



**RIC 2012  
State-of-the-Art Reactor  
Consequence Analyses (SOARCA)  
Uncertainty Analysis**

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**Goals of the Uncertainty Analysis**

- Develop insight into overall sensitivity of SOARCA results to uncertainty in inputs
- Identify most influential input parameters for releases and consequences
- Demonstrate uncertainty analysis methodology

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**Approach**

- Distributions defined for chosen uncertain input parameters
- Uncertainty in these parameters propagated in two steps using Monte Carlo sampling:
  - A set of source terms will be generated using MELCOR model
  - A distribution of consequence results will be generated using MACCS2 model
- First-of-a-kind analysis in some ways
  - Using up to 300 separate code runs (Monte Carlo “realizations”)

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### Approach (continued)

- Peach Bottom, unmitigated, long-term station blackout scenario chosen
- Results reported will include:
  - Cesium and Iodine release over time
  - Distribution of latent cancer fatality risk
- Tools used to analyze results include statistical regression-based methods as well as scatter plots and investigation of individual realizations of interest
- Guidance solicited from SOARCA peer reviewers on the uncertainty analysis plan

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### MELCOR Parameter Categories

- Sequence issues
- In-vessel accident progression issues
- Ex-vessel accident progression issues
- Containment behavior issues
- Fission product release, transport, and deposition

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### Specific MELCOR Parameters

- Battery duration
- SRV stochastic failure rate, thermal seizure criteria, and open area fraction
- Main steam line creep rupture open area fraction
- Zircaloy melt breakout temperature
- Molten clad drainage rate
- Fuel failure criterion
- Debris relocation time constants – radial in-vessel and lateral ex-vessel
- Drywell liner failure flow area
- Drywell head flange leakage parameters
- Hydrogen ignition criteria (where flammable)
- Railroad door open fraction
- Cesium and Iodine chemical forms
- Aerosol deposition parameters

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## MACCS2 Parameter Categories

- Atmospheric transport and deposition
- Health effects
- Emergency planning and response
- Weather trials

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## Specific MACCS2 Parameters

- Wet deposition model linear coefficient
- Dry deposition velocities
- Early health effects
- Latent health effects
  - Groundshine dose coefficients
  - Dose and dose rate effectiveness factors
  - Inhalation dose coefficients
  - Cancer mortality risk coefficients
- Emergency response
  - Shielding factors
  - Hotspot and normal relocation
  - Evacuation delay and speed
- Dispersion parameters

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