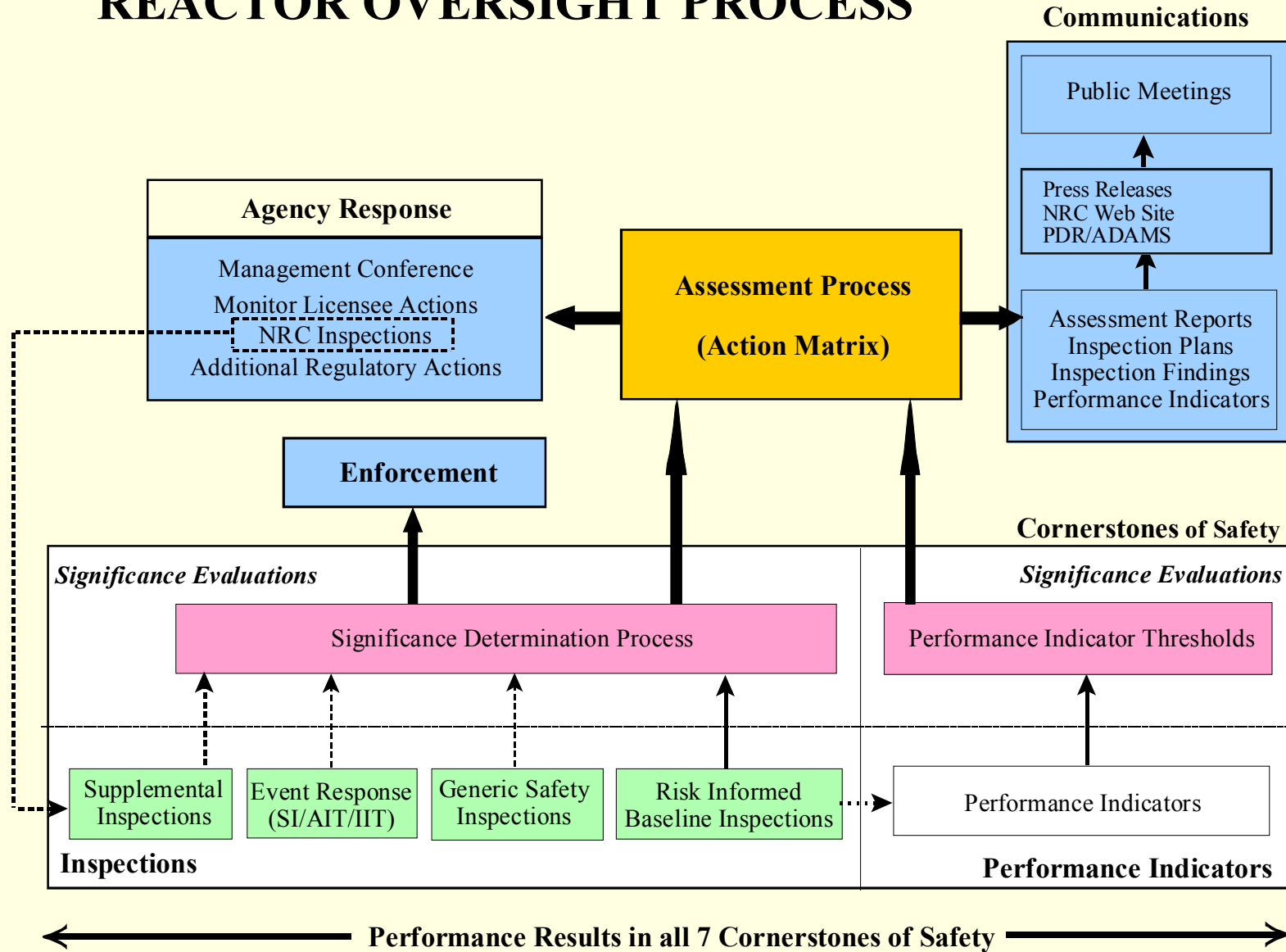




IAEA Workshop NPP Inspection & Oversight USNRC's Performance Indicator Program

Russell Gibbs
March 21 – 24, 2005
Saclay, France

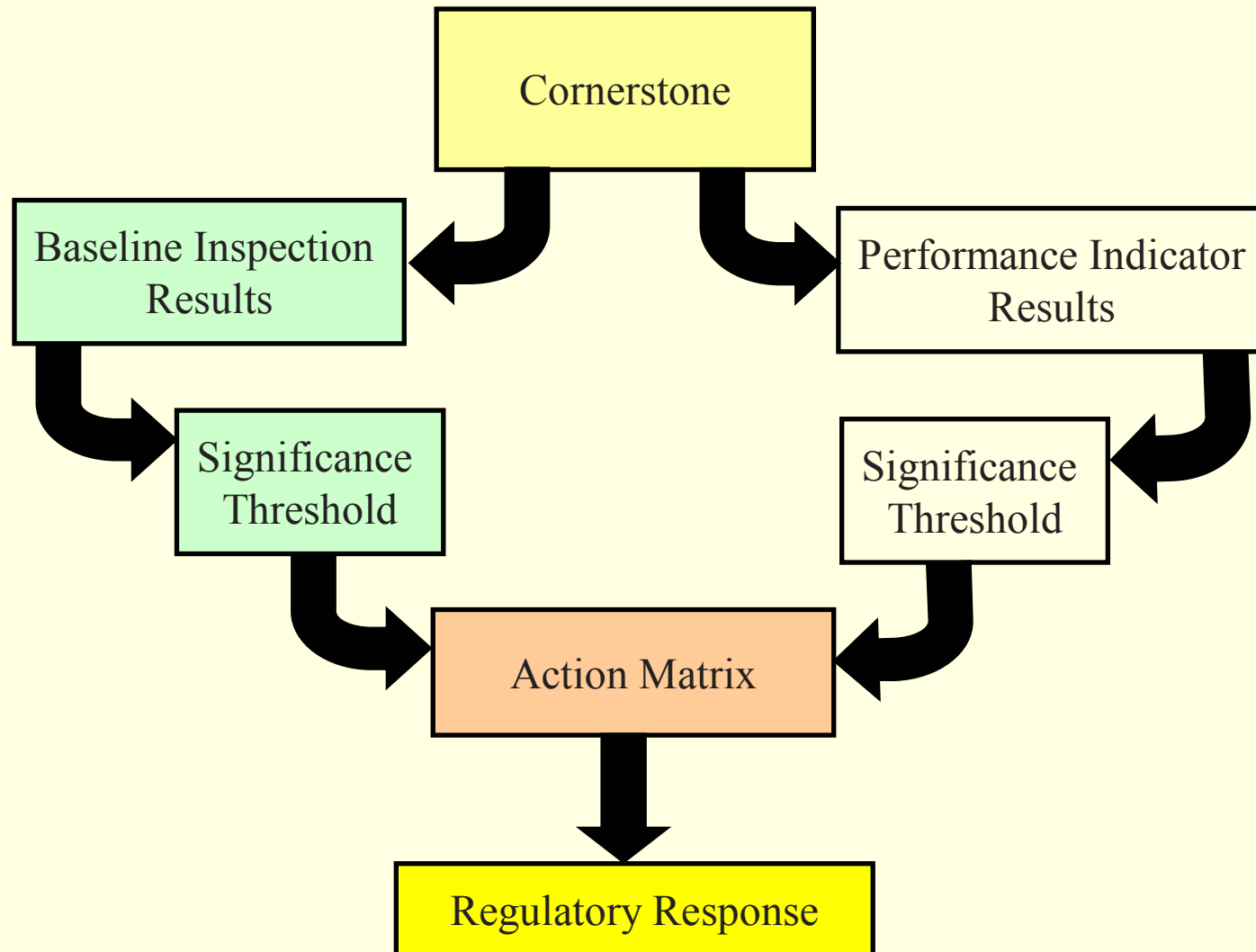
REACTOR OVERSIGHT PROCESS



