

POLICY ISSUE INFORMATION

September 29, 2009

SECY-09-0143

FOR: The Commissioners

FROM: Brian W. Sheron, Director
Office of Nuclear Regulatory Research

SUBJECT: STATUS OF THE ACCIDENT SEQUENCE PRECURSOR PROGRAM
AND THE STANDARDIZED PLANT ANALYSIS RISK MODELS

PURPOSE:

To inform the Commission of the status of the Accident Sequence Precursor (ASP) Program, provide the annual quantitative ASP results, and communicate the status of the standardized plant analysis risk (SPAR) models. This paper does not address any new commitments or resource implications.

BACKGROUND:

In a memorandum to the Chairman dated April 24, 1992, the staff of the U.S. Nuclear Regulatory Commission (NRC) committed to report periodically to the Commission on the status of the ASP Program, including development of associated risk models (e.g., SPAR models). The ASP Program systematically evaluates U.S. nuclear power plant operating experience to identify, document, and rank the operating events most likely to lead to inadequate core cooling and severe core damage (precursors). The ASP Program provides insights to NRC's risk-informed and performance-based regulatory programs and monitors performance against the safety goal established in the agency's Strategic Plan (see NUREG-1100, Volume 25, "Performance Budget: Fiscal Year 2010," issued May 2009). The SPAR Model Program develops and improves independent risk-analysis tools and capabilities to support the use of probabilistic risk assessment (PRA) in the agency's risk-informed regulatory activities. The staff uses SPAR models to support the Significance Determination Process (SDP), the ASP

CONTACT: Christopher S. Hunter, RES/DRA
301-251-7575

Program, the Incident Investigation Program event assessment process, and the Generic Issue Program resolution process.

DISCUSSION:

This section summarizes the status, accomplishments, and results of the ASP Program and SPAR Model Program since the previous status report, SECY-08-0145, "Status of the Accident Sequence Precursor Program and the Development of Standardized Plant Analysis Risk Models," dated October 1, 2008.

ASP Program

The staff has completed the analyses of all precursor events that were identified in fiscal year (FY) 2008 (15 precursors). Precursors are events with a conditional core damage probability (CCDP) or increase in core damage probability (Δ CDP) that is greater than or equal to 1×10^{-6} . In addition, the staff has completed the screening of FY 2009 events for *significant* precursors. *Significant* precursors have a CCDP or Δ CDP greater than or equal to 1×10^{-3} . No *significant* precursors were identified in either FY 2008 or FY 2009 and the staff continues to complete the review, analysis, and documentation of all potential precursors. The last *significant* precursor identified was the Davis-Besse event in FY 2002. The ASP Program provides input to the agency's safety-performance measure of zero events per year identified as a *significant* precursor of a nuclear reactor accident.

The staff evaluated precursor data during the period of FY 2001 through FY 2008 to identify statistically significant adverse trends for the Industry Trends Program (ITP). The staff detected a statistically significant decreasing trend for all precursors during this 8-year period. The ASP Program results are trended in the ITP to provide an input to the agency's safety-performance measure of no more than one significant adverse trend in industry safety performance. In addition to the decreasing trend of all precursors, the staff detected a statistically significant decreasing trend during this same period for precursors with a CCDP or Δ CDP greater than or equal to 1×10^{-4} .

The staff has begun analyzing potential precursors occurring in FY 2009. Thus far, two precursors have been identified in FY 2009.

SPAR Model Program

The staff completed an enhancement of the internal event SPAR models representing the 104 operating commercial nuclear power plants. This effort primarily involved comparing the SPAR models against the respective licensee's plant PRA models. Differences between the two models were discussed between the staff and the licensee. The staff revised the SPAR models as necessary to properly represent the as-built, as-operated plant and documented additional technical issues to be addressed through continuing NRC and industry efforts.

In addition to the above model enhancements, the staff completed an evaluation of the risk reduction associated with the severe accident mitigation strategies related to core damage for about two-thirds of the licensees. The evaluations of the remaining licensees are scheduled to be completed by October 2010.

The staff continued to expand the SPAR model capability beyond internal events at full power operation. The staff previously completed a total of 15 SPAR external event models (e.g., fires, floods, and seismic events). The staff initiated model development of shutdown scenarios for two plants. The staff also completed a project to extend SPAR models for three plants to include the modeling of containment systems and plant damage states. This project will provide the capability to assess accident progression to the level of containment damage.

The staff also completed the development of a new reactor SPAR model (AP1000) to allow confirmation of PRA results presented in licensing submittals and evaluation of risk-informed applications prior to new plant operation, and assessment of operational findings and events once operation commences.

