

POLICY ISSUE INFORMATION

October 1, 2008

SECY-08-0145

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 24, "Performance Budget: Fiscal Year 2009," issued February 2008).

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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 Program, the Incident Investigation Program event assessment process, and the Generic Issue Program resolution process. The staff also uses SPAR models to perform analyses in support of risk-informed reviews of license amendments and the State-of-the-Art Reactor Consequence Analysis project.

DISCUSSION:

This section summarizes the status, accomplishments, and results of the ASP Program and SPAR Model Program since the previous status report, SECY-07-0176, "Status of the Accident Sequence Precursor Program and the Development of Standardized Plant Analysis Risk Models," dated October 3, 2007.

ASP Program

The staff has completed the analyses of all precursor events that were identified in fiscal year (FY) 2007 (nine 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 for FY 2008 events for *significant* precursors. *Significant* precursors have a CCDP or Δ CDP greater than or equal to 1×10^{-3} . The staff identified no *significant* precursors in FY 2008. 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 2007 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 7-year period. The ASP Program provides the ITP 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 2008. Thus far, the staff has identified six precursors in FY 2008.

SPAR Model Program

The staff continued to enhance the Revision 3 SPAR models for internal events during power operations. This effort primarily involves comparing the SPAR models against the respective licensee's plant PRA models. Any differences between the two models are discussed between the staff and the licensee. Once the differences are understood, the staff will revise the SPAR models if necessary to properly represent the as-built, as-operated plant. In addition, the staff will document unresolved technical issues. The staff completed a total of 75 plant model comparisons (out of 77 models representing 104 operating nuclear plants). This includes the development of a Browns Ferry Unit 1 SPAR model.

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 low-power and shutdown scenarios for two plants. The staff also initiated 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 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.

UPCOMING ACTIVITIES:

- The staff will continue the screening, review, and analysis (preliminary and final) of potential precursors, including *significant* precursors, for FY 2008 and FY 2009 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 Revision 3 internal event 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 SPAR models. This cooperative effort is expected to span the next 3 years.
- The staff will continue to add additional modeling capability (e.g., external events, low-power and shutdown scenarios, and containment systems) into SPAR models. The staff will use information obtained as part of the National Fire Protection Association 805 pilot application process to update and enhance the SPAR fire models. The staff plans to complete several models, spanning the different plant types, that contain external events, low-power and shutdown scenarios, and the modeling of containment systems by 2009.
- The staff will evaluate the need for additional plant models after the use and assessment of this representative set of models in the SDP, ASP, and Management Directive 8.3, "NRC Incident Investigation Program."
- The staff initiated the development of new reactor SPAR models to allow performance of risk assessments to confirm licensee PRA results, comparisons of the effects of design differences, and evaluation of risk-informed applications prior to new plant operation. In addition, the new reactor SPAR models will be required for evaluating operational findings and events.

In summary, the ASP Program continues to evaluate the safety significance of operating events at nuclear power plants and to provide insights to the NRC's risk-informed and performance-based regulatory programs. The staff identified no *significant* precursors in FY 2008. The staff detected a statistically significant decreasing trend for all precursors during the FY 2001 through

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FY 2007 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/

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Enclosures:

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

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