Region I Utility Group – Reactor Oversight Process Training

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Training Outline

- Purpose
- Success Criteria
- ROP Overview
- MD 8.3
- SDP
- Examples
  - Reactor Trip w/ failure of HPCI to start
  - Reactor Trip w/ failure of HPCI and RCIC
  - SIT Finding – Phase 2 SDP

Purpose:

Provide an overview of Management Directive 8.3 and the Significance Determination Process and go through a few examples to help clarify the how these processes are used by the NRC staff.

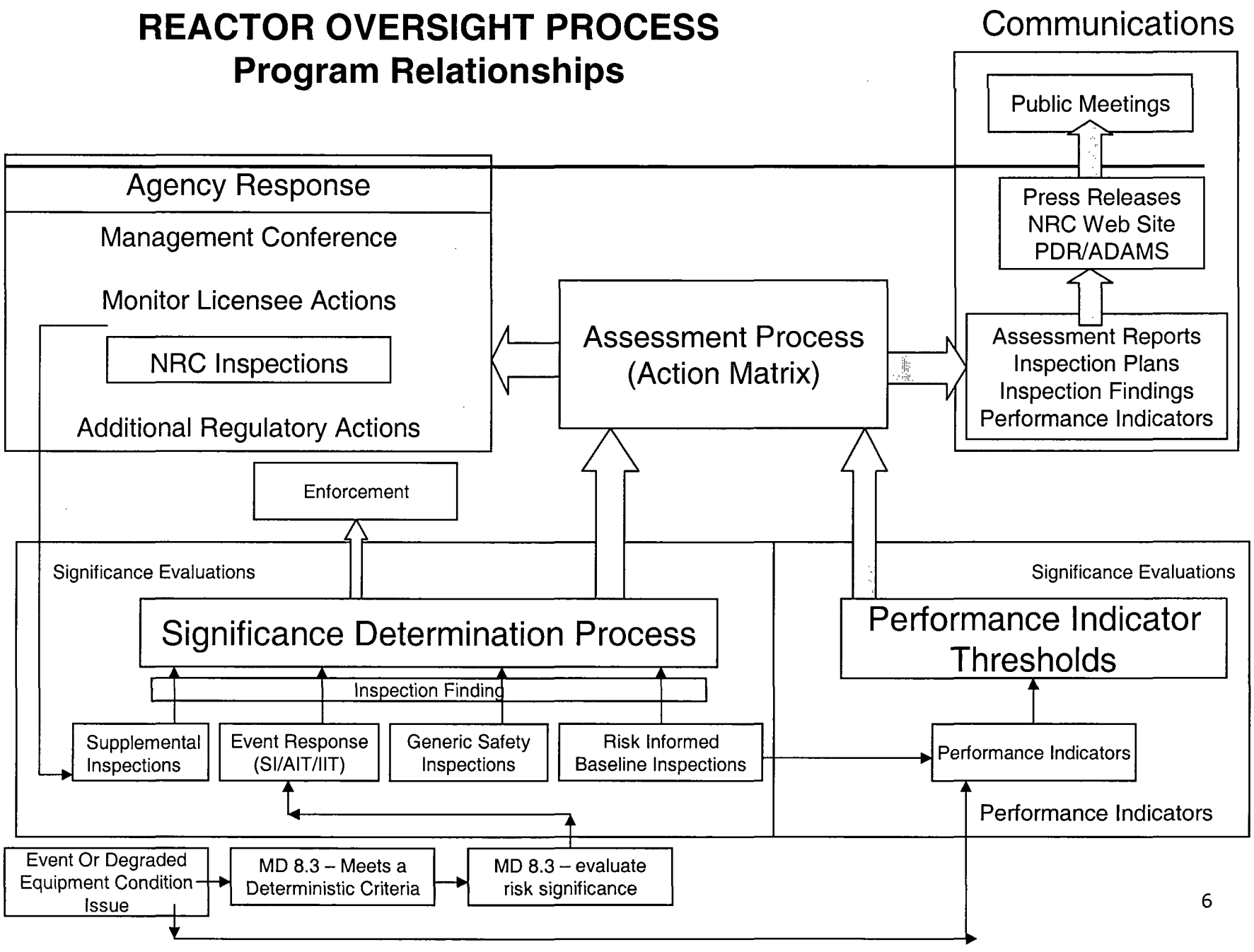
Success Criteria

Improved understanding of these two regulatory tools for: 1) evaluating initial NRC response to significant operational events and degraded equipment conditions; and 2) determining the risk significance of inspection findings.

