



# **Use of Probabilistic Risk Assessment in Fuel Cycle Facilities**

Michelle González

Felix González

Brian Wagner

U.S Nuclear Regulatory Commission

# Outline

- Introduction
- Probabilistic Risk Assessment
- Reactor oversight process
- Non-reactor nuclear PRA
- Oversight process application
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- Available NRC guidance

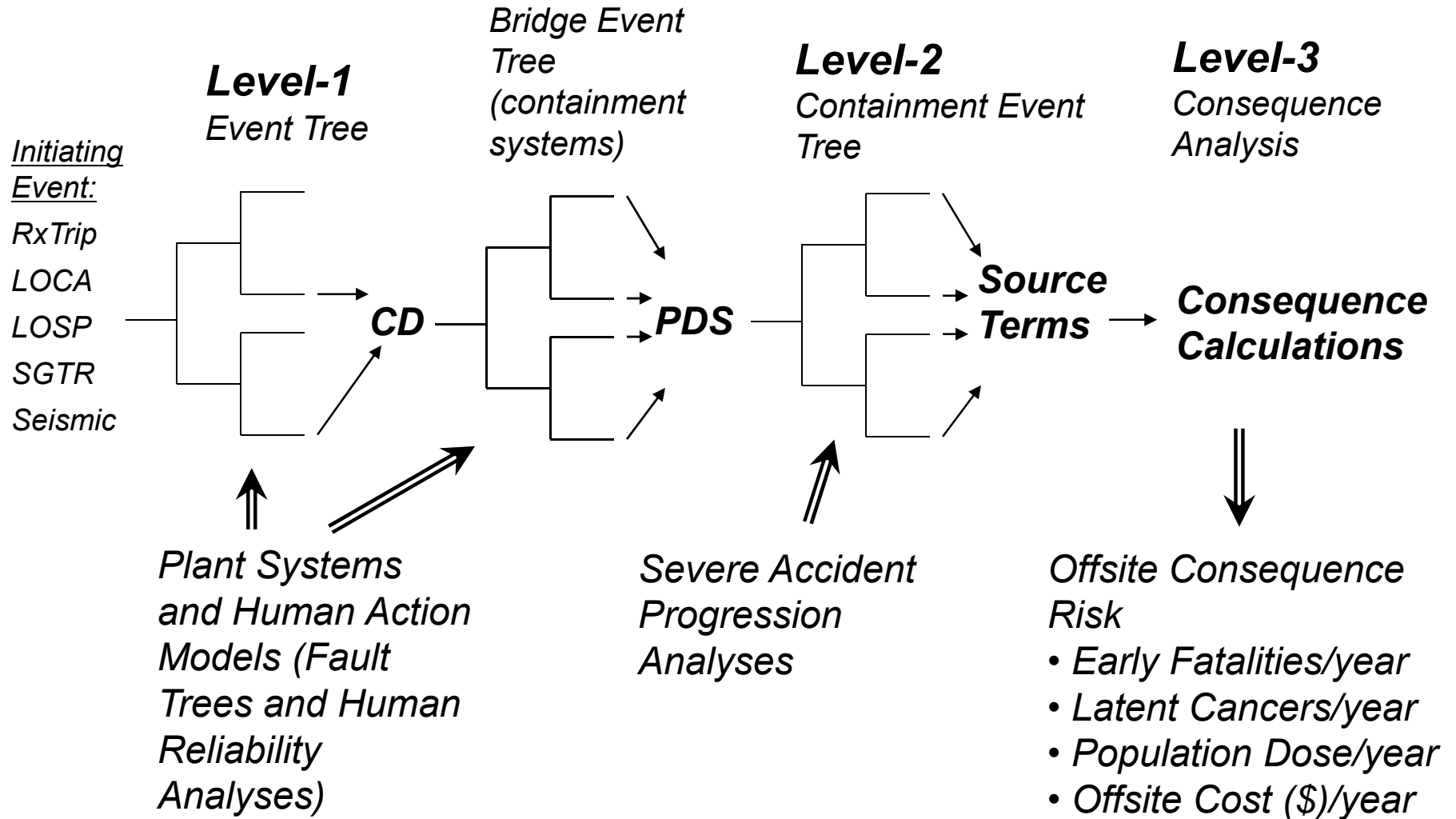
# Introduction

- Policy Statement on the Use of Probabilistic Risk Assessment Methods in Nuclear Regulatory Activities (1995)
- Risk informed approach
  - “An approach to regulation taken by the NRC, which incorporates an assessment of safety significance or relative risk. This approach ensures that the regulatory burden imposed by an individual regulation or process is appropriate to its importance in protecting the health and safety of the public and the environment”.

