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Standardized Plant Analysis Risk (SPAR) Model Philosophy

Kevin Coyne, Probabilistic Risk Assessment Branch
Office of Nuclear Regulatory Research
U.S. Nuclear Regulatory Commission
Kevin.Coyne@nrc.gov
(301) 415-2478

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Model Uses

- Reactor Oversight
  - Significance Determination Process (SDP)
  - Notices of Enforcement Discretion (NOEDs)
  - Management Directive MD 8.3 Incident Investigation Assessments
  - Accident Sequence Precursor Program
- System & Component Studies
- Generic Issue Screening
- Special Studies

SPAR Technical Adequacy

- Unlike licensee PRA models that support risk-informed licensing actions, SPAR models are not required to minimum technical adequacy requirements (e.g., RG 1.200).
- SPAR QA program helps to ensure SPAR models reflect as-built, as-operated plant
- Process controls also help to ensure quality
  - Trained/certified analysts
  - Internal reviews
  - External reviews

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SPAR Level 1 Model Development

- Feedback from ~50 ASP analyses per year
- Feedback from emergent SDP analyses
- Peer reviews from licensees (ASP/SDP analyses; MSPI reviews)
- Incorporation of information gathered during SDP
- Feedback to other models through use of standardized assumptions and methods
- Identification and resolution of generic industry modeling issues
- Resolution of Peer Review Comments

Rev. 1 Models
1995 – 1998

- Developed from "Daily Events Manual"
- Train level system modeling
- Limited number of event trees

Rev. 2/2QA Models
1998 - 2001

- Expanded modeling of event trees and front line systems based on NRC reviewed IPEs
- Detailed external review by SNL

Rev. 3i Models
Completed 11/02

- Expanded number of event trees
- Support system fault trees/initiators added
- SDP plant visit comments incorporated

Rev. 3 Models
Completed 12/04

- Detailed reviews (see review guideline, 3/14/05)
- Data updated and templates generated
- RCP seal LOCA and LOOP models updated

Rev. 3.x Models
Completed 12/09

- Detailed cut set level review against PRAs (see Rev 3P Review Process Guideline, 2/21/06)
- Model documentation expanded/updated

Rev. 8.x Models
In progress

- SAPHIRE version 8 enhancements
- SSIE Models (RES/EPRI MOU)
- Expanded LOOP/SBO models (RES/EPRI MOU)
- Resolve Peer Review Comments – phase 1
- Success Criteria Enhancements

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Capabilities

- Operating Reactors
  - 75 full-power, internal events models representing all operating plants
  - 18 IPEEE-based external hazard models
  - 4 “All Hazard Models”
  - 8 Shutdown template models
  - 3 Level 2 feasibility models
  - 1 Integrated Capability Model
- New Reactors
  - ABWR – GE & Toshiba (SD)
  - APWR
  - AP1000 (seismic, flooding, fire, LPSD)
  - US EPR

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Development Philosophy

- Provide independent, plant-specific PRA models for use by agency risk analysts
  - "[I]ndependent oversight of licensee performance is critical for effective NRC oversight and is an important aspect of upholding public confidence in the [SDP] process" (letter from EDO to NEI, October 2007, ML072490566)
- Use standardized modeling conventions
  - Standardization approach supports plant-specific modeling
  - Ease of use for agency analysts
  - Efficient model maintenance and updating

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Development Philosophy

- Support event and condition assessment (ECA) activities
  - SAPHIRE user “workspaces” structured to support ROP
  - SPAR models designed to efficiently address typical ECA activities (e.g., CCF, LOOP modeling)
- Apply agency resources in a cost-effective manner
  - SPAR models generally not as detailed as licensee models (with some exceptions)
  - SPAR generally relies on licensee PRA modeling assumptions (supported with some independent analysis)

Quality Assurance

- SPAR Quality Assurance Plan
- SPAR Project Manager Handbook
- Risk Assessment of Operational Events (RASP) Handbook
  - Helps to ensure that the SPAR models are of adequate quality, reflect the as-built, as-operated plant for the problem being analyzed, and are used in a consistent manner.
- Model Maker Guidelines (MMGs)
  - All Hazard Models
  - Shutdown
  - Integrated Capability Modeling

Quality Assurance

- Onsite verification reviews
  - Onsite reviews conducted during MSPI benchmarking activities
  - Onsite reviews conducted for new modeling elements (e.g., shutdown, fire, external hazards)
- SPAR Configuration/Version Control
- SAPHIRE Quality Assurance Plan
  - Independent Verification and Validation for SAPHIRE 8
  - NUREG/BR-0167, “Software Quality Assurance Program and Guidelines” compliant QA program, including annual audits

Maintenance Program

- Major updates are performed on approximately 8-12 SPAR models per year based on feedback from model users and licensees
  - Less significant model changes are performed on an additional 20-30 models per year to support risk assessments for specific regulatory applications
  - Approximately one half of the plant-specific SPAR models are typically updated in a given year

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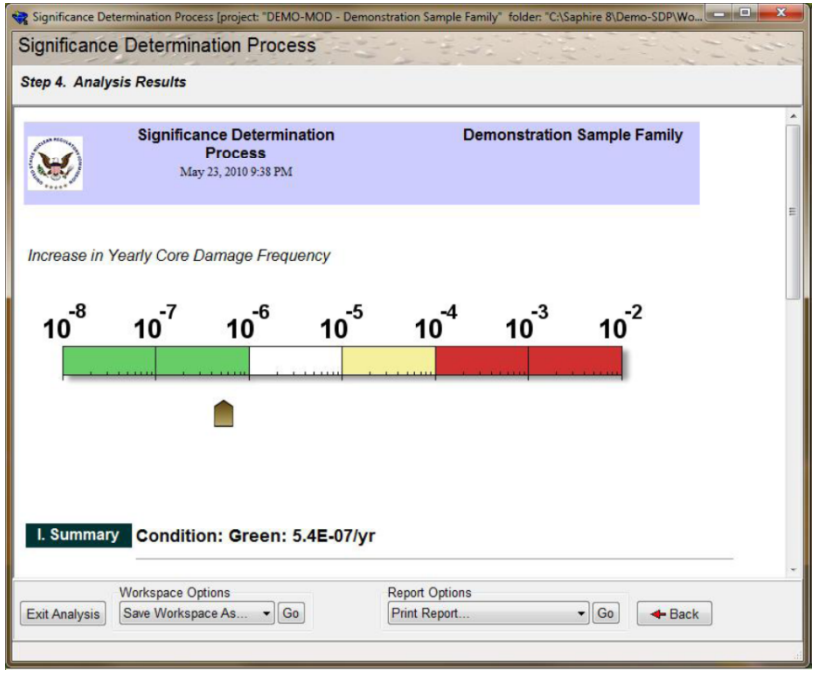
SAPHIRE

SAPHIRE (Systems Analysis Programs for Hands-on Integrated Reliability Evaluation)

- Performs logic solving and Boolean reduction to generate PRA cutsets from event tree/fault tree models
- NRC sponsored code developed at Idaho National Lab.
- Developed to Support Event and Condition and Analysis
  - Workspaces (SDP, ECA, GA)
  - CCF Module
  - Cut set editor
  - Reporting Capabilities
- NUREG/BR-0167 Compliant QA Program



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Questions?