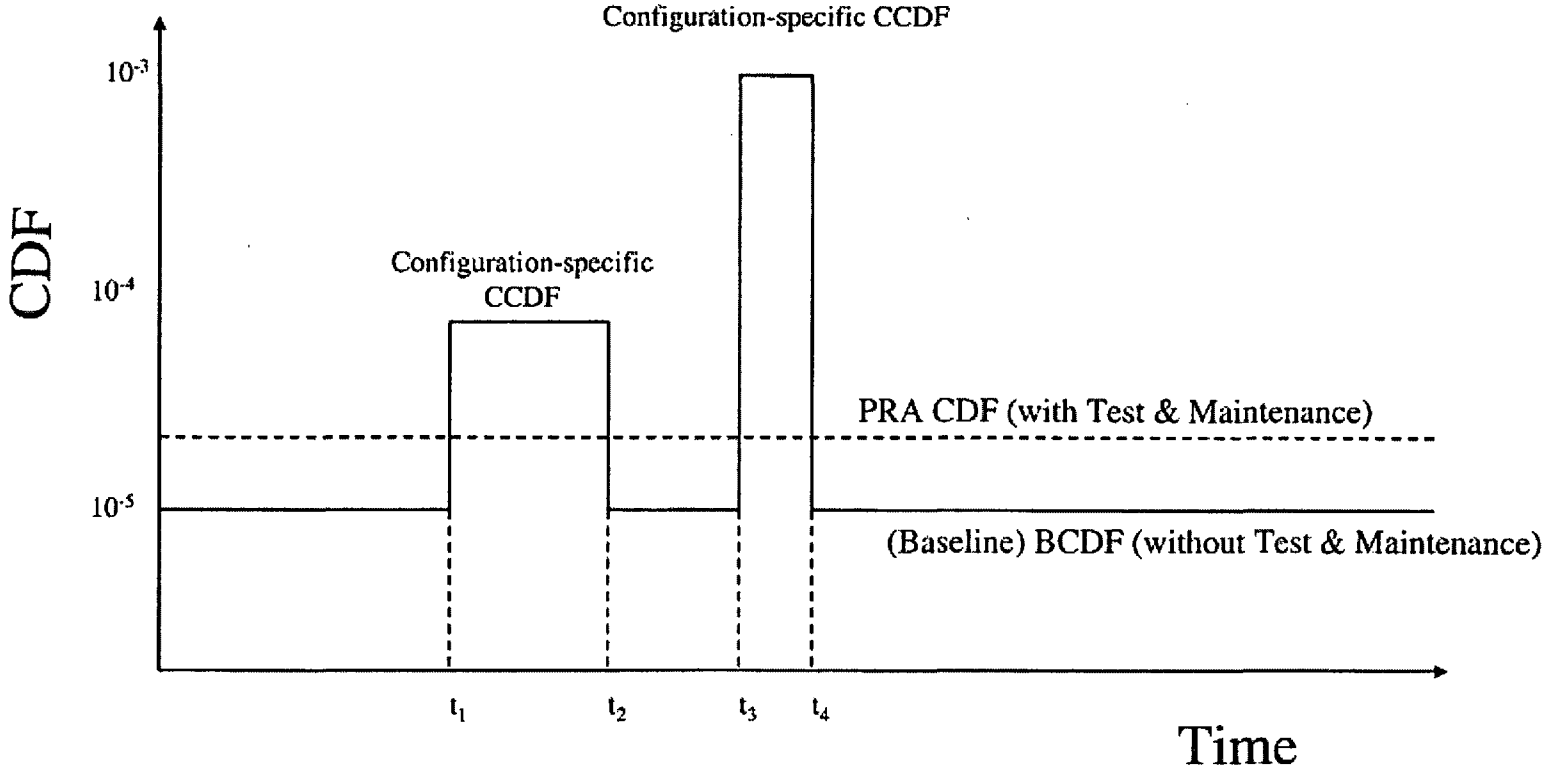
Reactor Oversight Process

- Integration of Inspection Findings, Performance Indicators, and Assessment
- Described in NRC Inspection Manual Chapters
  - 0305, Operating Reactor Assessment Program
  - 0308, Reactor Oversight Process Basis Document
  - 0609, Significance Determination Process
  - 0612, Power Reactor Inspection Reports

