



U.S. Nuclear Regulatory Commission  
**34<sup>th</sup> ANNUAL REGULATORY  
INFORMATION CONFERENCE**

**MARCH 8-10, 2022**

PREPARING FOR  
**TOMORROW**

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# **Perspective on Safety Improvements for Commercial Nuclear Power Plants**

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## Overview

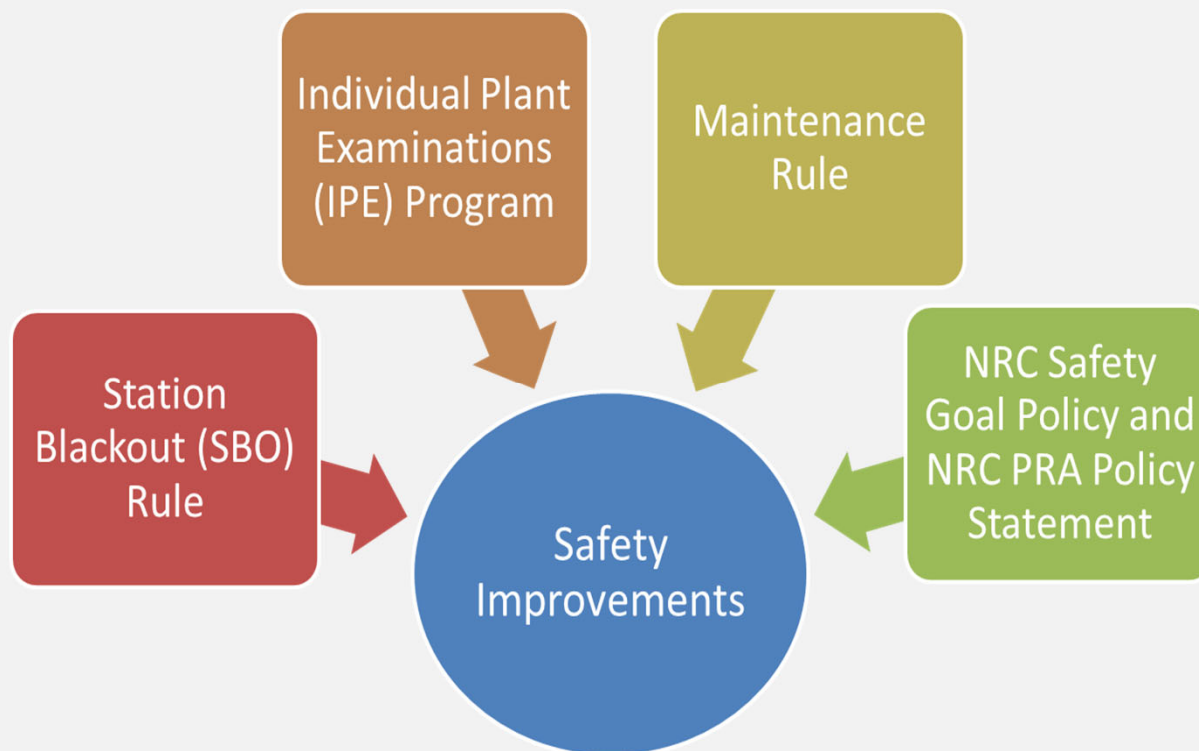
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## RES Considerations in Looking at Different Measures of Performance

- What timeframe should we consider?
  - 20 years (2000+)
  - 30 years (1990+)
- 
- Advancements make it difficult to compare performance measures over time
  - Measures of performance may need to be interpreted using engineering judgment

