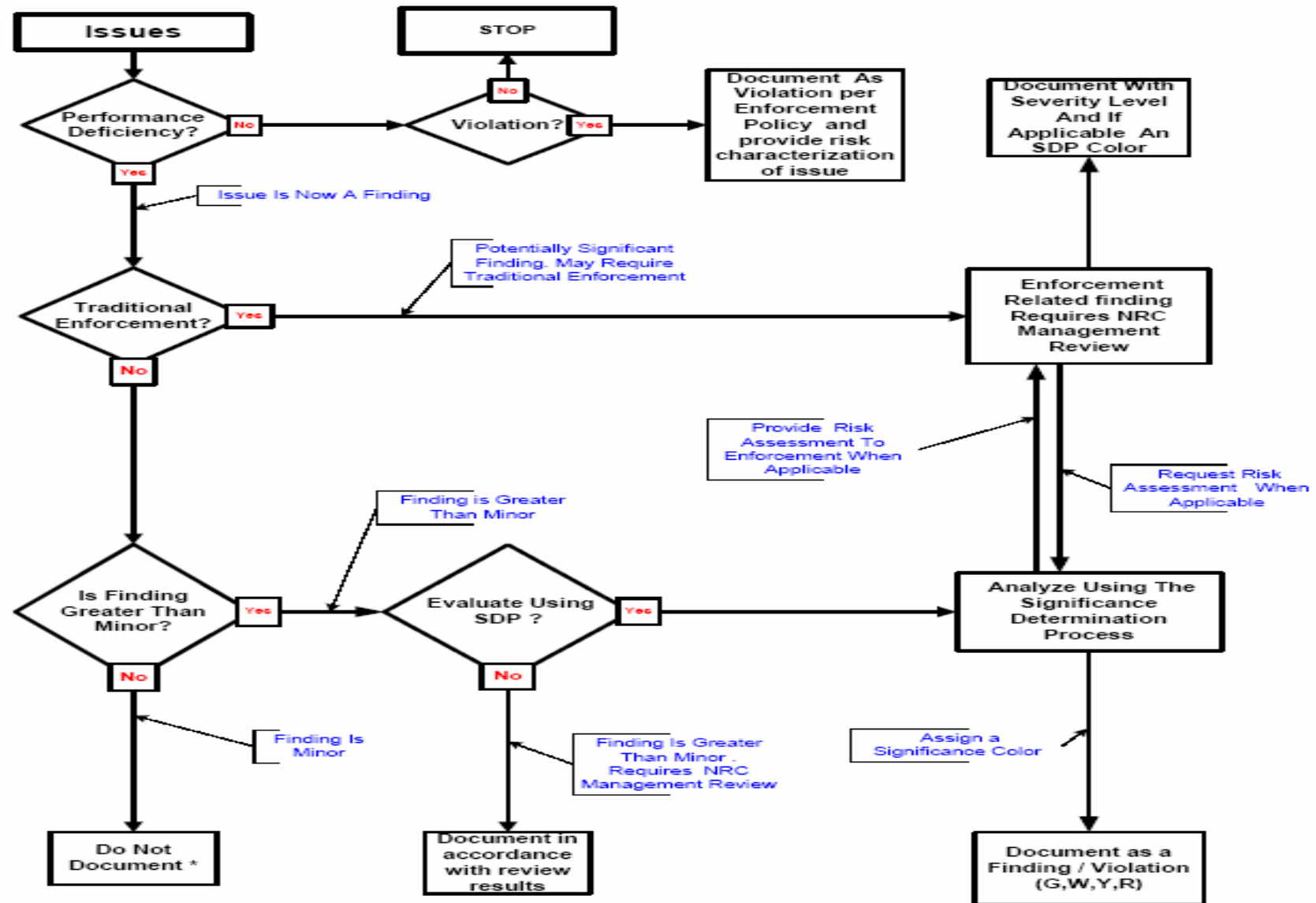
Risk Insights in Inspection Planning

- CDBI Inspections – Use licensee and NRC risk information to select components
- Fire Protection Inspections – Use licensee IPEEE or updated fire PRA information to select fire areas
- Other Inspections as necessary – Supplemental Inspections, Modifications 50.59

