THE USE OF SAFETY GOALS IN REGULATION OF NUCLEAR POWER PLANTS

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OUTLINE

- History of safety goals
- Their role in the regulatory process
- Issues associated with the use of numerical criteria

SAFETY GOAL POLICY STATEMENT

- Issued in 1986
- Implementation guidance provided in 1990
- There have been several proposals for revision, but none has been approved by the Commission

SAFETY GOAL POLICY STATEMENT (CONT'D)

- Not used as safety limits
- The policy statement is not a regulation, but has influenced various regulatory actions, primarily the development of the Regulatory Analysis Guidelines used in backfit analysis and the acceptance guidelines of RG 1.174
- While not originally intended to apply to individual plants, they are often used as benchmarks for individual plants

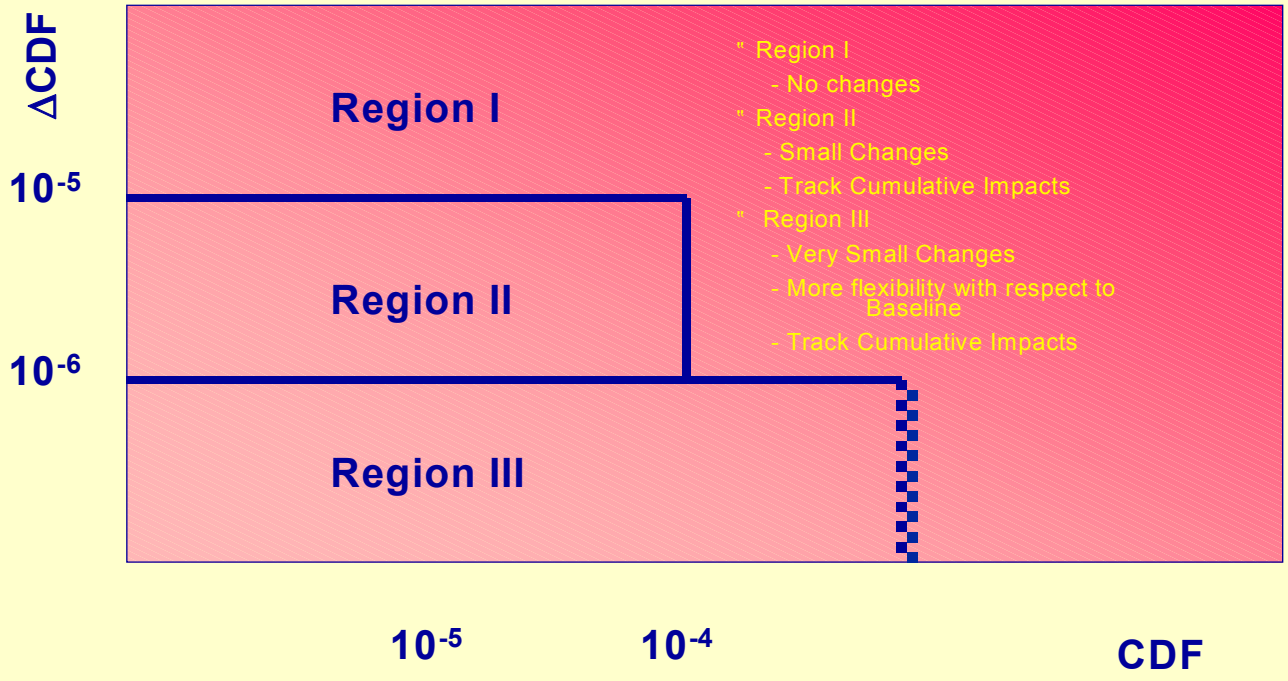
SAFETY GOAL POLICY STATEMENT (CONT'D)

- Qualitative goals on health effects
- Quantitative goals on early and latent cancer fatalities
- Subsidiary quantitative goal on core damage frequency (CDF)
- In practice, CDF and large early release frequency (LERF) are used as surrogates for latent cancer and early fatalities respectively

ACCEPTANCE GUIDELINES FOR RISK-INFORMED DECISION-MAKING

- While not directly translated into acceptance guidelines, the subsidiary goal on CDF informed the risk acceptance guidelines for RG 1.174

CORE DAMAGE FREQUENCY ACCEPTANCE GUIDELINES



Acceptance Guidelines for Core Damage Frequency

CONSIDERATIONS IN ESTABLISHING FORM OF GUIDLEINES

- Definition of very small increase informed by resolution capability of PRA models
- Limits of Region II guided by regulatory analysis guidelines, and the subsidiary goal on CDF

COMPARISON OF PRA RESULTS WITH GUIDELINES

- When comparing the results of a risk assessment use mean values of risk metrics, consistent with the safety goal policy statement
- Address uncertainties in the comparison

TREATMENT OF UNCERTAINTY

- Treatment of analysis uncertainty
  - Parameter (e.g., component failure probability, initiating event frequency) uncertainty
  - Model uncertainty (e.g., success criteria)
  - Incompleteness (e.g., missing initiating events or modes of operation, errors of commission)
- Incompleteness from unknown sources is one of the main reasons why the NRC has adopted a risk-informed rather than a risk-based process

CHARACTERIZATION OF INPUT UNCERTAINTY

- Parameter uncertainty characterized by probability distributions representing state of knowledge about "true" value
- Model uncertainty may be represented as a discrete probability distribution over several models, with the probabilities representing the analysts' relative degrees of belief in the validity of the models. More commonly, a single representative model is assumed
- By definition, incompleteness is not addressed in the model structure

APPROACH TO DEALING WITH UNCERTAINTY IN PRA RESULTS

- Objective is to provide assurance that the conclusion drawn from the PRA analysis is robust in light of the uncertainties
- Strategy
  - Identify and prioritize sources of uncertainty (with respect to their importance to the results being used)
  - Address parameter uncertainties by propagating uncertainties and using resulting mean value for comparison with acceptance guidelines
  - Address model uncertainties by developing an understanding of whether there are plausible, alternative assumptions that would impact the result of the comparison with the acceptance guidelines
  - Address incompleteness by one of the following approaches

APPROACHES TO ADDRESSING INCOMPLETENESS

- For the contributors to risk that are recognized but not modeled
  - Provide qualitative arguments or bounding analyses
  - Design the application so that it does not impact the unmodeled contribution to risk
  - Make conservative decisions to compensate for missing contributions
  - Perform a full scope PRA