Applying Risk in Assessment of Events and Conditions

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Introduction

Evaluation of risk or safety significance of events or degraded conditions (postulated or actual) is important for many key NRC processes and programs including:

- Operating experience
  - Operating Experience Program
  - Accident Sequence Precursor program
  - International Nuclear Events Scale
  - Abnormal Occurrence
  - Generic Issues Program
- Incident Investigation Program
- Incident Response
- Oversight
  - Significance Determination Process
- Rulemaking/Backfit
- Licensing

Agency-Level Documents/Procedures

Operating Experience	Draft MD 8.7	**Reactor Operating Experience Program**
	ASP	**Accident Sequence Precursor**
	MD 5.12	International Nuclear Event Scale
	MD 6.4	Generic Issues Program
	MD 8.1	Abnormal Occurrence
Incident Investigation	MD 8.3/ IMC 0309	**Incident Investigation Program**
Incident/Emergency Response	MD 8.2/ NUREG-0728	NRC Incident Response Program
Oversight	MD 8.13	**Reactor Oversight Process/ Significant Determination Process**
Rulemaking/Backfit	NUREG/BR-0058	Regulatory Analysis Guidelines
Licensing	RG 1.174 - 1.178	Risk-informed licensing

MD = NRC Management Directive
RG = Regulatory Guide
IMC = Inspection Manual Chapter

Operating Experience Program

(Draft Management Directive 8.7)

- Short-term and long-term evaluation of operating experience information for insights and applications
- Applications typically based on significance, recurrence, trends, and generic implications
  - Communication of lessons learned
  - Regulatory actions
  - Influencing agency programs
- Significance determination is risk-informed
- Events or conditions of CCDP $\geq$1E-6 or CLERP $\geq$1E-7 considered potentially risk significant for follow-up

CCDP = Conditional Core Damage Probability
CLERP = Conditional Large Early Release Probability

Incident Investigation Program

(Management Directive 8.3)

- Purpose
  - Significant operational events are investigated in a timely, systematic, an technically sound manner
- Appropriate event response options based on a function of CCDP and CLERP
  - Incident Investigation Team
  - Augmented Inspection Team
  - Special Inspection

CCDP = Conditional Core Damage Probability
CLERP = Conditional Large Early Release Probability

Management Directive 8.3

Operational events and degraded conditions are evaluated for risk significance to determine appropriate reactive inspection

Estimated Conditional Core Damage Probability (CCDP)				
CCDP <1E-6	1E-6 - 1E-5	1E-5 - 1E-4	1E-4 - 1E-3	CCDP >1E-3
No additional inspection				
	Special Inspection			
		AIT		
			IIT	

Table 1: CCDP vs Event Response

MD 8.3

Operational events and degraded conditions are evaluated for risk significance to determine appropriate reactive inspection

Estimated Conditional Large Early Release Probability (CLERP)				
CLERP <1E-7	1E-7 - 1E-6	1E-6 - 1E-5	1E-5 - 1E-4	CLERP >1E-4
No additional inspection				
	Special Inspection			
		AIT		
			IIT	