REACTOR OVERSIGHT PROCESS
Program Relationships



CDF Profile


Configuration-specific CCDF
10^{-3}
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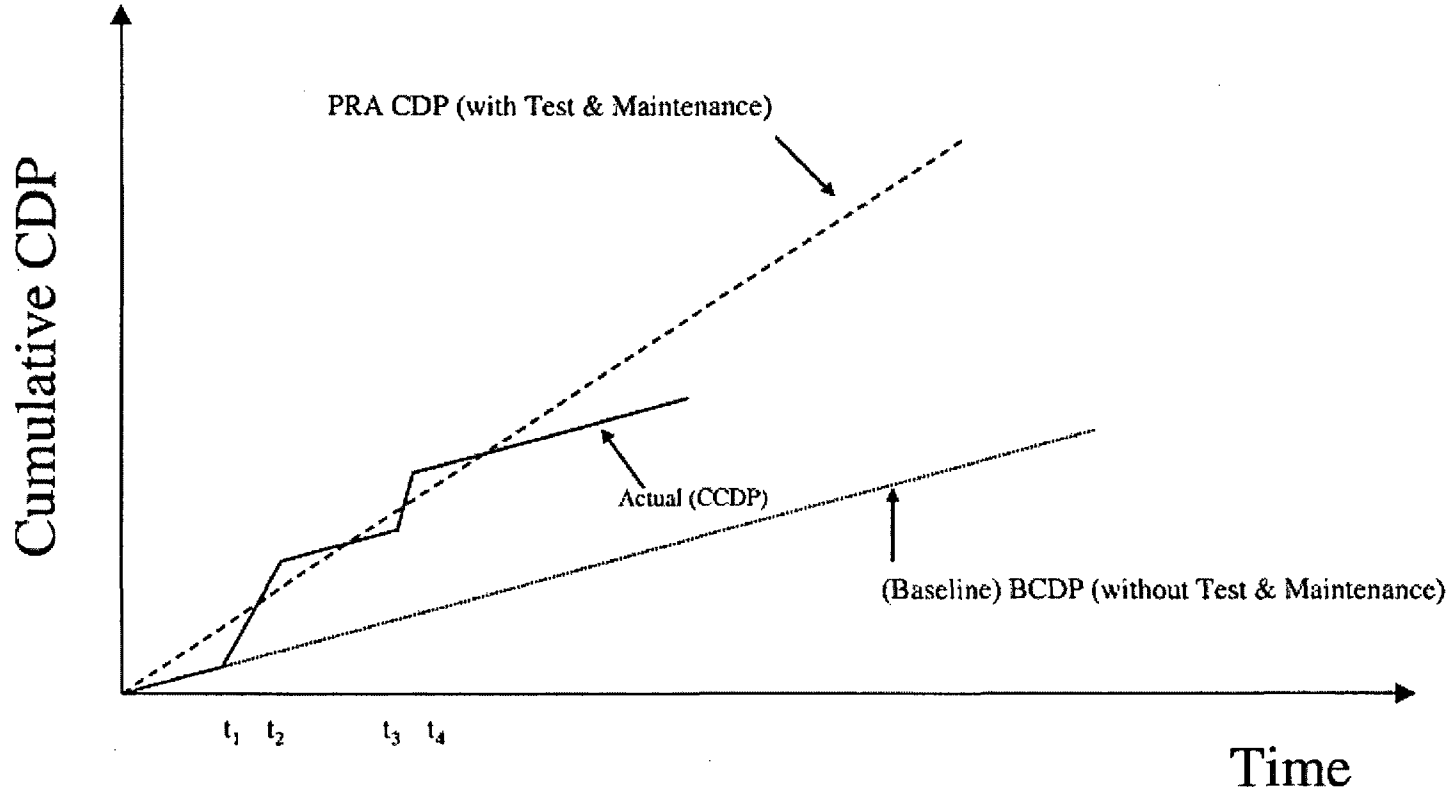
CDF
Configuration-specific CCDF
PRA CDF (with Test & Maintenance)
(Baseline) BCDF (without Test & Maintenance)
t_1
t_2
t_3
t_4
Time