PHILOSOPHY

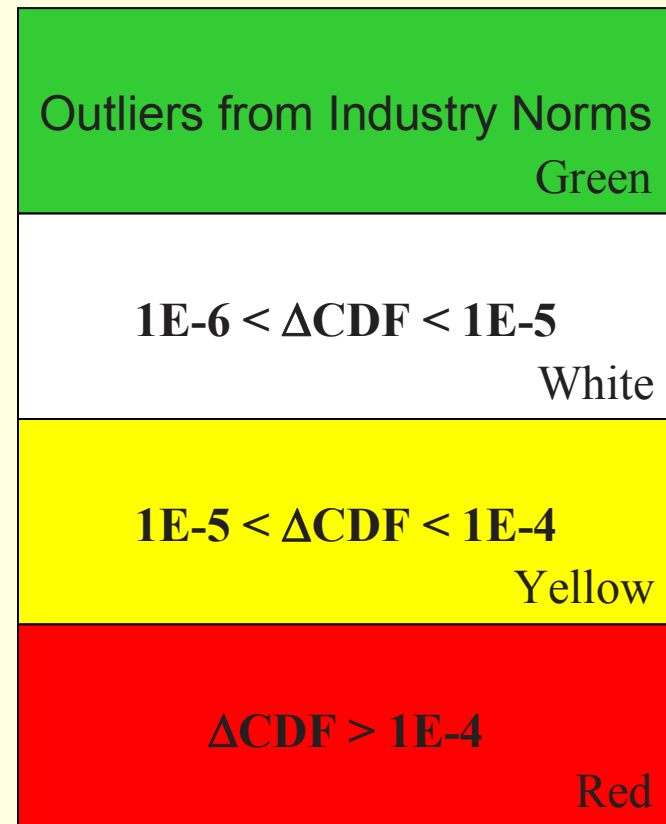
- Pls Should be Based on Objective Data
- Should Provide a Measure of Licensee Performance
- Should Encourage Appropriate Licensee Behavior
- Should Identify Problem Plants
- Should Not be Susceptible to Manipulation
