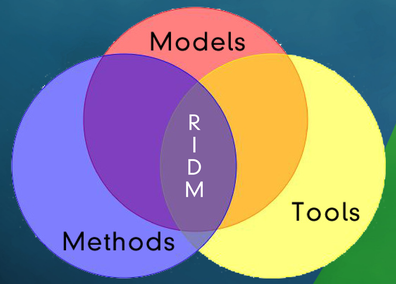
U.S.NRC
United States Nuclear Regulatory Commission
Protecting People and the Environment

Office of Nuclear Regulatory Research

Risk-Informed Decision Making (RIDM)



Improving Safety Through Risk Assessment

Supporting Reactor Oversight and Operating Experience Programs

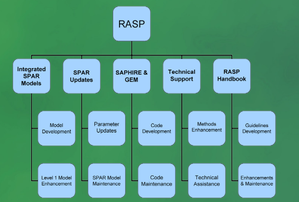
SPAR
- Standardized Plant Analysis Risk (SPAR) models quantify core damage risk
- 77 Level 1 (internal event, at power) models for the 104 U.S. plants; approximately 12 SPAR models updated per year to reflect plant modifications
- 15 External Event (EE) SPAR models and 6 Shutdown (SD) SPAR models
- 3 extended level 1/level 2 feasibility models

SAPHIRE
- Systems Analysis Program for Hands-on Integrated Reliability Evaluation (SAPHIRE) software uses fault-tree and event-tree analysis to create and quantify SPAR models
- SAPHIRE version 7 currently in use and maintained
- SAPHIRE version 8 being developed to provide user-friendly graphical interface and enhanced functionality

Guidance
- guidance on risk assessment of operational events provided in RASP Handbook to address Probablistic Risk Assessment (PRA) method consistency
- updates to the RASP Handbook to include EE and SD considerations

Photo courtesy of the National Oceanic and Atmospheric Administration

Station blackout is the dominant initiating event in most PRAs



RASP (Risk Assessment Standardization Project) incorporates different programs to provide PRA method consistency.

Supporting Continuous Advancement in PRA State-Of-The-Art And State-Of-Practice

Improving Current PRA Models
- advanced Level 2/3 PRA modeling techniques
- Organization for Economic Cooperation and Development (OECD) Severe Accident Management Workshop
- support system initiating events, Loss of Offsite Power methodology, and Boiling water Reactor (BWR) Emergency Core Cooling Recirculation after Containment Failure

Digital I&C
- developing methods to create and quantify digital system and software risk models for use in a PRA

Tools for Advanced Modeling
- thermal-hydraulic analysis based SPAR model success criteria evaluation and level 1 end-state project
- techniques to address sensitivity and model uncertainty
- updates to the handbook to include EE and SD considerations

Collaboration and Coordination

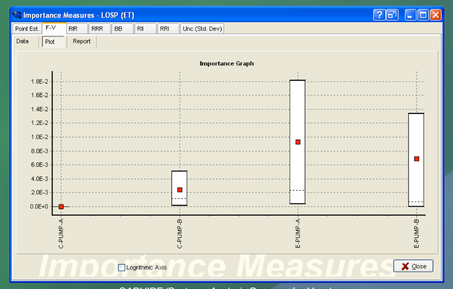
DOE Laboratories
Brookhaven National Laboratory
Idaho National Laboratory
Sandia National Laboratory

Memoranda of Understanding
National Aeronautics and Space Administration
Electric Power Research Institute

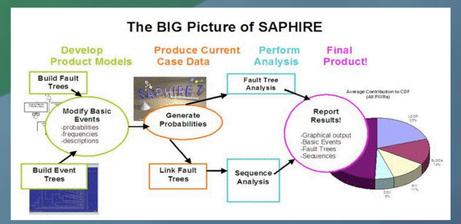
International Organizations
Organization for Economic Cooperation and Development
Nuclear Energy Association

University Cooperatives
Massachusetts Institute of Technology
University of Maryland

Standards Organizations
American Nuclear Society
American Society of Mechanical Engineers



SAPHIRE (Systems Analysis Program for Hands-on Integrated Reliability Evaluation) version 8 screen shot.



Improving the Effectiveness and Efficiency of Risk-Informed Regulation

PRA Technical Adequacy
- support the development of pra standards
  - level 1/LERF ASME/ANS standard
  - level 2 ANS/ASME standard
  - level 3 ANS/ASME standard
- update of Regulatory Guide (RG) 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities"

Guidance for Risk-Informed Decisionmaking
- update of RG 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis," and RG 1.177, RI Technical Specification
- new draft RG on hurricane wind speeds and wind-driven missiles, and two supporting NUREG/CRs
- risk-informed performance-based glossary of key terms

Risk Tools and Methods Development
- Risk assessment methodology for consequential Steam Generator Tube Rupture

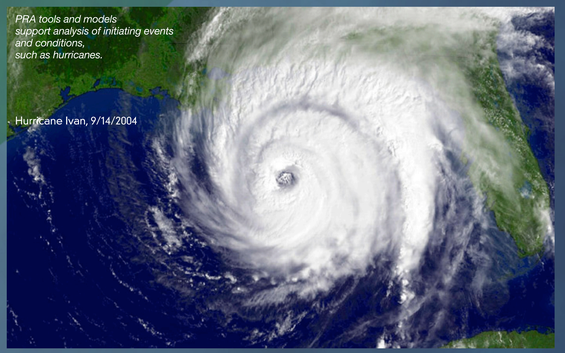


Photo courtesy of the National Oceanic and Atmospheric Administration

Expanding PRA Infrastructure to Encompass New Reactor Concepts and Designs

New Reactor PRA Models
- level 1 design-specific SPAR models for GE Advanced Boiling Water Reactor and Westinghouse AP1000

Advanced Reactor PRA Tools and Methods
- Advanced Reactor PRA Planning Study to identify needed tools and data
- OECD/WGRISK survey on advanced reactor PRA issues

Knowledge for Today and Tomorrow