



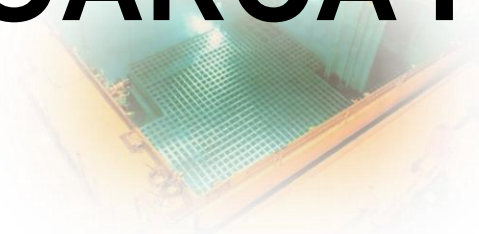
U.S.NRC

UNITED STATES NUCLEAR REGULATORY COMMISSION

Protecting People and the Environment



Benefits and Applications of the SOARCA Project



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Outline

1. SOARCA Project Overview
2. Benefits of the SOARCA Project
3. Examples of SOARCA Applications

SOARCA Project Overview

- Detailed, up-to-date NRC study of accident progression and offsite consequences of selected severe reactor accident scenarios
- 3 pilot plants analyzed:



Peach Bottom
(Boiling-Water Reactor
(BWR) Mark I)



Surry
(Pressurized-Water Reactor
(PWR) Large, Dry Containment)



Sequoyah
(PWR Ice Condenser
Containment)

- Deterministic and uncertainty analyses performed

SOARCA Project Overview (2)

To provide the most realistic, up-to-date evaluations of severe accident progression, radionuclide release, and offsite consequences, the SOARCA Project

- Built on previous reactor assessments
- Incorporated significant plant improvements and changes not reflected in earlier assessments
- Used state-of-the-art integrated modeling of severe accident behavior
 - MELCOR, MACCS
 - Detailed site- and plant- specific models
- Evaluated potential benefits of 10 CFR 50.54(hh) security enhancements

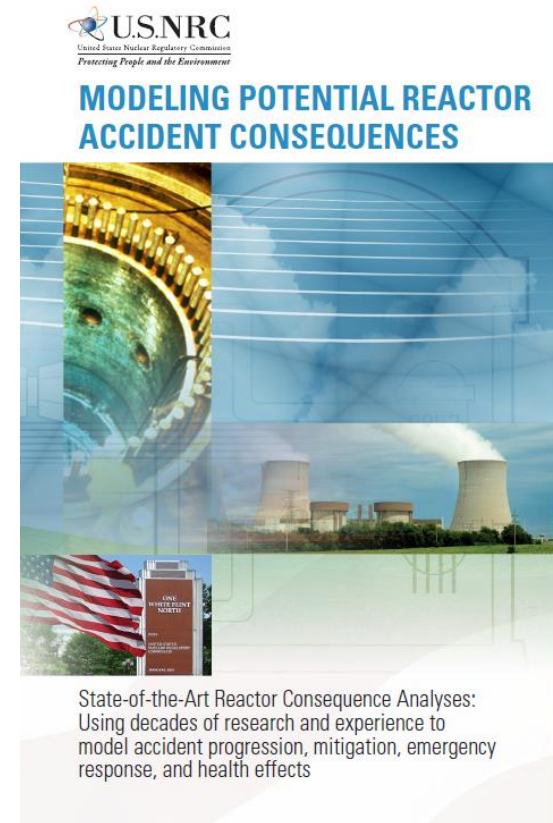
Benefits of the SOARCA Project

- Improvements in NRC computer codes and modeling best practices
- Detailed MELCOR and MACCS plant- and site-specific input decks available
- Improved staff expertise in accident progression and consequence analysis