- Definition Should be Clear, Concise, and Precise

REACTOR OVERSIGHT PROCESS



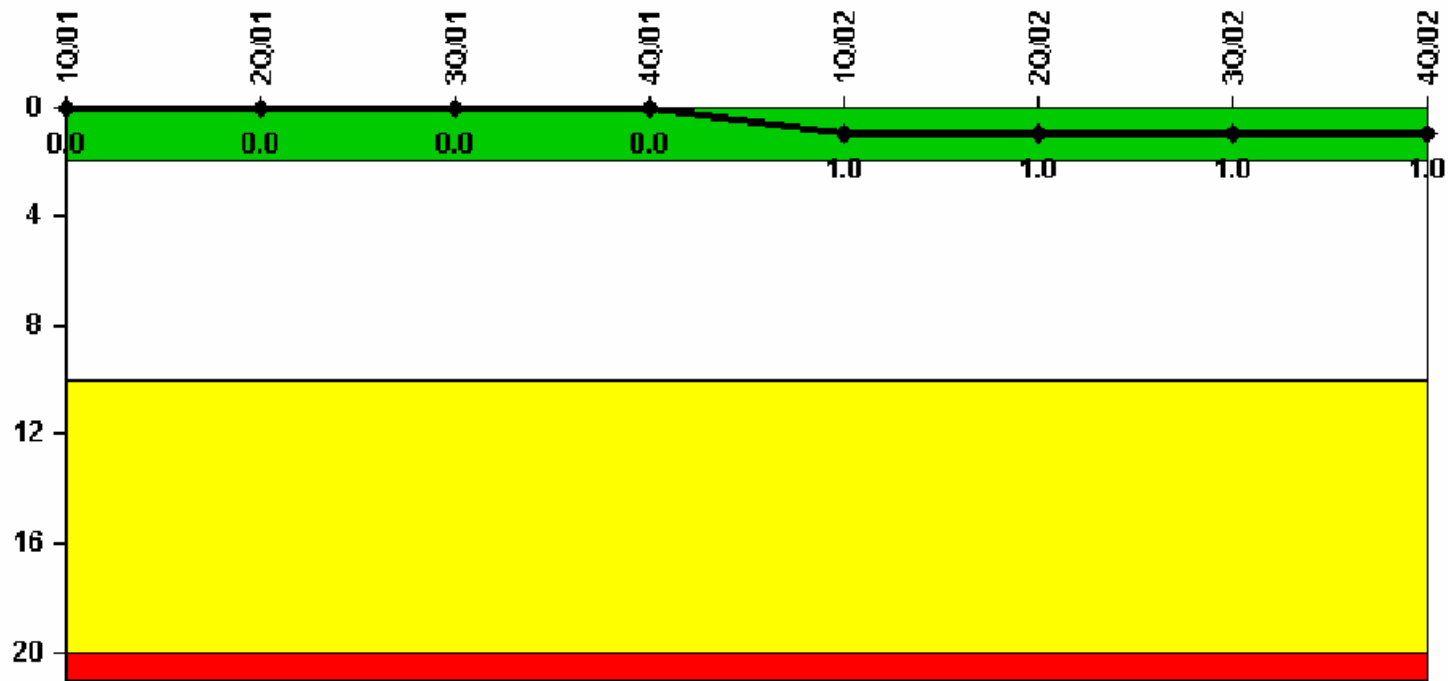
LEVEL OF SIGNIFICANCE ASSOCIATED WITH INITIATING EVENTS AND MITIGATING SYSTEMS PERFORMANCE INDICATORS