Table 2: CLERP vs. Event Investigative Response

Accident Sequence Precursor (ASP) Program

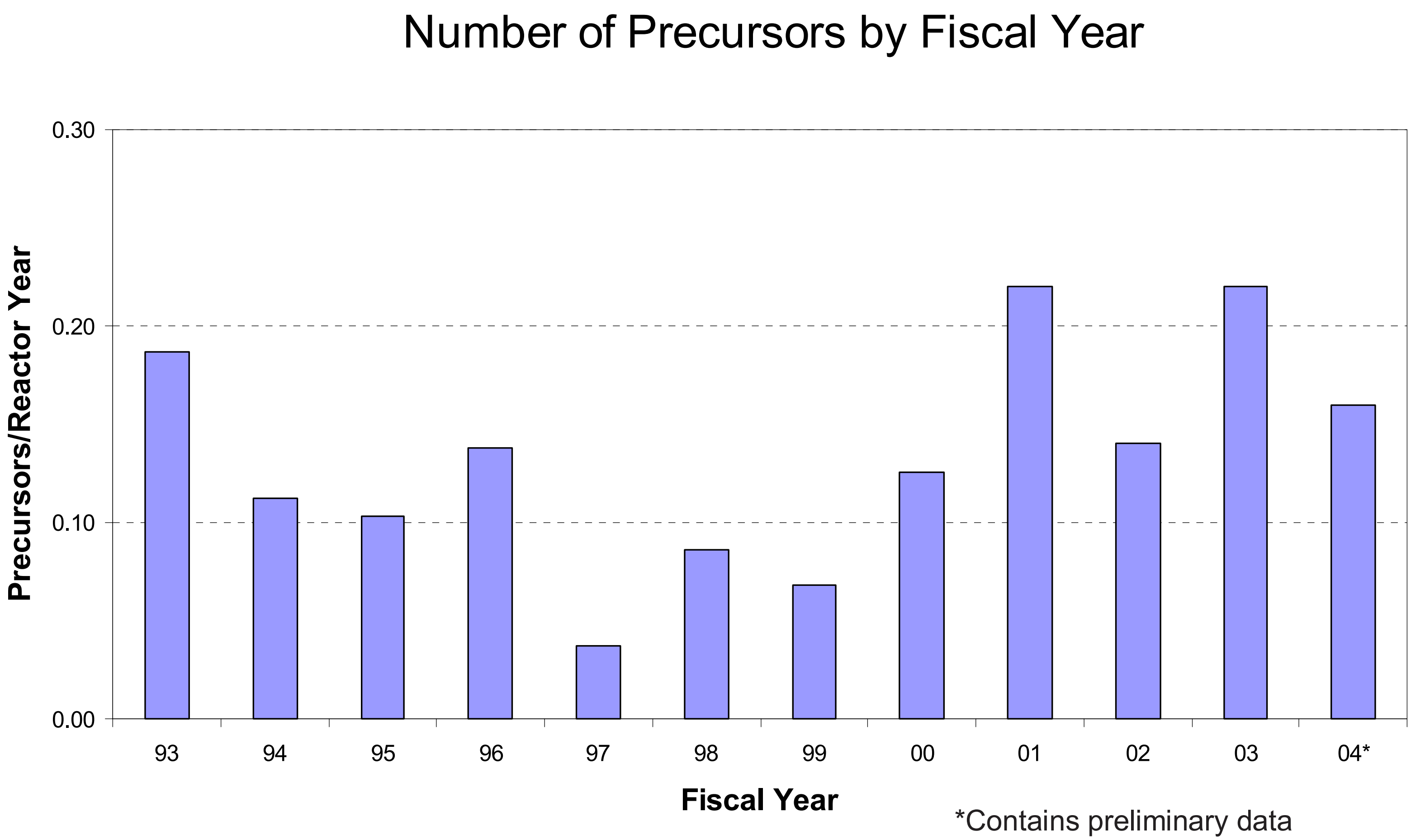
ASP has been a part of NRC events analysis activities for about 25 years, and it has a variety of internal and external users.

- The primary objective of the ASP Program is to systematically evaluate operating experience to identify and document events likely to lead to core damage. Analyses are performed to define and project potential accident scenarios, determine risk exposure, and assess risk mitigation measures.

- ASP analyses are also used to support:
  - Performance measures in the Annual Performance and Accountability Report to Congress
  - Industry trends program
  - Decisions to develop generic communications
  - Studies to determine the safety significance of potential regulatory issues
  - A partial check on PRA scenarios