Cumulative CDP



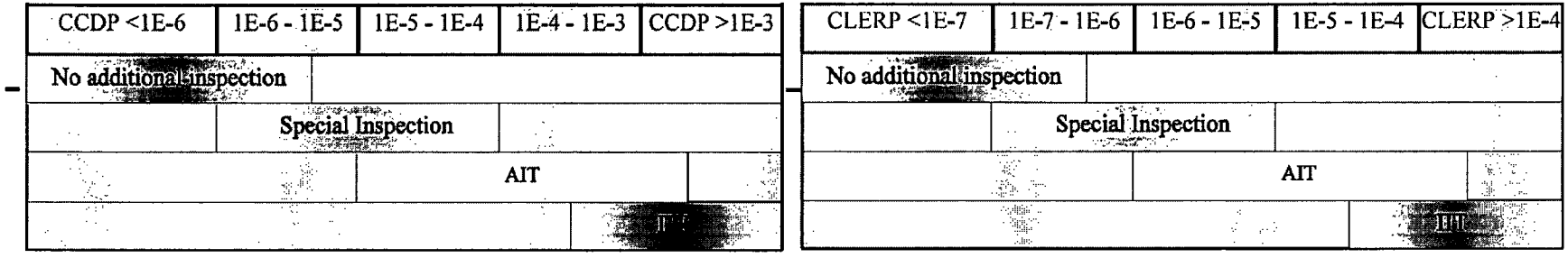
Management Directive 8.3 - NRC Incident Investigation Program

- **Quickly** gather and analyze factual information about events and degraded conditions to determine if NRC needs to apply reactive inspection effort
- Inspection Staff gathers the information and passes it to their Branch Chief and the SRA
- The Branch Chief makes the determination if a deterministic criteria has been met
- Discretionary level of response based on both deterministic and risk criteria
- The SRA will contact the Licensee PRA staff to discuss the risk characterization assumptions and outcome. If time permits this will happen prior to an the NRC MD 8.3 decision.

MD 8.3 Deterministic Criteria

- Operations outside design basis
- Major deficiency in design, construction, or operation
- Significant loss of integrity of fuel, primary boundary, or containment
- Loss of safety function or multiple failures
- Possible adverse generic implications
- Significant unexpected system interactions
- Repetitive failures or events
- Questions or concerns pertaining to licensee operational performance.