Enabled NRC to better communicate severe accident-related safety aspects

Communication of SOARCA Results to Stakeholders

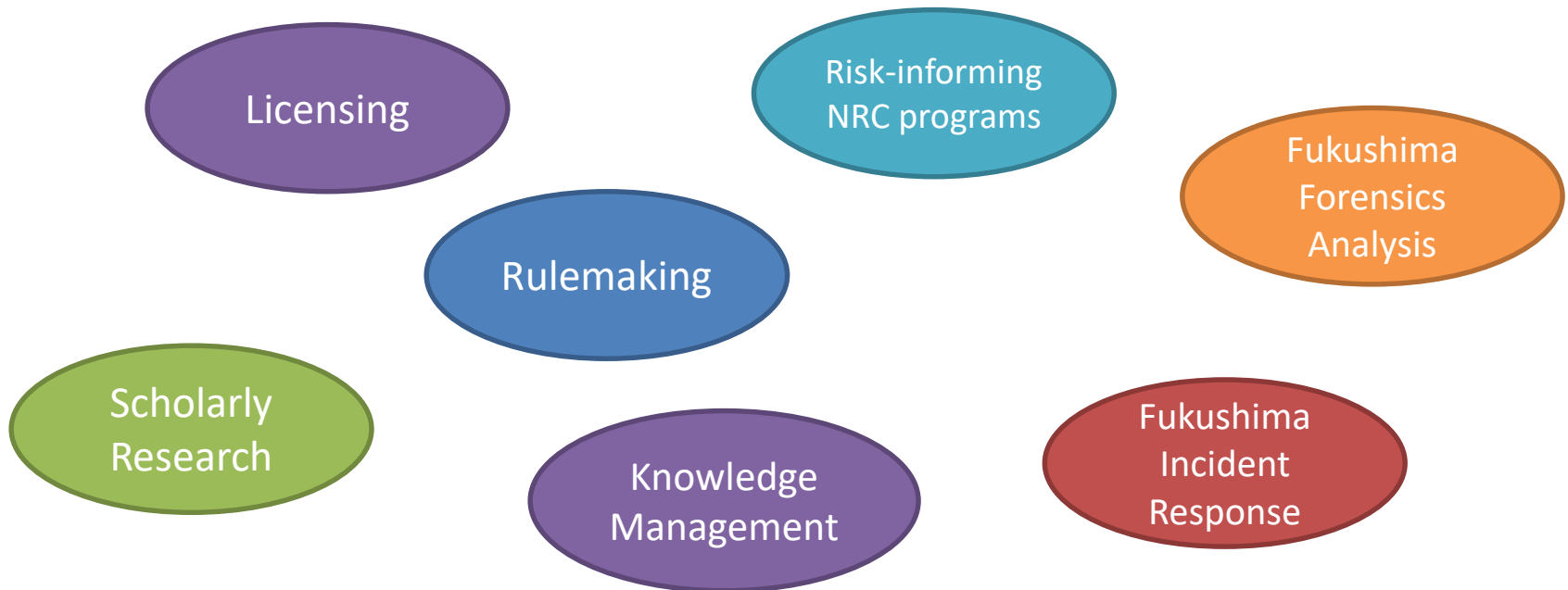
- Public meetings
- NRC Regulatory Information Conference Presentations
- CSARP and IMUG meetings
- Nine SOARCA reports
 - SOARCA Brochure
 - MELCOR and MACCS modeling best practices
- NRC staff and industry training
- Federal agencies



NUREG/BR-0359

Applications of the SOARCA Project

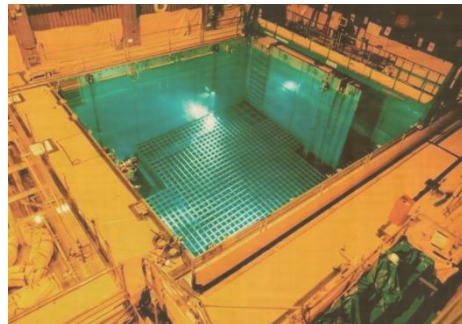
The SOARCA studies continue to be used in many ways beyond its original objectives:



- A Research Information Letter summarizing applications of SOARCA is under development

Rulemaking Support Post-Fukushima

- Fukushima NTTF Tier 1 Item 5.1: Containment Venting and Containment Protection and Release Reduction for BWR Mark I/Mark II (SECY-15-0085, NUREG-2206)
- Fukushima NTTF Tier 3 Item 5.2: Containment Venting for Other Designs (SECY-16-0041 Enclosure 1)
- Fukushima NTTF Item: Evaluation of Expedited Transfer of Spent Fuel to Dry Storage (COMSECY-13-0030 and NUREG-2161)



