Best-Estimate Plus Uncertainty Approaches to Dose Analysis

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February 13, 2024

Background

- Many safety analyses are applying a best-estimate plus uncertainty (BEPU)
  - Currently approved for 50.46 LOCA calculations for Peak Clad Temperature
  - NEDE-33005P-A GNF TRACG LOCA PCT Application
  - NEDE-32906P-A GNF TRACG AOO Calculations
- Radiological analysis is a good candidate for applying BEPU approaches
  - Many independent inputs that are defined by probability distributions
- Very similar approach to that assessed by NRC in 1996 in ML003702950
  - Suggested by ACRS
  - Applied to PWR MSLB and SGTR

Current Regulatory Guidance

- Section 5.1.3 of Reg Guide 1.183 Rev. 1

  - *"The licensee should select the numerical values to be used as inputs to the dose analyses with the objective of determining a conservative postulated dose."*

- For input parameters subject to a probability distribution, the selection of the worst-case (e.g., 10th percentile) for all inputs can lead to overly-conservative dose results.

Inputs Subject to Probability Distribution

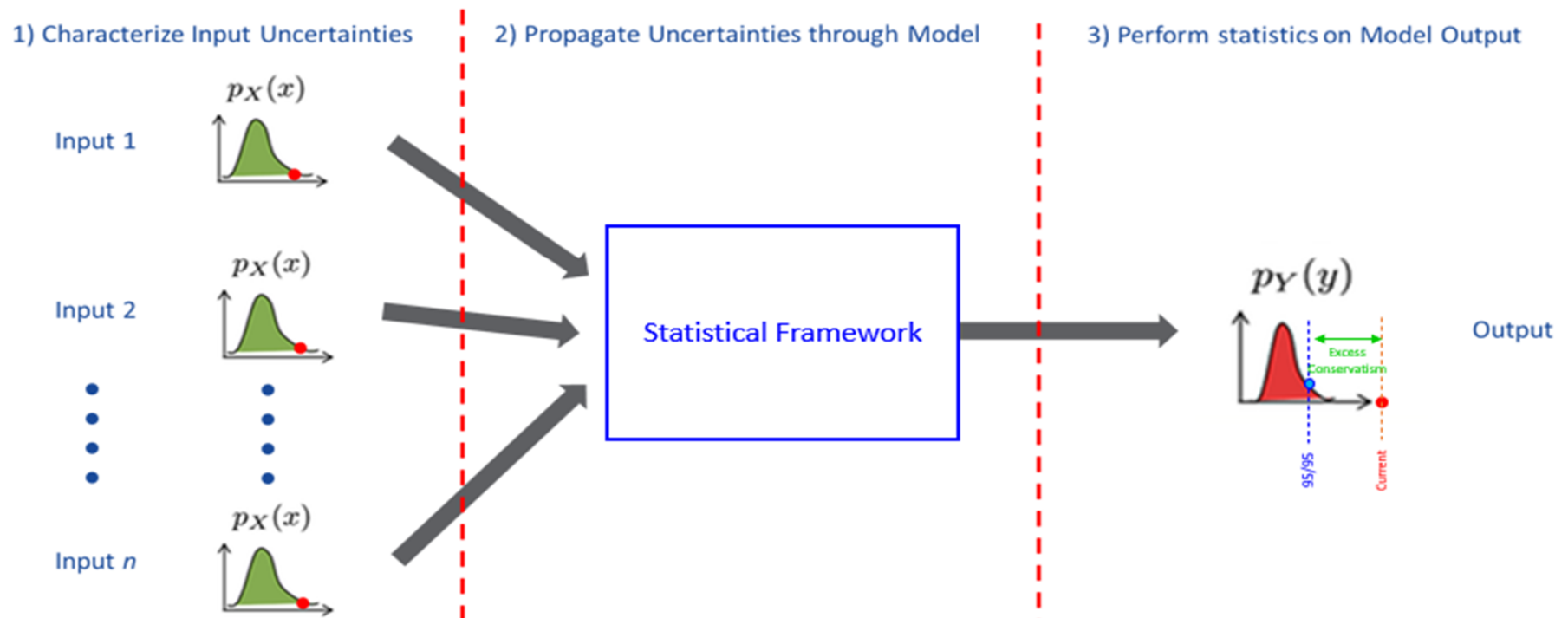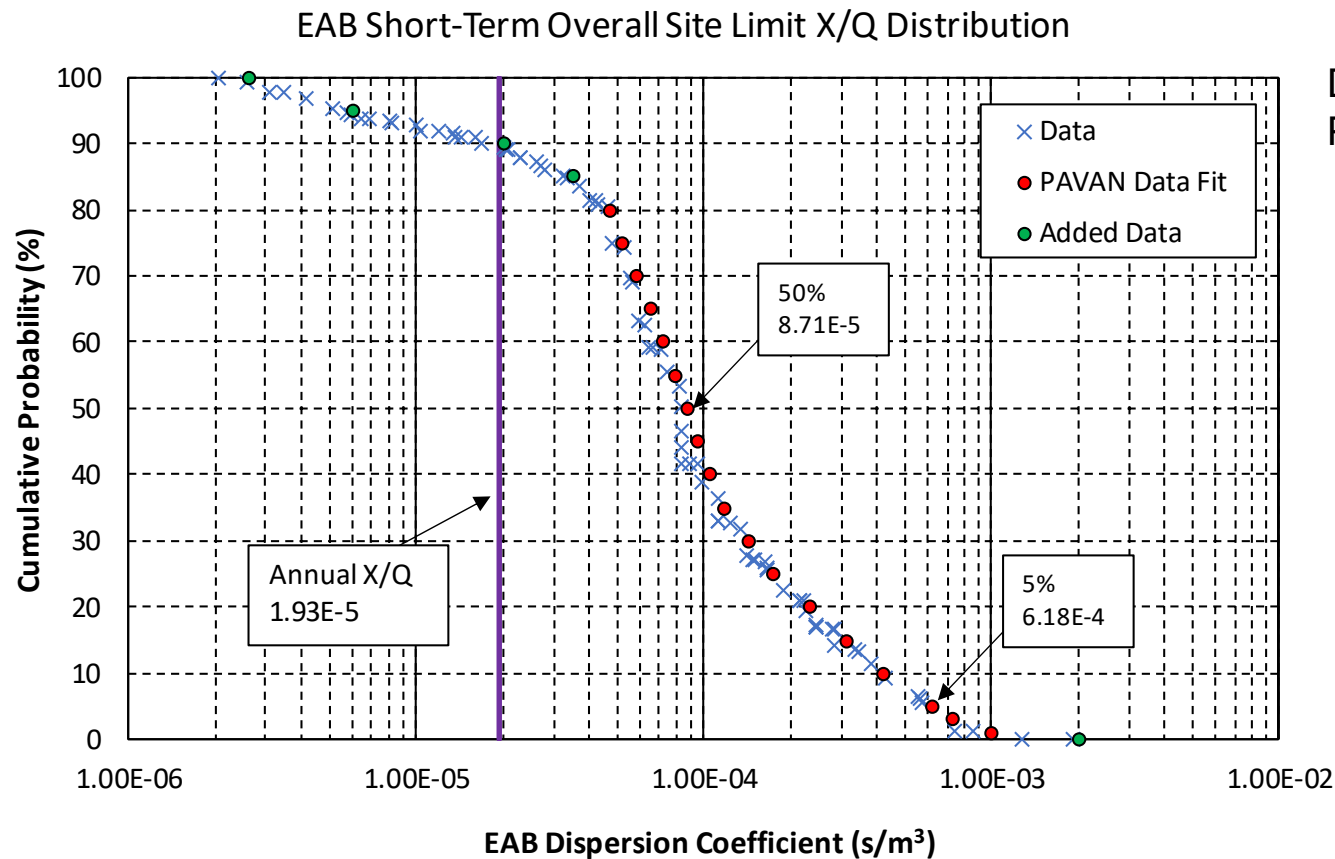| Dose Inputs Subject to a Potential Probability Distribution (Not All Inclusive) |
|---|
| 5% X/Q |
| Worst 2-Hour X/Q Occurs at Time of Peak Release |
| 10% Powers Aerosol Removal Rate |