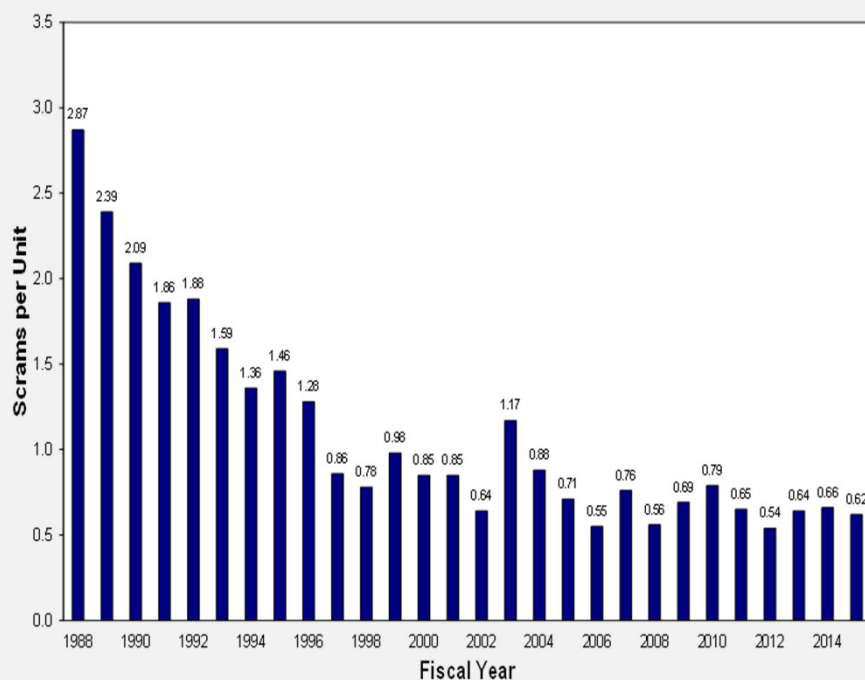
## 1988–2000 Plant Safety Improvements

- The period of interest impacts overall conclusions
- Many safety-significant actions/changes were made