Licensing and Design Certification Applications

- NuScale application and NRC's review of it
 - Accident progression and source term evaluations for DBA dose
 - Severe accident mitigation
 - SAMDA analysis



- APR1400 design certification review



Fukushima Incident Response and Analysis

- Fukushima incident response
- Support for federal government response to accident at Fukushima
- Benchmarking study of the accident at Fukushima

SOARCA Uses to Risk-Inform NRC Programs and Projects

- Level 3 PRA project
 - Full-scope, all hazards PRA
 - SOARCA used for Levels 2 and 3 assessments
- Seismic PRA relief request
 - NRC NTTF Recommendation 2.1
- Emergency preparedness significance quantification process
 - DUQI process developed
 - Used Peach Bottom and Surry MELCOR and MACCS models

Computer Model Enhancement

- Cyber-attack vectors
- MELCOR integration with ERDS
- Enhancement of RASCAL for Incident Response

Applications of SOARCA in Basic and Applied Research

- 325+ citations of SOARCA information in journal articles, reports, and conference proceedings
- Research topics include
 - Advanced reactor safety
 - Fuel performance modeling
 - Accident tolerant fuels
 - Fusion
- SOARCA RIL includes detailed citation list

Conclusions

- The SOARCA project leveraged decades of severe accident phenomenology, health effects, and risk assessment studies to provide a realistic, up-to-date evaluation of severe accident consequences for selected scenarios
- It continues to have important applications in many areas
 - Licensing, rulemaking, oversight, etc.
- There are at least 325 citations of SOARCA studies.
 - Fusion, accident-tolerant fuels, etc.
- A publicly available Research Information Letter about SOARCA uses is in preparation.

Questions?

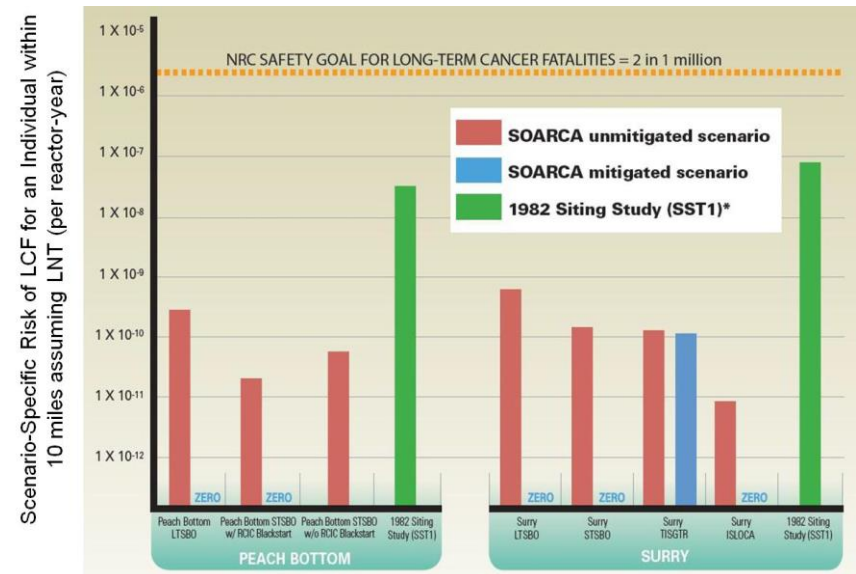
Accident Scenarios Analyzed



Reactor Site	Accident Scenario
Peach Bottom & Surry	Long-Term Station Blackout (LTSBO)
Peach Bottom, Surry & Sequoyah	Short-Term Station Blackout (STSBO)
Surry	STSBO with Thermally Induced Steam Generator Tube Rupture (TISGTR)
Surry	Interfacing Systems Loss-of-Coolant Accident (ISLOCA)

General SOARCA Results

- Effective implementation of existing plant resources and procedures can stop an accident, slow it down, or reduce its consequences
- Even without effective mitigation, the analyzed accidents happen more slowly and release less radioactive material than previously thought
- Predicted essentially zero individual early fatality risk for the modeled scenarios, and very low long-term cancer fatality risks



Results from uncertainty analyses and for Sequoyah corroborate these results