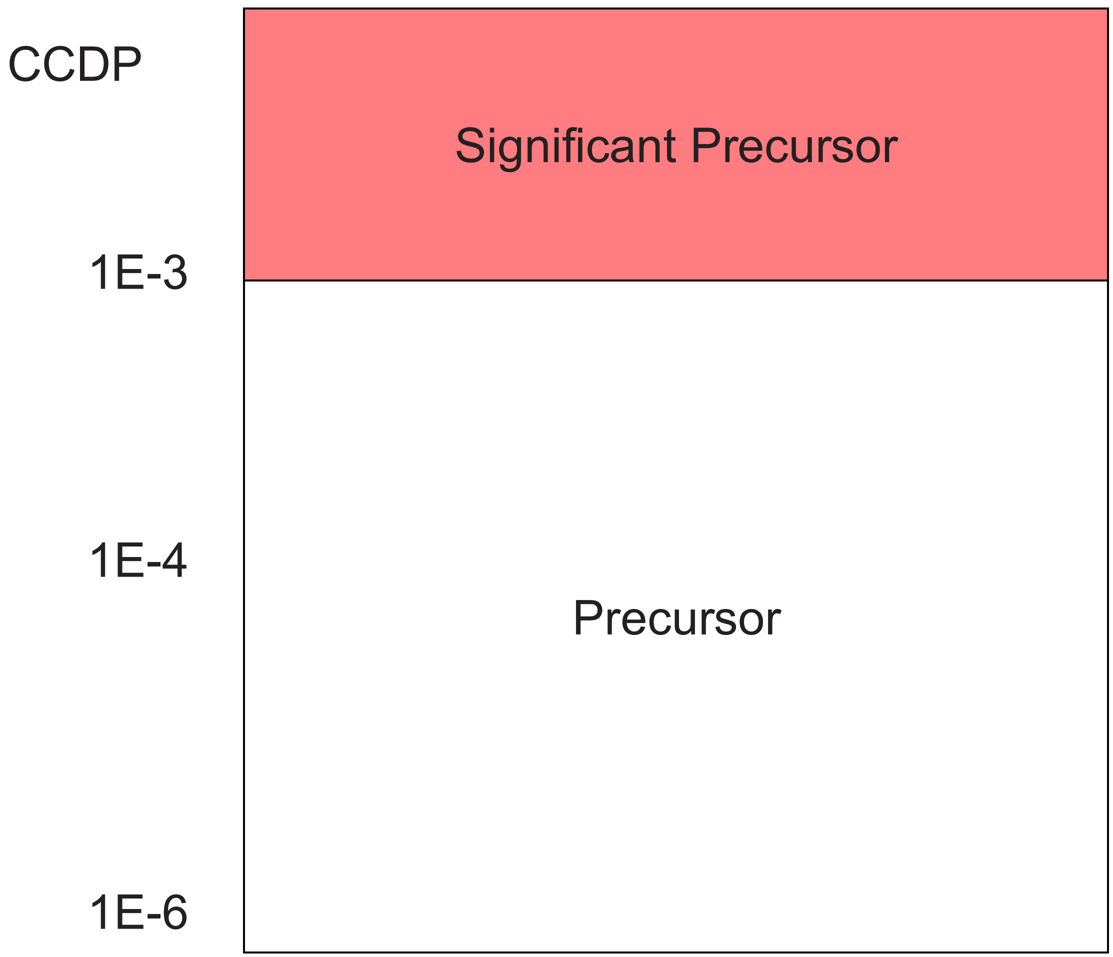
ASP RESULTS, TRENDS & INSIGHTS

No trend was identified in the rates of occurrence of all precursors during the period from FY 1993 through FY 2004