# Probabilistic Risk Assessment

- NRC definition:
  - A systematic method for assessing three questions:
    - What can go wrong?
    - How likely is it?
    - What its consequences might be?
  - Levels of PRA
    - Level 1 PRA
    - Level 2 PRA
    - Level 3 PRA

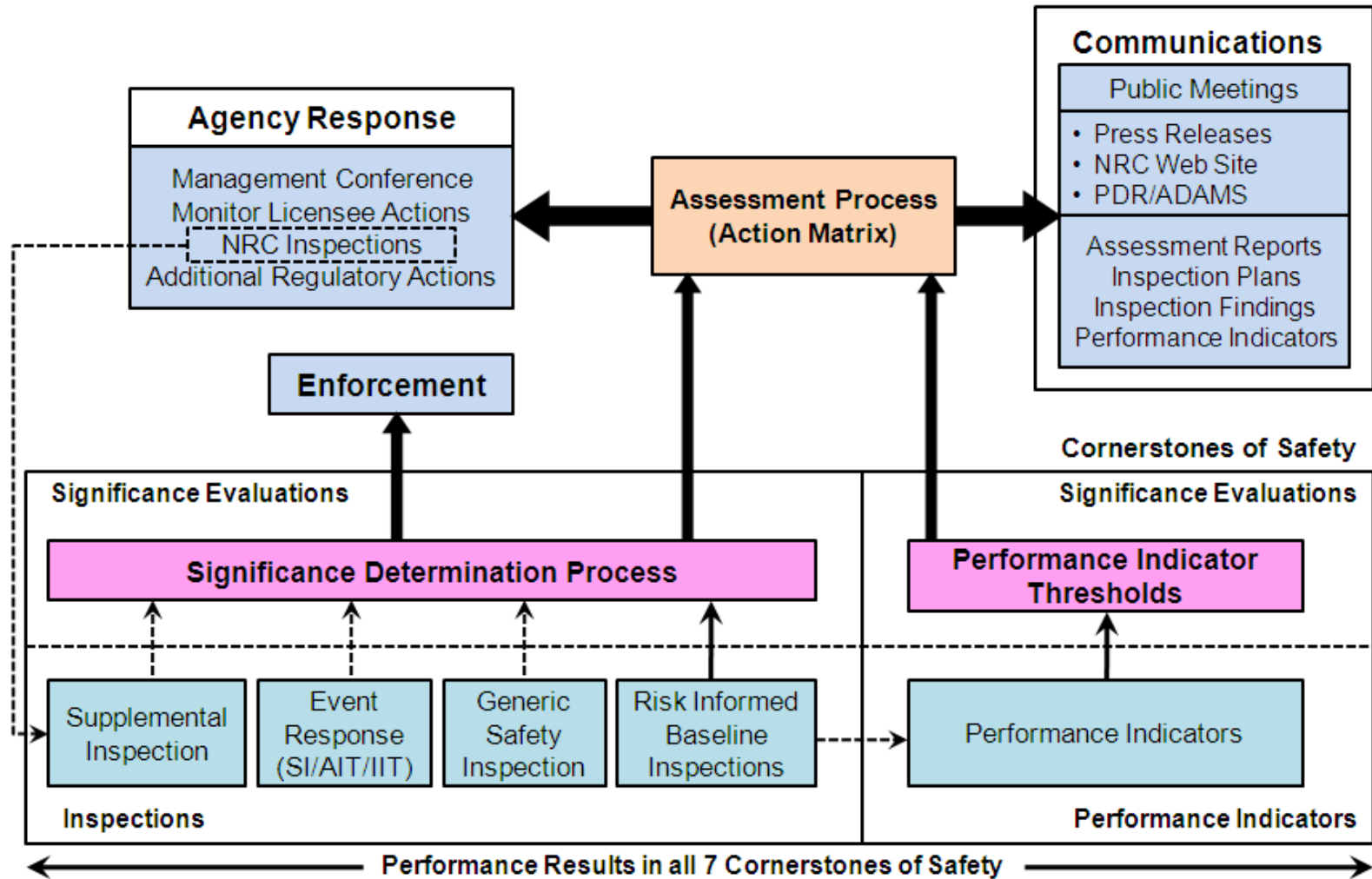
# Probabilistic Risk Assessment



# Reactor Oversight Process

- Risk informed approach used by the NRC to monitor reactor safety performance.
- ROP activities:
  - ROP inspection program
  - Significance determination process (SDP)
  - Other assessment activities