- Green - very low risk significance – baseline inspection
- White - low to moderate risk significance – supplemental inspection (95001)
- Yellow - substantive risk significance – supplemental inspection (95002)
- Red - high risk significance – supplemental inspection (95003)



TYPICAL PERFORMANCE INDICATOR

Scrams with Loss of Normal Heat Removal



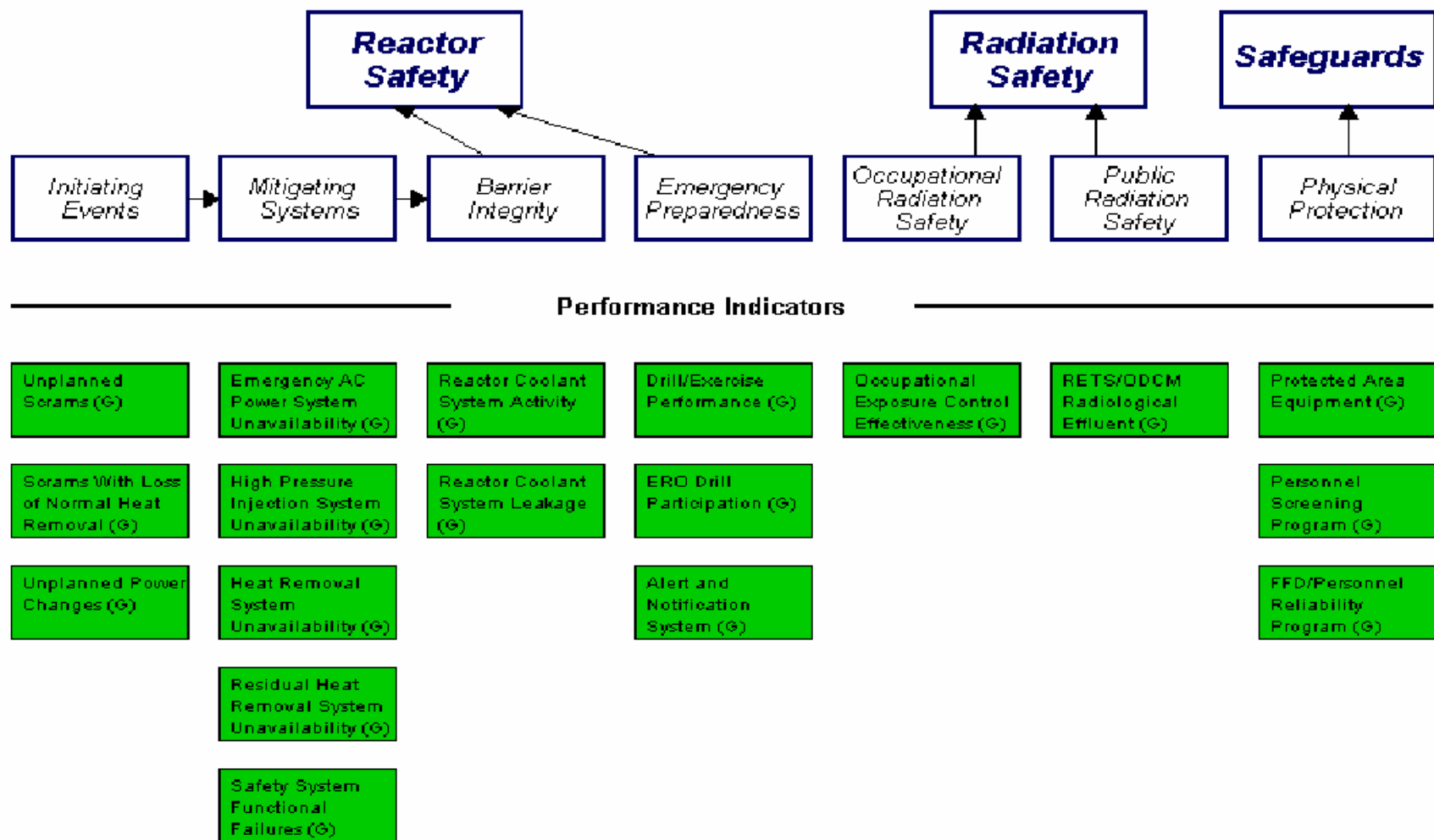
Thresholds: White > 2.0 Yellow > 10.0 Red > 20.0

