



U.S. Nuclear Regulatory Commission
**34th 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

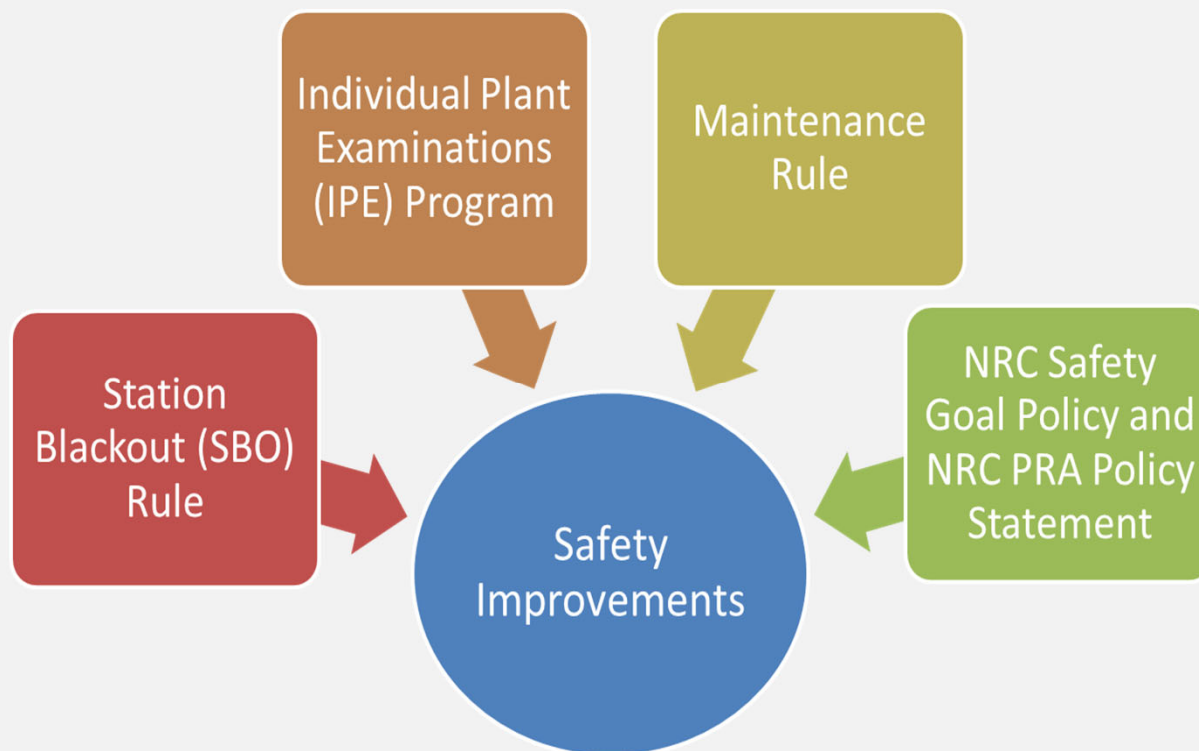
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- Wkh#QUF#N#dvvhvvp h#qwr i#vdi#hw| #ir f#xvhv#r#q#s#xeof#k#hdok#l#g#g#vdi#hw|