## REACTOR OVERSIGHT PROCESS



# Reactor Oversight Process

- ROP Objectives
  - Obtain information on operating facilities and identify safety concerns
  - Evaluate the risk significance of issues to ensure the appropriate regulatory measure
  - Assess licensee performance
  - Take enforcement actions that encourage the resolution of risk- significant issues



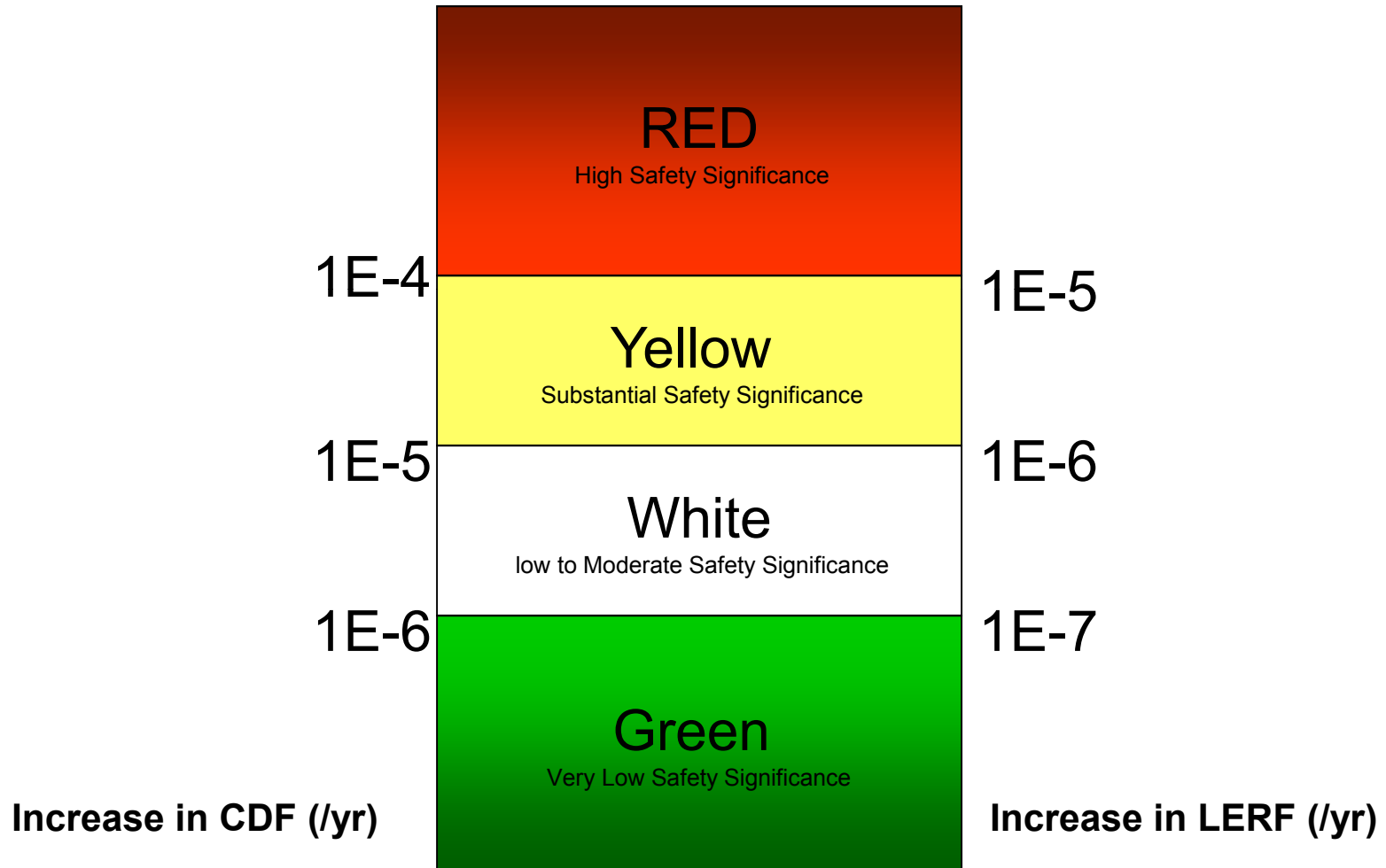
# Reactor Oversight Process

- ROP Objectives (cont'd)
  - Verify that licensees effectively identify problems and resolve issues
  - Provide the appropriate regulatory response to operational events on the basis of their safety significance
  - Monitor licensees and encourage them to maintain a safety-conscious work environment