The SPAR Model Quality Assurance Plan was formerly established in 2006 for SPAR model development activities. In addition to internal quality assurance efforts, the staff is working with industry representatives to ensure that the models and risk assessment techniques continue to be improved and updated. The staff and the Electric Power Research Institute executed an Addendum to the Memorandum of Understanding to conduct cooperative research for PRA. Several of the initiatives in this effort are intended to resolve technical issues that account for differences between NRC's SPAR models and the licensees' PRAs. In addition, the staff, with the cooperation of industry experts, performed a peer review of a typical boiling-water reactor SPAR model in accordance with American National Standard ASME RA-S-2002, "Standard for Probabilistic Risk Assessment for Nuclear Power Plant Applications," and Regulatory Guide 1.200, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities." A peer review of a typical pressurized-water reactor SPAR model is scheduled to be completed in October 2009.

UPCOMING ACTIVITIES:

- The staff will continue the screening, review, and analysis (preliminary and final) of potential precursors for FY 2009 and FY 2010 events to support the agency's Strategic Plan goals for monitoring performance.
- For the SPAR Model Program, the staff will continue to implement enhancements to the internal event SPAR models for full power operations. Anticipated enhancements include incorporating new models for support-system initiators and revised success criteria based on insights from thermal-hydraulic analyses. The staff also is working with industry representatives to resolve PRA technical issues common to both licensee PRA and NRC SPAR models. This cooperative effort is expected to span the next 2 years.
- As part of a broader, ongoing initiative among internal stakeholders to enhance risk tools used in reactor oversight, the staff is identifying additional enhancements to the SPAR models based on specific needs of end users. These enhancements are planned to be incorporated into the models.

- The staff will use information obtained as part of the National Fire Protection Association 805 pilot application process to create two new SPAR fire models with updated fire scenarios.
- The staff will continue to evaluate the need for additional SPAR model capability (beyond full power internal events) based on experience gained from SDP, ASP, and Management Directive 8.3, "NRC Incident Investigation Program Assessments."
- The staff will continue the development of SPAR models for new reactors to allow confirmation of PRA results presented in licensing submittals and evaluation of risk-informed applications prior to new plant operation, and assessment of operational findings and events once operation commences.

In summary, the ASP Program continues to evaluate the safety significance of operating events at nuclear power plants and to provide insights to NRC's risk-informed and performance-based regulatory programs. The staff identified no *significant* precursors in FY 2009. The staff detected a statistically significant decreasing trend for all precursors during the FY 2001 through FY 2008 period. The SPAR Model Program is continuing to develop and improve independent risk analysis tools and capabilities to support the use of PRA in the agency's risk-informed regulatory activities.

COORDINATION:

The Office of the General Counsel reviewed this Commission paper and has no legal objection.

/RA/

Brian W. Sheron, Director
Office of Nuclear Regulatory Research

Enclosures:

1. Results, Trends, and Insights
of the ASP Program
2. Status of the SPAR Models

- The staff will use information obtained as part of the National Fire Protection Association 805 pilot application process to create two new SPAR fire models with updated fire scenarios.
- The staff will continue to evaluate the need for additional SPAR model capability (beyond full power internal events) based on experience gained from SDP, ASP, and Management Directive 8.3, "NRC Incident Investigation Program Assessments."
- The staff will continue the development of SPAR models for new reactors to allow confirmation of PRA results presented in licensing submittals and evaluation of risk-informed applications prior to new plant operation, and assessment of operational findings and events once operation commences.

In summary, the ASP Program continues to evaluate the safety significance of operating events at nuclear power plants and to provide insights to NRC's risk-informed and performance-based regulatory programs. The staff identified no *significant* precursors in FY 2009. The staff detected a statistically significant decreasing trend for all precursors during the FY 2001 through FY 2008 period. The SPAR Model Program is continuing to develop and improve independent risk analysis tools and capabilities to support the use of PRA in the agency's risk-informed regulatory activities.

COORDINATION:

The Office of the General Counsel reviewed this Commission paper and has no legal objection.

/RA/

Brian W. Sheron, Director
Office of Nuclear Regulatory Research

Enclosures:

1. Results, Trends, and Insights of the ASP Program
2. Status of the SPAR Models

ADAMS Accession No.: ML092190578

WITS 199200101/EDATS: SECY-2009-0434

OFFICE	RES/DRA/PRB	SUNSI Review	RES/DRA/PRB	RES/DRA/PRAB	Tech. Editor
NAME	C. Hunter	C.Hunter	G. DeMoss	K. Coyne	J. Zabel (via email)
DATE	08/10/09	08/10/09	08/11/09	08/11/09	08/11/09
OFFICE	D:RES/DRA	NRR	NRO	OGC	D:RES
NAME	C. Lui	J. Wiggins (T. Wertz for)	C. Ader (via email)	G. Mizuno (NLO) (via email)	B. Sheron
DATE	08/28/09	09/17/09	09/18/09	09/08/09	09/29/09

OFFICIAL RECORD COPY