MD 8.3 - Risk Criteria

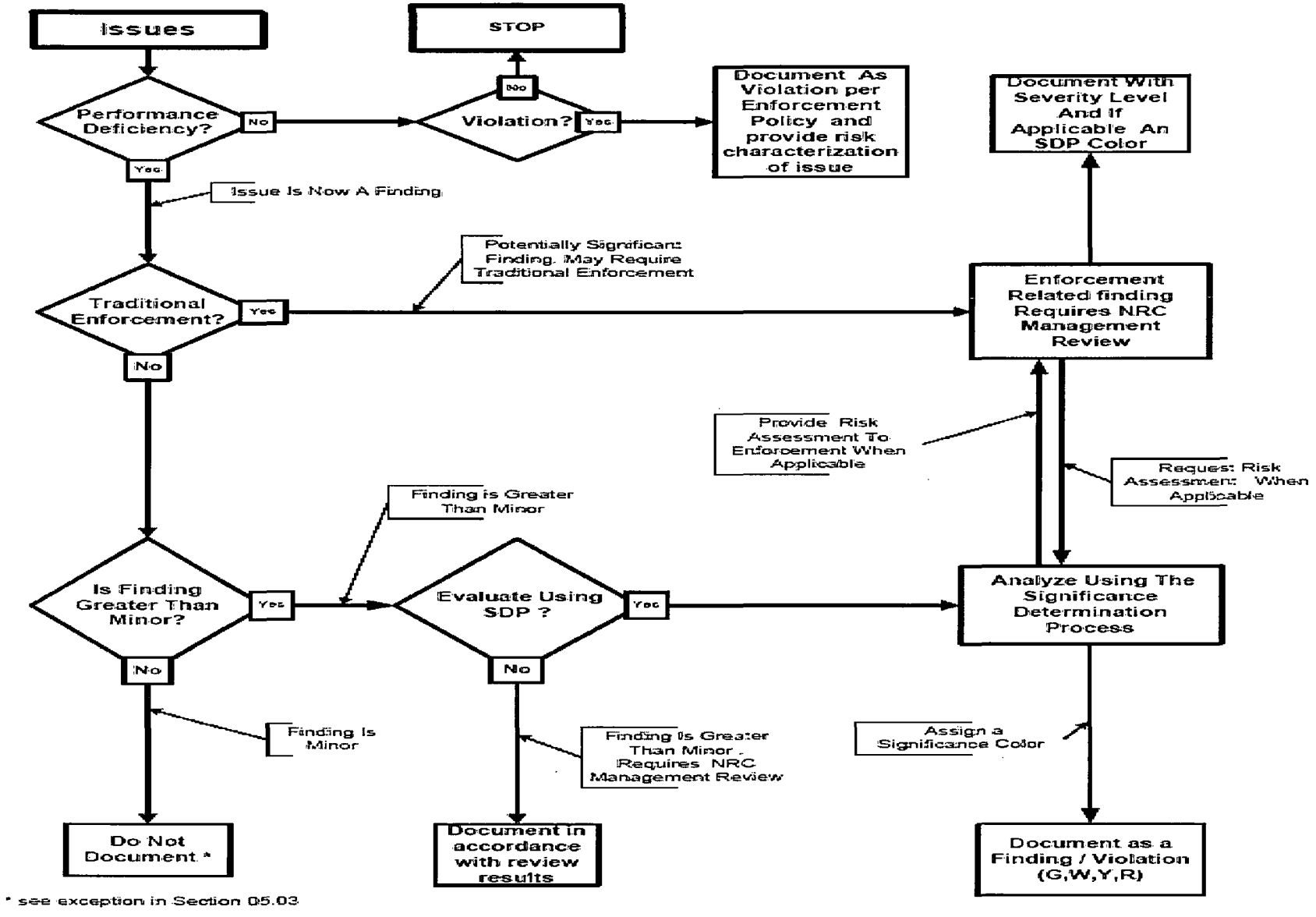


- Overlap areas allows some NRC management discretion.
- Risk Assessment includes the actual conditions that occurred. Depending on the event it will included known equipment problems and human performance issues.
- The plant Standardized Plant Analysis Risk (SPAR) model is used for the calculation.
- Risk Metrics
  - **For events - conditional core damage probability (CCDP) or conditional large early release probability (CLERP)**, given that the event has happened, this includes any associated equipment or human problems that actually happened
  - **For a degraded equipment condition – increase in core damage probability (delta-CDP) or increase in large early release probability (delta-LERP)**, given the equipment condition over an assumed exposure time. This is based on the actual plant configuration from the zero-test and maintenance baseline
  - **CLERP and delta-LERP bands are one order of magnitude lower than CCDP and delta-CDP**
- SI/AIT/IIT
  - Headquarters involvement in AIT and IIT decisions.
  - Inspection Charter will outline the areas of concern and the associated risk
  - Press release, unless security related
  - Inspection Report will discuss the MD8.3 risk assessment and a a final risk assessment given the information developed during the inspection
  - Findings are discrete issues and are evaluated based on the SDP
  - RES may conduct an ASP review and ask the licensee and SRA to provide comments.