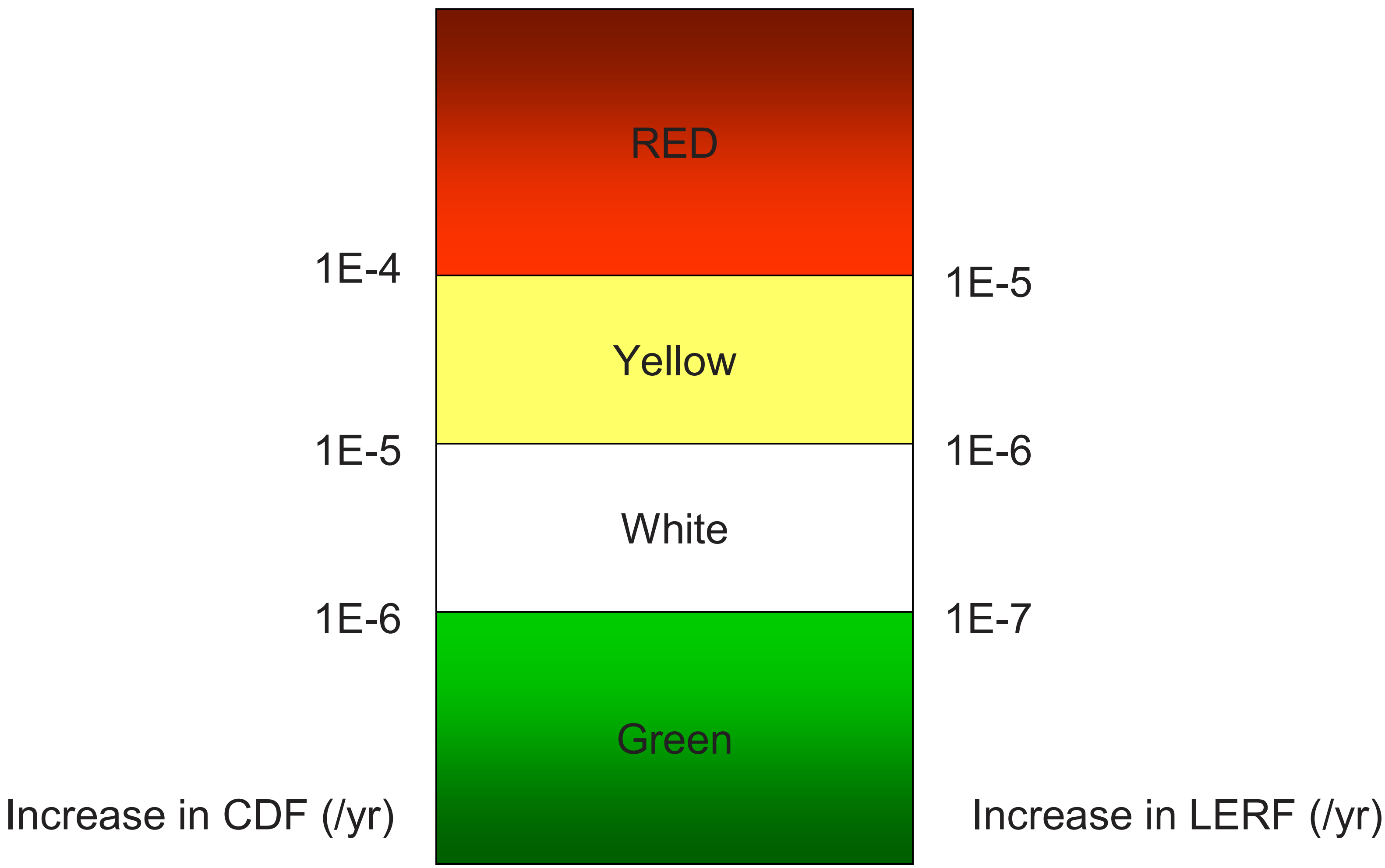
ASP

Licensee event reports and other documents are reviewed to identify accident precursors