| Worst Case Core Source Terms |
| 10% Containment/Drywell Spray Removal Rate |
| Concurrent Independent LOOP |
| SG Tube Failure is at Worst-Case Location (i.e., top of tube bundle) |
| Dropped Bundle in High Peaking Bundle and Impacts Other High Peaking Bundles |
| Worst-Case Single Active Failure |
| Control Room Breathing Rates |

Approach Overview

Best Estimate Plus Uncertainty (BEPU)

1) Characterize Input Uncertainties

2) Propagate Uncertainties through Model

3) Perform statistics on Model Output

EAB Short-Term Probability Distribution

EAB Short-Term Overall Site Limit X/Q Distribution

Direct from
PAVAN Output

Legend:
- × Data
- ● PAVAN Data Fit
- ● Added Data

50%
8.71E-5

5%
6.18E-4

Annual X/Q
1.93E-5

Y-axis: Cumulative Probability (%)
X-axis: EAB Dispersion Coefficient (s/m³)

Conclusions

- Consistent with current regulations
  - Continues to provide "reasonable assurance" of meeting the 50.67 regulatory limits
  - Consistent with other approved methodologies (e.g., PCT)

- Consistent with current regulatory guidance
  - Meets the objective of determining a conservative postulated dose per Section 5.13 of RG 1.183 Rev. 1

- For additional clarity, does Section 5.1.3 need a statement to the effect of:

  Best-Estimate Plus Uncertainty approaches that develop conservative doses based on sampling input distributions are acceptable and will be evaluated on a case-by-case basis.