Significance Determination Process Overview

- Guidance provided in Inspection Manual Chapter 0609
- Risk Informed Reactor Safety Guidelines:
  - Appendix A: At-Power Situations
  - Appendix B: Emergency Preparedness
  - Appendix C: Occupational Radiation Safety
  - Appendix D: Public Radiation Safety
  - Appendix E: Physical Safety
  - Appendix F: Fire Protection
  - Appendix G: Shutdown Safety
  - Appendix H: Containment Integrity
  - Appendix I: Operator Requalification
  - Appendix J: Steam Generator Tube Integrity
  - Appendix K: Maintenance Risk Assessment and Management

Issue Screening



* see exception in Section 05.03

IIMC 0612, Appendix B (5/19/05)

Performance Deficiency and Minor Finding Determination

- IMC 0612 clarifies:
  - If the issue a PD
  - If Traditional Enforcement is appropriate, if so the Enforcement Process is followed.
  - If the issues is more than minor. (Similarity to examples in Appendix E or Appendix B questions)
  - If the issue can be evaluated within the SDP, if so it is transferred to the appropriate section of IMC 0609.
  - How to review and document issues that can not be evaluated in the SDP
- The inspectors should clearly be able to say why an issue is a PD, why traditional enforcement applies or why an issue is more than minor.
- Open Items
  - URI if we are not sure there is a PD and more inspection is needed
  - VIO or Finding with Significance TBD, if we know there is a PD, but can not complete the SDP in the 45 days prior to IR issuance.

At Power SDP

- Three phase process:
  - Phase 1, Screening Worksheet
  - Phase 2, estimate risk using Plant Specific Risk-Informed Inspection Notebooks
  - Phase 3, evaluate risk by modification of the Phase 2 and/or using other risk tools, as needed
- Phases 1 and 2 are generally performed by inspection staff, with assistance of a Senior Reactor Analyst (SRA), as necessary
- Phase 3 is defined as ANY departure from the Phase 2 process, performed by an SRA

Risk Metrics

Green Finding: very low safety significance

(delta-CDF_{total} <1E-6, delta-LERF<1E-7)

White Finding: low to moderate safety significance

(delta-CDF_{total} 1E-6 – 1E-5, delta-LERF 1E-7 – 1E-6)

Yellow Finding: substantial safety significance

(delta-CDF_{total} 1E-5 – 1E-4, delta-LERF 1E-6 – 1E-5)

Red Finding: high safety significance

(d delta-CDF_{total} >1E-4, delta-LERF > 1E-5)

- The delta-CDF_{total} includes the contribution from external initiating events, if the internal delta-CDF is greater than or equal to 1E-7 per year.
- The delta-LERF is evaluated if the internal and external delta CDF is greater than or equal to 1E-7 per year

Phase 1 Screening

- Greater than minor findings are processed using the Phase 1 Screening Worksheet, which prioritizes the need for continued risk assessment.
  - Cull clearly very low significance issues, as soon as possible
  - Use Phase 2 Notebook
  - Use Phase 3 for some issues that are not covered in the Notebook

SRA - PRA Staff Interactions

- The SRAs routinely speak with the inspectors about pending issues and how to proceed in the SDP.
- Likewise as issues come up the SRAs routine call the PRA staffs and vice versa. We have very good working relationships will all the Regional PRA staffs
- Once Phase 2 is entered the PRA staff will be contacted if
  - There are plant assumption questions based on the Phase 2 Notebook
  - A quick look at Phase 2 indicates it may be greater than green.
- Additional PRA types of information may be requested or exchanged to allow more detailed understanding and modeling of the plant in a modified Phase 2 or in the Phase 3 SPAR model. This may include
  - Design documents related to deficiency
  - Procedures to support recovery credit
  - PRA modeling information
- We try to keep these information exchanges as informal as possible.
- Interactions will continue, to ensure a common understanding and comparison of assumptions and results, all the way through development of the SERP package and review of additional information provided following a greater than green preliminary finding and the issuance of the Final Risk Determination.

Phase 2 Process

- Findings are evaluated using the Risk Informed Inspection Notebooks.
  - Rev 1 was benchmarked against the Licensee's PRA between 2001 and 2003
  - Rev 2 is being issues shortly, and was based in recent information
  - Trip Reports provide comparison of Notebook results and Licensee PRA calculated RAW values.
- Notebooks assist the inspectors in estimating the increase in Core Damage Probability (delta-CDP) given the finding, based on
  - The Initiating Events and mitigating systems impacted
  - The accident sequences affected
  - Exposure Time assumed(>30 days assumes a year; 3- 30 days assumes a 10^{th} of a year and < 3 days assumes a 100^{th} of a year)
  - The SDP then spreads the delta-CDP over a year to get delta-CDF (per year) (same numerical value)

Phase 2 Process (Cont'd)

- Phase 2 results may be conservative if the actual exposure time is in the low end of the exposure band (i.e., 45 day finding will assume a years worth of exposure)
- If Green, SRA prepares the analysis section writeup
- If Greater than Green, usually proceed to Phase 3 – unless agreement (SERP and Licensee) can be reached on the suitability of the Phase 2 result.