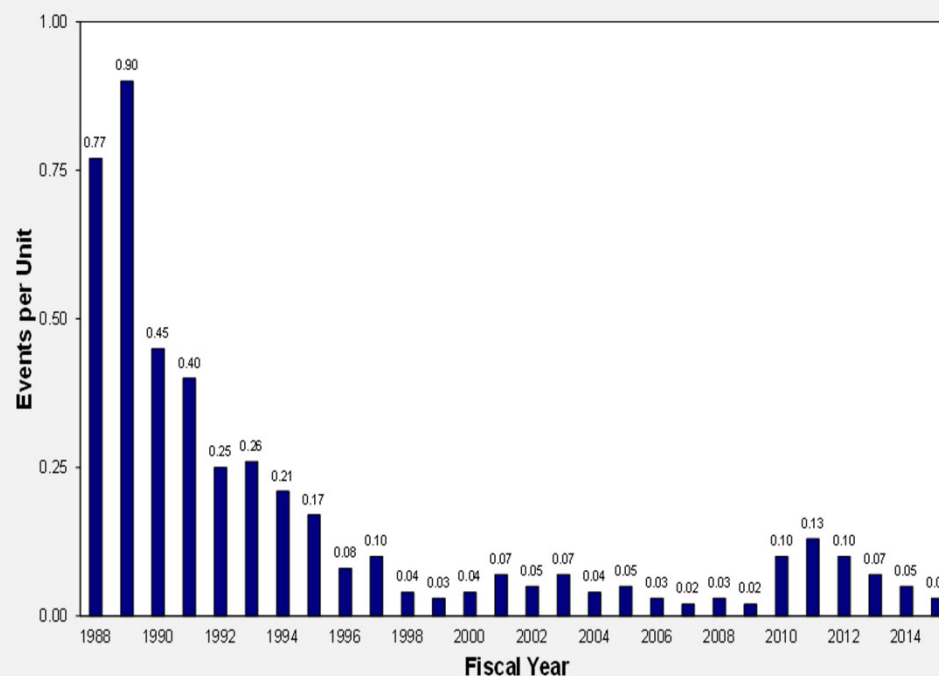


# 1988–2000 Plant Safety Improvements

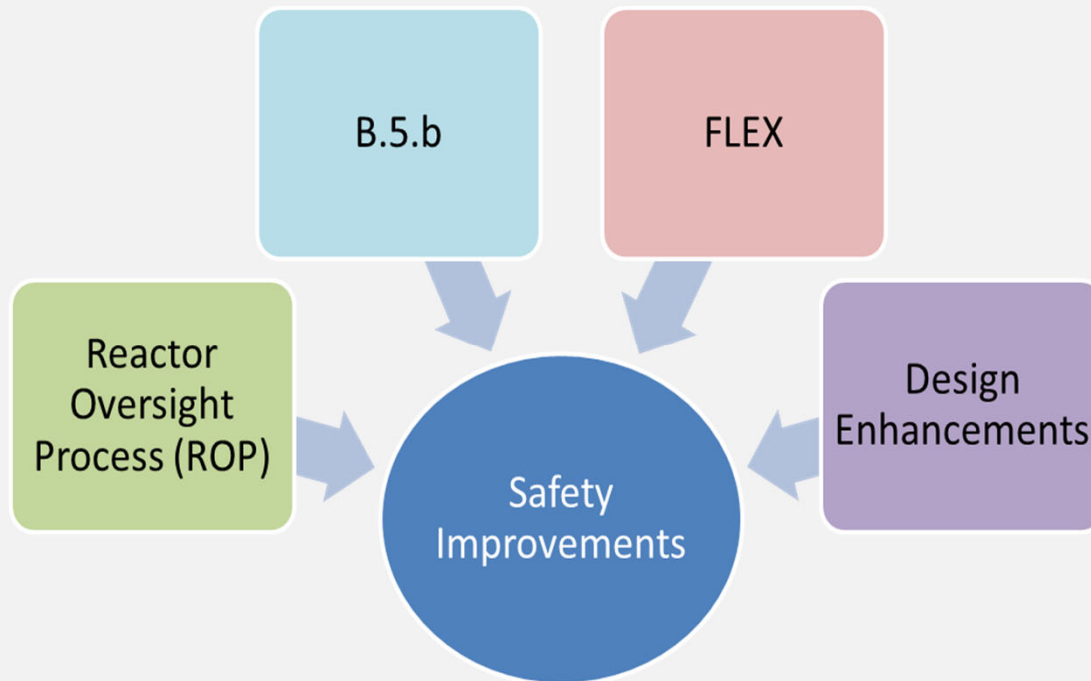
**Scrams while Critical**



**Significant Events**



## 2000–Present: Plant Safety Improvements



- Improvements made during this period are not as significant as those in the 1990s
- Not all changes have been fully realized



## RES Categories of Performance Measures

Operational trends

Plant risk due to internal events/internal floods

Plant risk due to other hazards

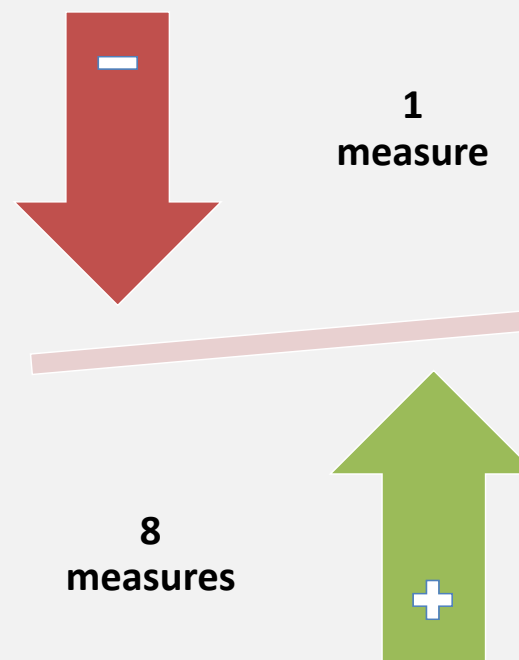
NRC studies, orders, models, etc.

Industry studies, standards, models, etc.

Other

## Safety Measure Trends

- **51 measures**
- **Negative Trends**
  - Loss of offsite power (LOOP) recovery time
- **Positive Trends**
  - Annual scrams
  - NRC reactive inspections
  - Accident sequence precursor (ASP) results
  - Radiation exposure
  - Performance indicators
  - Internal events core damage frequency (CDF)
  - Reactor coolant pump (RCP) seal performance
  - Loss of offsite power (LOOP) frequency





## Remaining Safety-Related Measures



- Apparent favorable trends
  - Lower conditional probability that a radiological release would lead to prompt or latent health effects
  - Improvements related to flooding and seismic hazard reevaluations
  - Mitigating strategies improvements (FLEX)
  - Risk insights from the State-of-the-Art Reactor Consequence Analyses (SOARCA)
  - Generic Issues Program improvements
  - B.5.b improvements
  - Improvements in consensus standards and regulatory guidance
  - Pressurized-water reactor steam generator performance improvements
  - Improvements in PRA development tools
- 32 neither favorable or negative trend



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## Some Observations

- Large reduction in average core damage frequency (CDF) ([since the IPE results](#))
  - Limited to contributions from internal events
  - External event hazards can add significantly to plant risk, so it is important to include in discussion of safety trending
- Reduction in performance issues
- Risk below NRC safety goals
  - Both the uncertainties and external hazards need to be considered when looking at the safety goal impacts



## Conclusions

- Performance measures appear to show improvements in nuclear power plants
  - Could be attributed to initiatives and rules addressing key safety issues (e.g., station blackout (SBO) rule, greater use of risk-informed decisionmaking)
- Plant safety improvements implemented since the year 2000 have shown a gradual increase in safety, but to a smaller extent than during the previous 10 years
- Not all safety measures moved in the same positive direction
- External event impacts are important, and significant uncertainties still exist



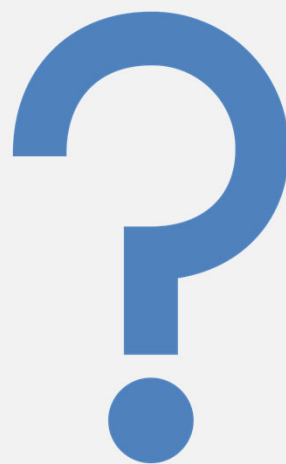
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# Questions





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