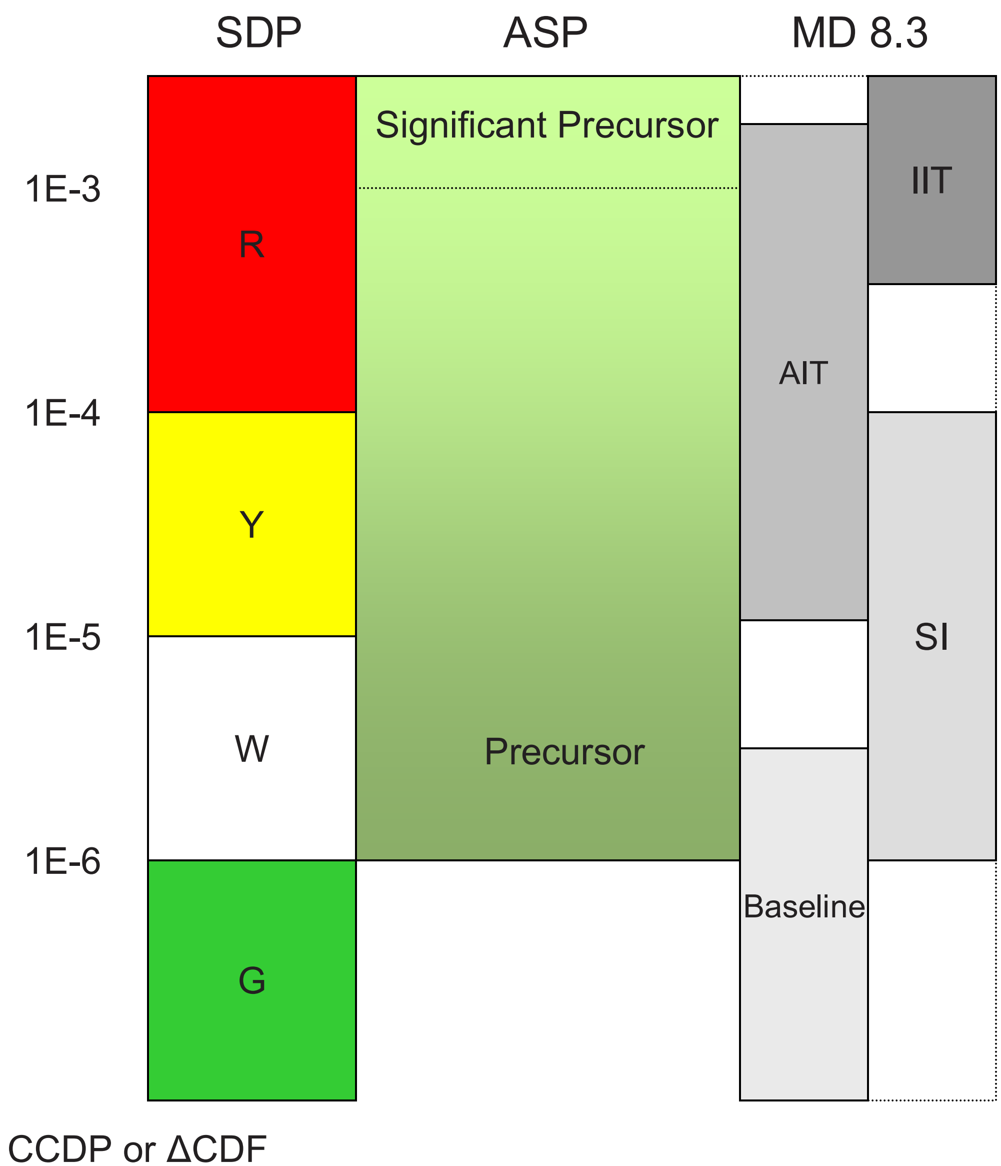


Significance Determination Process

Inspection findings (licensee performance deficiencies) are evaluated for risk significance



Comparison Table



Use of PRA in Event Risk Evaluations

- Probabilistic risk analyses: Typically Level 1 (core damage) and limited Level 2 (containment performance)
- Metrics
  - Initiating events and degraded conditions: conditional core damage probability (CCDP) or conditional large early release probability (CLERP)
- Sources/Tools
  - NRC-developed plant-specific Standardized Plant Analysis Risk (SPAR) models
  - Licensee PRA evaluations
  - Consideration of other PRA results and insights
- Thresholds:
  - Risk is generally considered low when change in CDF or CCDP is below 1E-6 (/yr) or change in LERF or CLERP below 1E-7 (/yr)
  - Risk is generally considered high when change in CDF or CCDP is above 1E-4 (yr) or change in LERF or CLERP above 1E-5 (/yr)

Example: Oconee 3 Automatic Reactor Trip

August 31, 2005

- Summary
  - A routine test of the alternate power source for the Control Rod Drive (CRD) System was in progress when power to the CRD system was interrupted
  - Reactor trip and AC power transferred to the Start-up source (switchyard)
  - The Main Steam Header pressure control setpoint did not automatically increase for post-trip RCS temperature control
  - The RCS cooled down to approximately 536F (versus a normal post-trip temperature of approximately 555F), reducing RCS pressure to the actuation setpoint for Engineered Safeguards Channels 1 and 2. This started the High Pressure Injection pumps in ECCS mode, caused partial containment isolation and initiated start-up of both Keowee Hydro Units (emergency power)
  - Pressurizer level decreased off-scale low and was recovered prior to securing the High Pressure Injection pumps

Example: Oconee 3 Automatic Reactor Trip

(Continued)