Table 1 – PERFORMANCE INDICATORS

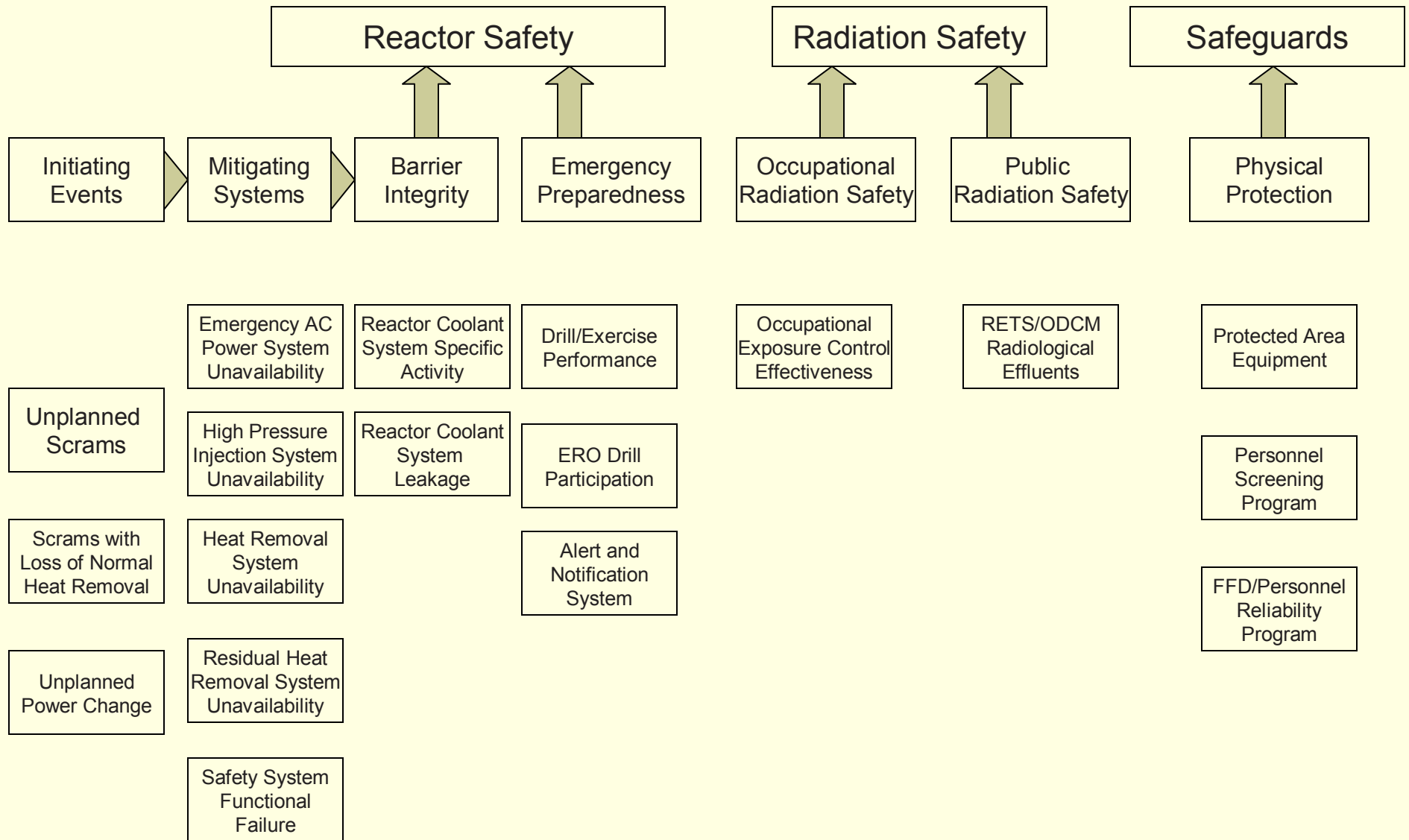
Cornerstone	Indicator	Thresholds (see Note 1)		
		Increased Regulatory Response Band	Required Regulatory Response Band	Unacceptable Performance Band
Initiating Events	Unplanned Scrams per 7000 Critical Hours (automatic and manual scrams during the previous four quarters)	>3.0	>6.0	>25.0
	Scrams with a Loss of Normal Heat Removal (over the previous 12 quarters)	>2.0	>10.0	>20.0
	Unplanned Power Changes per 7000 Critical Hours (over previous four quarters)	>6.0	N/A	N/A
Mitigating Systems	Safety System Unavailability (SSU) (average of previous 12 quarters)	<u>All Plants</u>		
		≤2EDG	>2.5%	>5.0%
		>2EDG	>2.5%	>10.0%
		Hydro Emerg. Power	TBD	TBD
		<u>BWRs</u>		
		HPCI	>4.0%	>12.0%
		HPCS	>1.5%	>4.0%
		RCIC	>4.0%	>12.0%
		RHR	>1.5%	>5.0%
		<u>PWRs</u>		
		HPSI	>1.5%	>5.0%
		AFW	>2.0%	>6.0%
		RHR	>1.5%	>5.0%
	Safety System Functional Failures (over previous four quarters)	BWRs	>6.0	N/A
		PWRs	>5.0	N/A

Note 1: Thresholds that are specific to a site or unit will be provided in Appendix D when identified.

4Q PERFORMANCE INDICATORS



Performance Indicators in the Seven Cornerstones



Initiating Events Performance Indicator

Unplanned Scrams

Purpose:
indication Monitors the rate of scrams per year and provides an
of initiating event frequency.

Definition:
automatic, The number of unplanned scrams, both manual and
per 7,000 critical hours

The value of 7,000 hours is used because it represents one year of reactor operation at an 80% availability factor.

White threshold: > 3 per four quarters

Yellow threshold: > 6 per four quarters

Red threshold: > 25 per four quarters

Initiating Events Performance Indicator

Unplanned Scrams with Loss of Normal Heat Removal

Purpose: Monitors the subset of scrams that were complicated by the loss of the power conversion system

Definition: Number of unplanned scrams while critical in the previous 12 quarters that were either caused by or involved the loss of the normal heat removal path through the main condenser prior to establishing reactor conditions that allow use of the plant's normal long term heat removal systems.

