State-of-the-Art Reactor Consequence Analyses (SOARCA)

ACRS Sub-Committee July 10, 2007

MEETING AGENDA

- Project Overview
- Accident Sequence Selection
- Containment System States
- Mitigative Measures
- Structural Analyses
- MELCOR
- Emergency Preparedness
- MACCS2
- Project Status

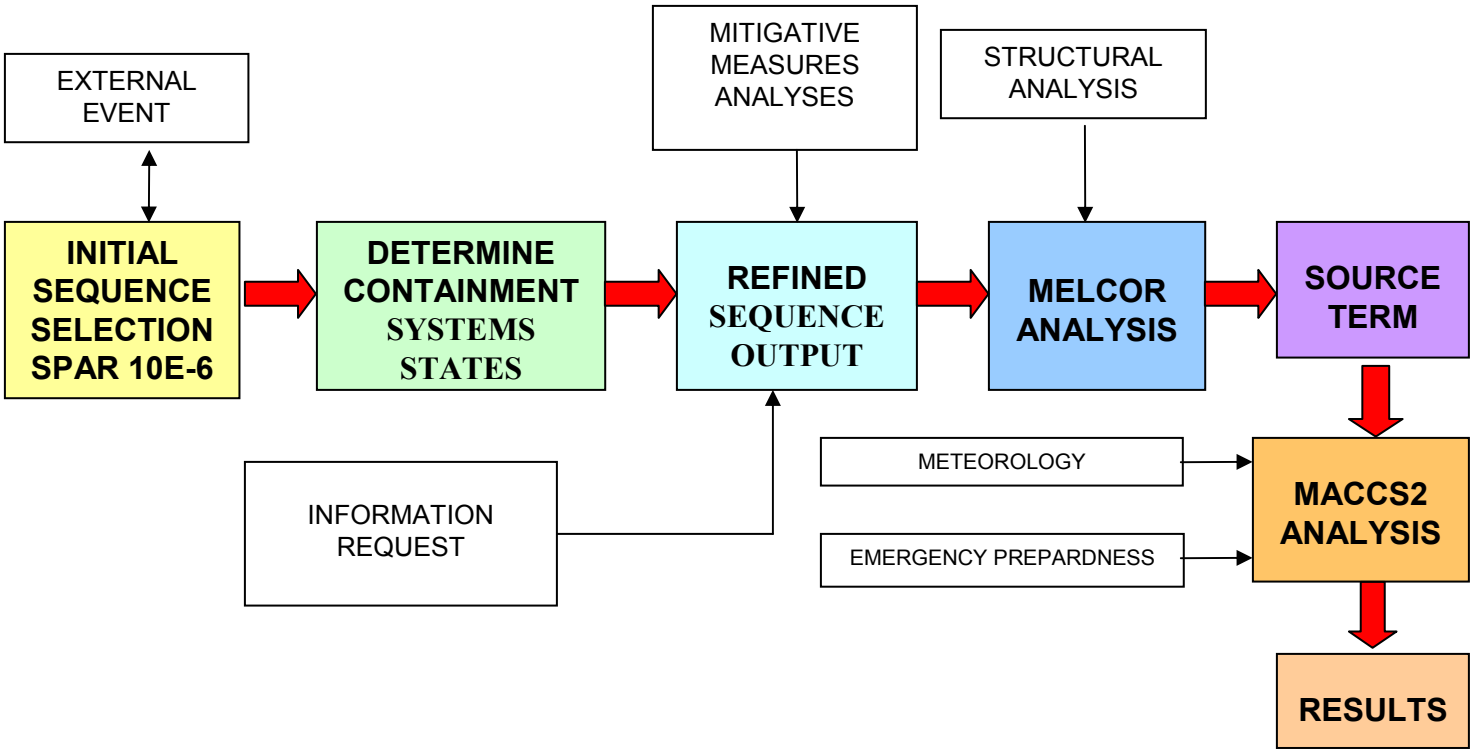
SOARCA OVERVIEW

Goal - Develop a state-of-the-art, more realistic evaluation of severe accident progression, radiological releases and offsite consequences for dominant accident sequences.

Objectives:

- Determine best estimates of the radiological consequence estimates for select US operating reactor site and update such analyses as NUREG/CR-2239.
- Evaluate and update analytical methods and models for realistic evaluation of severe accident progression and offsite consequences.
- Include mitigative measures and plant improvements that have the potential to reduce offsite consequences.
- Use updated emergency planning modeling assumptions.
- Incorporate effective risk communication techniques

SOARCA PROCESS



Accident Sequence Selection

(Internal Events)

- Initial Screening - use enhanced SPAR models to screen out low CDFs initiating events (CDF $\leq$1.0E-7) and sequences/sequence groupings[1] with a CDF <1.0E-8 (eliminates <10% of the overall CDF).

- Sequence Evaluation – identify and evaluate the dominant cutsets for the remaining sequences (~90% of initiator CDF). Determine system and equipment availability/unavailability and accident sequence timing.

- Scenario Grouping - group sequences together that have similar times to core damage and equipment unavailability.

- Results will include dominant sequences / sequence groupings with a CDF $\geq$ 1.0 E-6 ($\geq$ 1.0E-7 for bypass events).

Containment System States

The staff will identify the anticipated availability of containment and containment support systems not considered in the Level 1 core damage analysis that impact post-core-damage containment accident progression, containment failure, and radionuclide release, based on limited analyses and engineering judgment.

Structural Analyses

- Develop a structural analysis to determine containment leak rates in terms of “leakage versus pressure” for reinforced, pre-stressed, and steel containment structures for each site within the scope of the SOAR-CA analyses.

- Consider other potential effects including temperature extremes [>204°C (>400°F)], degradations (e.g., corrosion), aging (e.g., radiation effects), and original construction defects based on sound engineering judgment.

Mitigative Measures

- For each sequence groupings within the scope of the site-specific analyses, identify applicable (implemented or committed to) mitigative measures and the approximate time for implementation after the initiating event.

- Perform a procedural and system review to identify the availability and time to implementation for mitigative measures that can potentially prevent or delay core damage, RCS failure, and/or containment failure for input into the MELCOR analysis.

MELCOR

- Develop a plant-specific model for each plant being analyzed.

- Perform accident progression analyses for each plant using MELCOR computer code to determine source term, potential containment failure state and time, and time of release as input in the MACCS2 analyses.

Emergency Preparedness

- Model the protective response afforded by current site-specific Emergency Preparedness (EP) Program to substantially improve realism.

- Perform an evaluation of the potential benefits of staged evacuation and increased use of initial sheltering (followed by evacuation) for a high population site.

MACCS 2

- Develop a site-specific model for each plant being analyzed based on refined source term, meteorological data, and emergency response parameters.

- Perform consequence analyses for each plant using MACCS2 computer code to determine early fatalities, and latent cancer fatalities.

Current SOARCA Project Status

- MELCOR and MACCS models improvements implemented
- First two sites
  - Initial contact, provided information requests
  - Completed site visit for both sites
    - Determined sequences to be analyzed
    - Performed mitigative measures assessment

Current SOARCA Project Status (Continued)

- BWR model developed, majority of information requested has been received, analyses ongoing
- PWR model development almost completed, information requested is being received
- Emergency Preparedness
  - Computerized modeling of evacuation route network
  - Completed Road network analyses for 10-20 miles to estimate cohort travel speed and route
  - Modeled SBO scenario for Peach Bottom