Significance Determination Process Overview

- Described in NRC Inspection Manual Chapter 0609
- Risk-Informed Reactor Safety Guidelines:
 - Appendix A: Findings Affecting At-power Operations
 - Appendix G: Findings Affecting Shutdown Operations
 - Appendix H: Large-Early Release Frequency
 - Specialty SDPs:
 - Appendix F: Fire Protection
 - Appendix J: Steam Generator Tube Integrity
 - Appendix K: Maintenance Rule Violations

Entry into the SDP



* see exception in Section 05.03

Reactor Safety

Significance Determination Process

- Three Phase Process:
 - Phase 1 Screen Issues
 - Phase 2 Estimate Risk Using Plant Specific Risk-Informed Inspection Notebooks
 - Phase 3 Evaluate Risk Using Modification of Phase 2 and/or Independent Risk Tools
- Phases 1 and 2 are Generally Performed by Inspection Staff, with Assistance of a Senior Reactor Analyst (SRA), When Necessary.
- Phase 3 is Defined as ANY Departure from the Phase 2 Process, and are Performed by Risk Analysts.

Minor Determination and Phase 1 At-Power Inspection Findings

- Minor Findings are not Normally Documented.
- Minor Determinations are Made in Accordance with NRC Inspection Manual Chapter 0612, Appendices E and B.
- Greater than Minor Findings are Processed Using the Phase 1 Screening Worksheet.
- The Screening Process is Designed to:
 - Reduce the Number of Findings Processed in Phase 2.
 - Decrease Inspection of Very Low Risk Significant Items.
 - Screen Some Deficiencies Immediately Based on Low Impact.

Phase 2 Estimation

At-Power Inspection Findings

- Findings are Evaluated Using the Risk-Informed Inspection Notebooks.
- Notebooks Assist the Inspectors in Identifying:
 - The Initiating Events Impacted by the Finding
 - The Accident Sequences Affected
 - The Systems Available to Perform Risk-Significant Functions
 - An Estimated Increase in Core Damage Frequency
- Notebooks Provide Risk Estimates for Findings Involving the Unavailability of Mitigating Systems and/or Increases in Initiating Event Frequencies.

External Initiator Contribution

Phases 2 and 3



- External Risk Contribution may be 10 times greater than Internal Alone
- Required in NRC Inspection Manual Chapter 0609, Appendix A, Attachment 1
- Performed for all internal results greater than 1×10^{-7}
- Predominately Fire, Flooding, and Seismic (Except High Winds Season)

Large-Early Release Frequency

- Large-Early Release Frequency is a Separate Metric for Findings
- Required in NRC Inspection Manual Chapter 0609, Appendix A, Attachment 1
- Performed for all sequences greater than 1×10^{-7}
- Currently Evacuation Time Versus Time of Release is Evaluated



Licensee Input to Phase 2 Process

- Analysts May be Asked for:
 - Assessment of Assumption Validity
 - Comments on Phase 2 Applicability
 - Validation of Phase 2 Using Licensee's PRA
 - Input to External Events and/or LERF Assessments
- Licensee May Also be Asked for:
 - Design Documents Related to Deficiency
 - Procedures to Support Recovery Credit
- It is ALWAYS in the Licensee's Best Interest to Provide and/or Comment on Completed Phase 2!
- Greater than Green Phase 2 Estimations Usually Proceed to Phase 3.

Phase 3 Evaluation

At-Power Inspection Findings

- **Phase 3 is a Risk Significance Evaluation Using a Risk Basis That Departs from the Phase 2 Process**
 - In Phase 3, SRAs will Refine, Modify, or Supercede the Phase 2 Result.
 - In Addition, Phase 3 Addresses Findings that Cannot be Evaluated Using the Phase 2 Process.
 - While Performing a Phase 3 Evaluation, the SRAs will Use Appropriate PRA or Other Techniques.
 - Specialty Risk Analysts May be Consulted.