White threshold: > 2 per 12 quarters

Yellow threshold: > 10 per 12 quarters

Red threshold: > 20 per 12 quarters

Initiating Events Performance Indicator

Unplanned Power Changes per 7000 Critical Hours

Purpose: Monitors the number of unplanned power changes that could have, under other plant conditions, challenged safety functions

Definition: Number of unplanned changes in reactor power of greater than 20 percent of full power per 7,000 critical hours

The value of 7,000 hours is used because it represents one year of reactor operation at an 80% availability factor.

White threshold: > 6 per 4 quarters

No Yellow threshold because unplanned power changes are not as risk-significant

Mitigating Systems Performance Indicators

Emergency AC Power System Unavailability
High Pressure Injection System Unavailability
Heat Removal System Unavailability
Residual Heat Removal System Unavailability

Purpose: Monitor the readiness of important safety systems to perform their safety functions in response to off-normal events or accidents

Definition: The average of the individual train unavailabilities over the previous 12 quarters; train unavailability is the ratio of the train unavailable hours to the number of hours the train is required to be able to perform its intended safety function

Thresholds: Variable with system

Mitigating Systems Performance Indicator

Safety System Functional Failures

Purpose: Monitors events or conditions that prevented or could have prevented the fulfillment of the safety function of structures or systems that are needed to shut down the reactor and maintain it in safe shutdown, remove residual heat, control the release of radiation, or mitigate the consequences of an accident

Definition: The number of events or conditions that prevented or could have prevented the fulfillment the safety function of structures or systems

White threshold: PWRs - > 5 per four quarters
BWRs - > 6 per four quarters

No Yellow threshold because many safety system functional failures are potential failures and are not risk-significant

Barrier Integrity Performance Indicator

Reactor Coolant System Specific (RCS) Activity

Purpose: Monitors the integrity of the fuel cladding, the first of three barriers to the release of fission products

Definition: The maximum RCS activity each quarter in micro-Curies per gram dose-equivalent Iodine-131 expressed as a percentage of the Technical Specification limit

White threshold: 50 percent of limit

Yellow threshold: 100 percent of limit

No Red threshold because the plant must shut down if the Technical Specification limit (the Yellow threshold) is exceeded

Barrier Integrity Performance Indicator

Reactor Coolant System Leakage

Purpose: Monitors the integrity of the RCS pressure boundary, the second of the three barriers to the release of fission products

Definition: The maximum RCS leakage each quarter in gallons per minute expressed as a percentage of the Technical Specification limit

White threshold: 50 percent of limit

Yellow threshold: 100 percent of limit

No Red threshold because the plant must shut down if the Technical Specification limit (the Yellow threshold) is exceeded

Emergency Preparedness Performance Indicator

Drill/Exercise Performance (DEP)

Purpose: Monitors timely and accurate licensee performance when presented opportunities for classification of emergencies, notification of offsite authorities, and development of protective action recommendations

Definition: The percentage of drill, exercise, and actual opportunities that were performed timely and accurately during the last eight quarters

White threshold: < 90 percent

Yellow threshold: < 70 percent

No Red threshold because the NRC will take appropriate action if the Yellow threshold is crossed

Emergency Preparedness Performance Indicator

ERO Drill Participation

Purpose: Monitors participation of key Emergency Response Organization (ERO) members in performance-enhancing experiences and is linked to DEP to ensure that the risk-significant functions are evaluated

Definition: The percentage of key ERO members who have participated in a drill, exercise, or actual event in the previous eight quarters

White threshold: < 80 percent

Yellow threshold: < 60 percent

No Red threshold because the NRC will take appropriate action if the Yellow threshold is crossed

Emergency Preparedness Performance Indicator

Alert and Notification System Reliability

Purpose: Monitors the reliability of the offsite Alert and Notification System (ANS), a critical link for alerting and notifying the public

Definition: The percentage of ANS sirens that are capable of performing their function as measured by periodic siren testing in the previous four quarters

White threshold: < 94 percent

Yellow threshold: < 90 percent

No Red threshold because the NRC will take appropriate action if the Yellow threshold is crossed