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

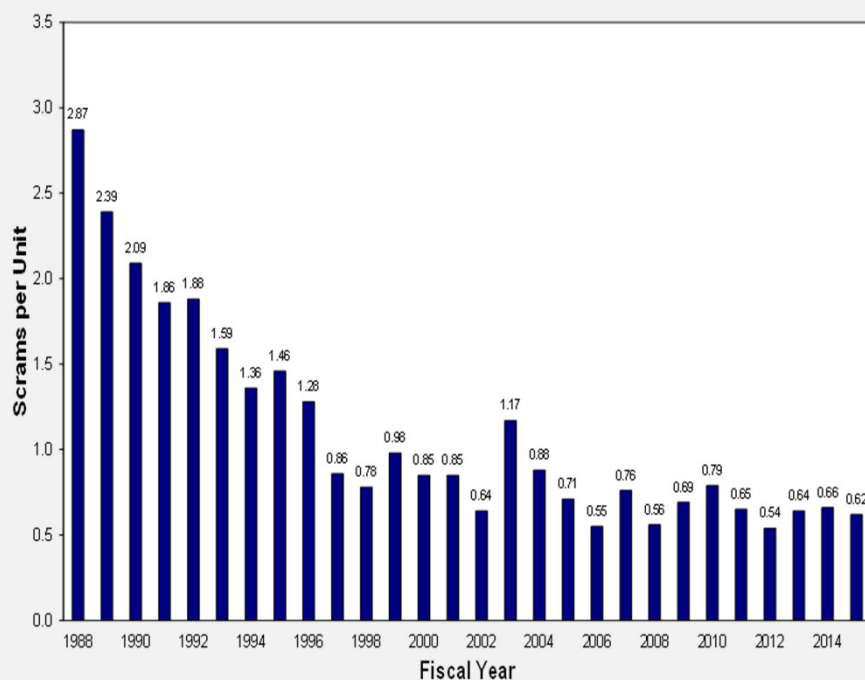
1988–2000 Plant Safety Improvements

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

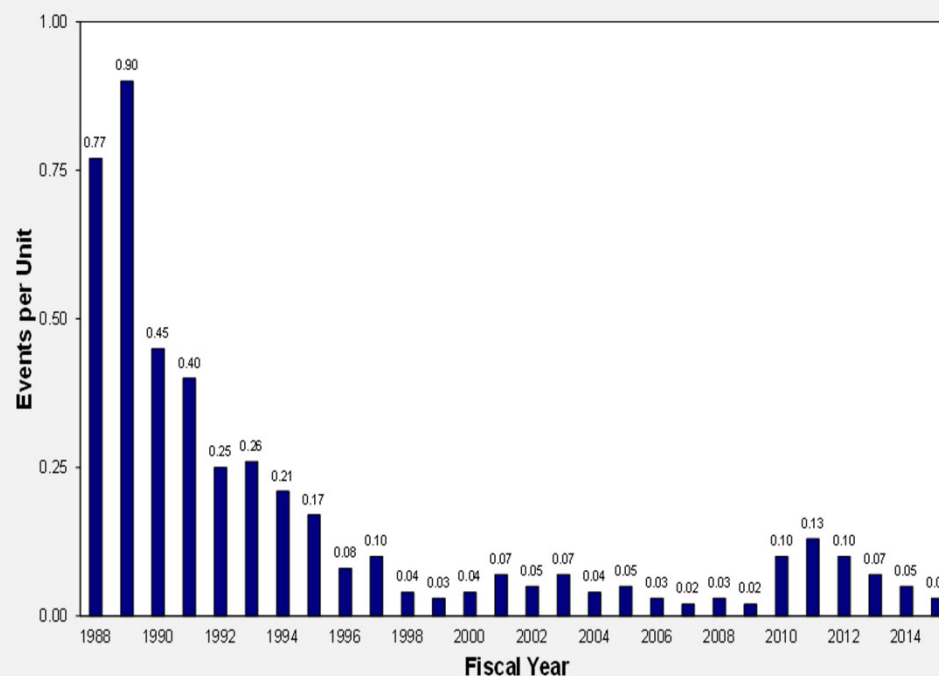


1988–2000 Plant Safety Improvements

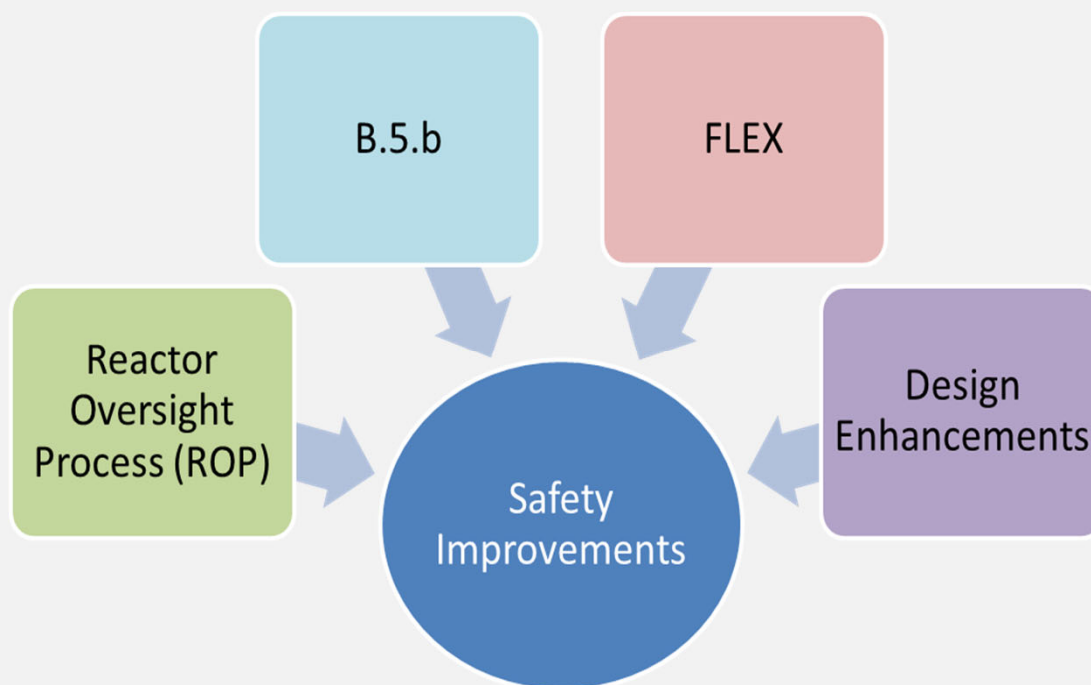
Scrams while Critical



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

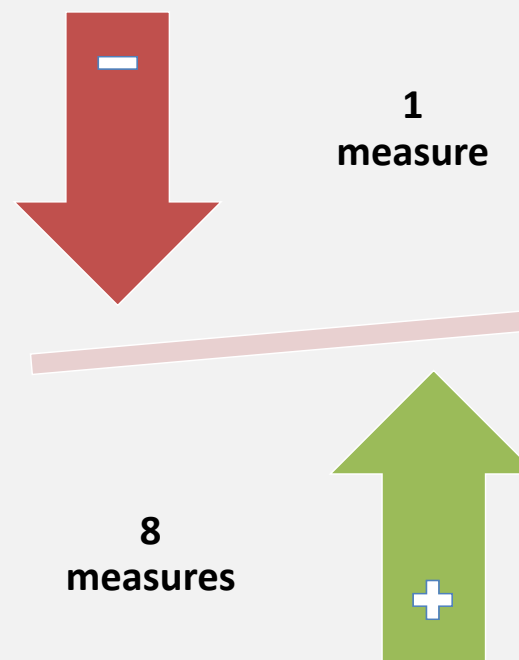
NRC studies, orders, models, etc.

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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