Licensee Input to Phase 3 Process

- Licensee is Encouraged to Provide a Complete Phase 3 Evaluation Including:
 - All Assumptions Made
 - The Revision of the PRA Model Used in the Analysis
 - Any Changes Made to the Model of Record
 - The Top Sequence and Event Cutsets
 - External Events Evaluated and Outcome
 - The Methods Used to Evaluate LERF
 - Documentation to Support Recovery and Human Reliability Analyses

- Routine Discussions Between the NRC and the Licensee are Encouraged Throughout the Process.

Reaching a Preliminary Determination



- Differences Between SRAs and Licensee's Evaluation Must First Be Understood
- Differences are Quantified to Ensure Understanding
- Critical Differences are Assessed to Determine the Best Approach to Modeling and/or Best Assumption to be Used
- SRA, with NRR and Research Support, have Final Decision

Significance Determination Process and Enforcement Review Panel

- Phase 3 Result is Provided to SERP as the Recommended NRC Preliminary Determination
- If Preliminary SERP Decision is Greater than Green:
 - Licensee is Sent a “Choice Letter.”
 - Licensee Must Respond by Letter or Attend a Regulatory Conference
 - Licensee May Accept Preliminary Result
- If Preliminary Result is Changed:
 - SERP Reconvenes
 - SERP Evaluates New Information or Insights
 - SERP Makes Final Significance Determination of Finding
- Final Significance Letter is Issued

Licensee Input to SERP Process

- Licensees Do Not have Direct Input to the SERP Process.
- Written Responses and/or Regulatory Conference Presentations Should Completely Explain Licensee Positions
- Licensee May be Asked to Provide Additional Information in a Short Period of Time
- Final Significance Determination is the Responsibility of the NRC
- Licensee May Decide to Appeal Final Determination upon Meeting Certain Criteria

Notice of Enforcement Discretion (NOED)

- NOEDs designed to address unanticipated temporary noncompliances
- Request must be able to show “no net increase in risk” for the duration of the NOED
- SRA and NRR risk analysts will jointly review the licensee’s risk assessment and independently verify results
- Risk assessment uses “zero maintenance” PRA model and calculates Incremental Conditional Core Damage Probability (ICCDP) and Incremental Conditional Large Early Release Probability (ICLERP)
- Guidance Thresholds – ICCDP < 5E-7 ICLERP < 5E-8
- Risk Assessment needs to address dominant risk contributors, external events, and compensatory measures

SDP References

Inspection Manual Chapters

- IMC 308, Attachment 3 and Associated Appendices A thru J, Significance Determination Process Basis Document
- IMC 609, Significance Determination Process
- IMC 60901, Significance and Enforcement Review Process
- IMC 60902, Process for Appealing NRC Characterization of Inspection Findings (SDP Appeal Process)
- IMC 60903, Senior Reactor Analyst Support Objectives
- IMC 609A, Determining the Significance of Reactor Inspection Findings for At-Power Situations
- IMC 609, Appendix B, Emergency Preparedness SDP
- IMC 609, Appendix C, Occupational Radiation Safety SDP
- IMC 609, Appendix D, Public Radiation Safety SDP
- IMC 609, Appendix E, Physical Security SDP (withheld from public)
- IMC 609, Appendix F, Fire Protection SDP
- IMC 609, Appendix G, Shutdown Operations SDP
- IMC 609, Appendix H, Containment Integrity SDP
- IMC 609, Appendix I, Operator Requalification Human Performance SDP
- IMC 609, Appendix J, Steam Generator Tube Integrity Findings Significance Determination Process
- Web address - <http://www.nrc.gov/reading-rm/doc-collections/insp-manual/manual-chapter/index.html>