Occupational Radiation Safety Performance Indicator

Occupational Exposure Control Effectiveness

Purpose: Monitors control of access to and work within radiologically- Significant areas and occurrences involving degradation or failure of radiation safety barriers that result in readily-identifiable unintended dose

Definition: The number of technical specification violations, very high radiation occurrences, and/or unintended exposure occurrences in the previous four quarters

White threshold: > 2

Yellow threshold: > 5

No Red threshold because the NRC will take appropriate action if the Yellow threshold is crossed

Public Radiation Safety Performance Indicator

RETS/ODCM Radiological Effluent Occurrences

Purpose: Monitors performance of the licensee's radiological effluent program

Definition: The number of effluent release occurrences per site that exceed allowable values in the previous four quarters

White threshold: > 1

Yellow threshold: > 3

No Red threshold because the NRC will take appropriate action if the Yellow threshold is crossed

Physical Protection Performance Indicator

Protected Area Security Equipment Performance Index

Purpose: Monitors the unavailability of protected area intrusion detection systems and alarm assessment systems to perform their intended functions

Definition: The percentage of time that compensatory measures are required (guards are posted) due to unavailability of intrusion detection or alarm assessment systems in the previous four quarters

White threshold: > 0.08

No Yellow or Red thresholds because the NRC will take appropriate action if the White threshold is crossed

Physical Protection Performance Indicator

Personnel Screening Program Performance

Purpose: Monitors compliance of the Unescorted Access Authorization Program with the regulatory requirements

Definition: The number of reportable failures to implement the regulatory requirements in the previous four quarters

White threshold: > 2

Yellow threshold: > 5

No Red threshold because the NRC will take appropriate action if the Yellow threshold is crossed

Physical Protection Performance Indicator

Fitness-for-Duty (FFD) Personnel Reliability Program Performance

Purpose: Monitors compliance of the FFD/Personnel Reliability Program with the regulatory requirements

Definition: The number of reportable failures to properly implement the regulatory requirements in the previous four quarters

White threshold: > 2

Yellow threshold: > 5

No Red threshold because the NRC will take appropriate action if the Yellow threshold is crossed

Performance Indicator Verification

- Each PI is verified once per year in the baseline inspection program
- A sample of plant records and activities are inspected against the reported PIs
- Plant tours during Plant Status Review is an effective time to check some PIs

Performance Indicator Verification – cont.

- If major discrepancies are found, the inspector verifies the PI has been updated and the problem entered into the licensee's Corrective Action Program
- Feedback forms are generated when the inspector and licensee disagree on the circumstances of a particular PI
 - NRC HQ staff reviews and provides interpretation, if necessary
- Frequently asked questions used to help interpret some PIs
 - NEI 99-02 provides lists of current FAQs

INDUSTRY TRENDS

- NRC monitors PIs at the industry-level to assess whether there are any adverse trends in performance
- Annual report to Congress of any adverse trends
- Indicators posted on NRC web site

[http://www.nrc.gov/reactors/operating/oversight/
industry-trends.html](http://www.nrc.gov/reactors/operating/oversight/industry-trends.html)

PERFORMANCE INDICATOR PROGRAM CHALLENGES

- Address inconsistencies between the ROP maintenance rule, INPO, and WANO requirements
 - primarily the safety system unavailability PI
- Safety System Unavailability PI
- Improve the Physical Protection PI
- Initiating Events PI
- Develop Improved Barrier Integrity PIs.

SAFETY SYSTEM UNAVAILABILITY

- Issues

- Thresholds are the same for all plants, and do not take into account plant specific differences in risk importance
- Failures are addressed via the 'fault exposure time' which can produce step changes in PI values

- One proposed resolution is the MSPI – Mitigating System Performance Index – currently under development

Performance Indicator Program

References

- IMC 308, Attachment 1, Technical Basis for Performance Indicators
- IMC 608, Performance Indicator Program
- Nuclear Energy Institute 99-02, Regulatory Assessment Performance Guideline Inspection procedure (IP) 71151, Performance Indicator Verification
- IP 71150, Discrepant or Unreported Performance Indicator Data