# Reactor Oversight Process

- Performance areas:
  - Reactor safety, radiation safety and safeguards
- Cornerstones
  - Initiating events
  - Mitigating systems
  - Barrier integrity
  - Emergency preparedness
  - Public radiation safety
  - Occupational radiation safety
  - Security

# Significance Determination Process (SDP)



# Non-Reactor Nuclear PRA

- Storage and transportation
- Fuel cycle facilities (FCFs)
- Advanced reactors
- Waste applications

# Non-Reactor Nuclear PRA

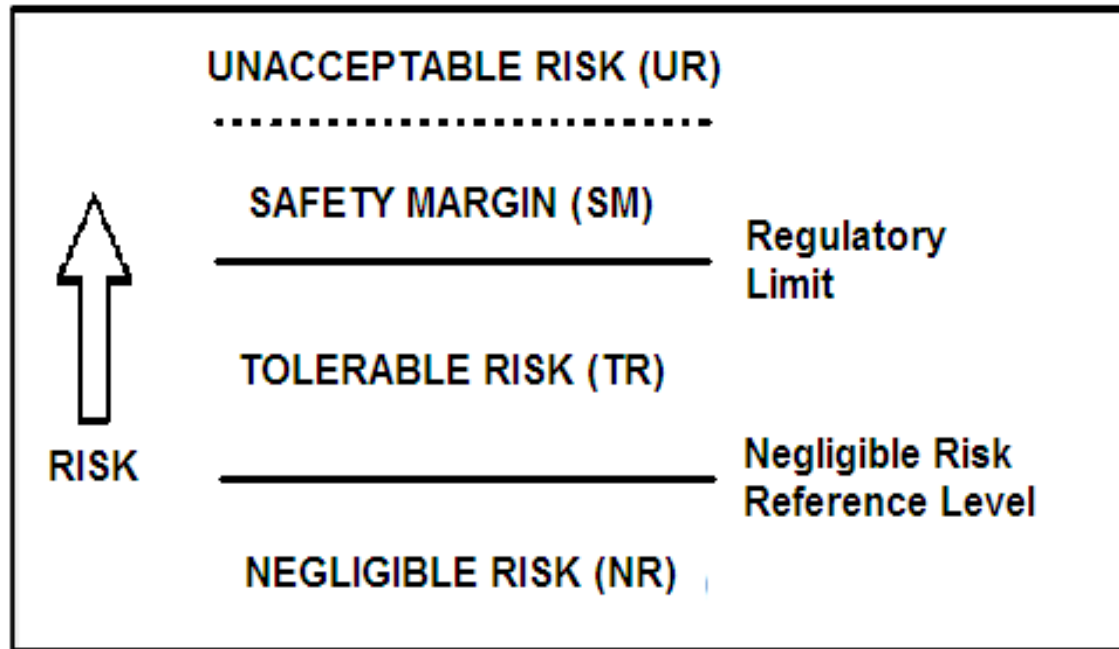
- Differences between Reactor and Non-Reactor PRA
  - Lack of an analogue to the reactor core as found in a nuclear power reactor.
  - Different types of hazards, variable source terms throughout a process, event sequences, vulnerability duration, lack of standby systems and reliance on human actions due to process differences.
  - Differences in processing technologies which provide challenges during an analysis.

# Non-Reactor Nuclear PRA

- Fuel Cycle PRA Pros and Cons
  - Resource intensive and time consuming
    - NRC is exploring which PRA technique would be more beneficial to FCFs
  - PRA techniques could improve model realism.
    - PRA has been used in FCF licensing applications and is being explored and developed for oversight applications for the Revised Fuel Cycle Oversight Process.

# Non-Reactor Nuclear PRA

Four region risk diagram



# Oversight Process Application

- Differences between ROP and FCOP
  - FCOP would be composed of two phases
  - Thresholds
  - Cornerstones



# Challenges

- Diversity of technologies and processes
- Different types of hazards
- Available information
- Limitation of databases (i.e failure rate data)

## Available NRC Guidance

- *NUREG-1520: Standard Review Plan for the Review of a License Application for a Fuel Cycle Facility\**
- *Risk informed Decision Making for Nuclear Material and Waste Applications (RIDM)\**
- *NUREG/CR-2300: PRA Procedures Guide: A Guide to Performance of Probabilistic Risk Assessments for Nuclear Power Plants\**

\*Available at [www.nrc.gov](http://www.nrc.gov)



Questions??



## **Acronyms:**

- CD- Core damage
- FCF- Fuel cycle facility
- LOCA- Loss of coolant accident
- LOSP – Loss of offsite power
- PDS- Plant damage state
- ROP- Reactor oversight process
- SDP- Significance determination process
- SGTR- steam generator tube rupture