External Initiator Contribution

- External risk contribution may potentially be 10 times greater than internal risk
- SRA must evaluate the finding for external event contribution to core damage as required in NRC Inspection Manual Chapter 0609, Appendix A, Attachment 1, if the internal events delta-CDF is greater than or equal to 1E-7 per year
- Predominately Fire, Flooding, and Seismic (and possibly High Winds)
- The SRA will try to gather IPEEE information and discuss it with the PRA staff
- The PRA staff may have more current information, including possibly a fully internal and external initiating events PRA
- External delta-CDF contributions are added to the Internal to get an estimate of the total delta-CDF.

Large Early Release Frequency

- Increase in Large Early Release Frequency (delta-LERF) is a separate metric for inspection findings, as in the MD 8.3 the criteria are one order of magnitude lower than the delta CDF.
- The SRA will perform a delta-LERF review, as required per NRC Inspection Manual Chapter 0609, Appendix A, Attachment 1, for all sequences (internal or external) that have a delta CDF of greater than or equal to 1E-7 per year
- An initial screening is performed using IMC -0609 Appendix H, this is dependent on the cores damage sequence and the type of containment
- The PRA staff may be contacted to review the sequences and provide information from the Level 2 PRA for Phase 3 evaluations.

Phase 3 Process

- Phase 3 is a significance evaluation conducted by the SRA that departs from the Phase 2 process, and may include:
  - PRA staff will know we are at this point
  - Changes/adjustments to the Phase 2 result.
  - Use of the Standardized Plant Assessment Risk (SPAR) model.
  - Use of basic PRA techniques
  - If green SRA will discuss the outcome with the PRA staff and prepare the analysis section of the Inspection Report
  - If the initial Phase 3 work indicates a greater that green issue, the SRA will conteinue the dialog with the PRA staff on the influential assumptions and dominant results with the PRA staff. Further, the inspector and the SRA will start to prepare the SERP package.

Phase 3 Process (Cont'd)

- Routine discussions between SRA and PRA staff is essential in completing a Phase 3 evaluation.
- To allow a comparison with the Phase 3 analysis the PRA staff may be asked to provide information from their own analysis including:
  - Assumptions made
  - Any changes made to the model
  - 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
- The SRA will also provide information to the PRA staff so that they too can look at and understand any differences in the evaluations

SERP Package Development

- The SERP Package is prepared by the inspectors and the SRA, it provides the details on the specific finding and the risk assessments.
- The risk assessment will include the Phase 2 and Phase 3 analyzes of the delta-CDF_{total} and delta-LERF.
  - All assumptions are detailed
  - Any changes made to SPAR model are discussed
  - External events and LERF are evlauated
  - Comparison with Licensee PRA results with evaluation of differences.
  - Sensitivity study of the results for each major assumption and bounding analysis may be used.
  - NRR or another SRA conducts a peer review of the completed analyzes.

Significance and Enforcement Review Panel (SERP)

- The Region presents the SERP package to the SERP.
- If the SERP agrees with the preliminary >Green determination:
  - Licensee is sent a "Choice Letter."
  - Licensee must respond by letter or attend a Regulatory Conference
  - Licensee may accept preliminary result
  - Press release if there is a Regulatory Conference

Final Determination

- 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
- Following review of the additional information provided the NRC will decide if the risk analysis is to be redone. If it is to be redone:
  - SRA will conduct the review and contact PRA staff as needed
  - SERP evaluates new information or insights
  - SERP makes final significance determination of finding
- Final significance letter is issued
  - Press release if greater than green
  - The final significance determination is the responsibility of the NRC
- Licensee may appeal the final determination (reference IMC 0609, Attachment 0609.01)

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