

POLICY ISSUE (Information)

October 3, 2007

SECY-07-0176

FOR: The Commissioners

FROM: Luis A. Reyes
Executive Director for Operations /RA/

SUBJECT: STATUS OF THE ACCIDENT SEQUENCE PRECURSOR PROGRAM
AND THE DEVELOPMENT OF 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 development 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 committed to report periodically to the Commission on the status of the ASP Program. In SECY-94-268, "Status of the Accident Sequence Precursor Program and Related Initiatives," dated October 31, 1994, the staff made two significant changes to this commitment. First, the staff committed to provide the report annually, and second, the staff began to provide annual quantitative ASP results. The ASP Program systematically evaluates U.S. nuclear power plant operating experience to identify, document, and rank the operating events that are most likely to lead to inadequate core cooling and severe core damage (precursors), contributing to the likelihood of additional failures.

CONTACTS: Christopher S. Hunter, RES/DRASP
(301) 415-4127

In SECY-02-0041, "Status of Accident Sequence Precursor and SPAR Model Development Programs," dated March 8, 2002, the staff expanded the annual ASP SECY paper to include detailed information on the status of the SPAR Model Development Program. Through the SPAR Model Development Program, the staff developed standardized risk analysis models and tools that staff analysts can use in many regulatory activities.

BACKGROUND

In fiscal year (FY) 2006, the staff streamlined the analysis and revised the review process and thus improved the timeliness of ASP analyses. The analysis process now includes results from the significance determination process (SDP) and Management Directive (MD) 8.3, "NRC Incident Investigation Program," dated March 27, 2001, when practicable. By including these results, the staff prevented duplicate analyses for 13 precursors in FY 2006 and reduced unintended consequences of inconsistent outcomes. In addition, the revised review process has reduced administrative and review burdens to NRC staff and licensees since no formal peer reviews were required for FY 2006 analyses.

In SECY-04-0210, "Status of the Accident Sequence Precursor Program and the Development of Standardized Plant Analysis Risk Models," dated November 8, 2004, the staff informed the Commission of a plan to improve the timeliness of ASP analyses and complete the analyses of prior years' precursor events.

DISCUSSION:

This section summarizes the status, accomplishments, and results of the ASP Program and SPAR Model Development Programs since the previous status report, SECY-06-0208, "Status of the Accident Sequence Precursor Program and the Development of Standardized Plant Analysis Risk Models," dated October 5, 2006.

ASP Program

The staff has completed the analyses of all precursor events that were identified in FY 2006 (14 precursors). Precursors are events with a conditional core damage probability (CCDP) or increase in core damage probability (Δ CCDP) that is greater than or equal to 1×10^{-6} . In addition, the staff has completed the screening for FY 2007 events for *significant* precursors. *Significant* precursors have a CCDP or Δ CCDP greater than or equal to 1×10^{-3} . The staff identified no *significant* precursors in FY 2007. The last *significant* precursor identified was the Davis-Besse event in FY 2002. The staff already has begun analyzing potential precursors occurring in FY 2007.

The staff evaluated precursor data during the period of FY 2001 through FY 2006 to identify statistically significant adverse trends for the Industry Trends Program. No statistically significant trend was detected for all precursors during this 6-year period. However, the staff noted a statistically significant decreasing trend for precursors with a CCDP or Δ CCDP greater than or equal to 1×10^{-4} during this same period.

SPAR Model Development 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 probabilistic risk assessments (PRAs). Any differences identified between the two models are discussed with the licensee. Once the differences are understood, the SPAR models are revised if necessary to properly represent the as-built, as-operated plant, while unresolved technical issues are documented. A total of 52 plant models (out of 74 models) have been completed. In addition, the staff developed a preliminary Browns Ferry Unit 1 SPAR model and will review it against the licensee model when the licensee completes an American Society of Mechanical Engineers standard peer review of its PRA.

Also in FY 2006, the staff continued to expand the SPAR model capability beyond internal events at full power operation. External event scenarios (e.g., fires, floods, and seismic events) from the licensee submittals of the Individual Plant Examinations for External Events (IPEEEs) were incorporated into five additional SPAR external event models. To date, the staff has completed a total of 15 SPAR external event models. In response to a user need for SDP and ASP analyses, the staff initiated model development of low-power and shutdown (LP/SD) operation 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 through to the level of containment damage.

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 worked with the Office of the Inspector General (OIG) on an audit of the NRC's use of PRA and SPAR models in regulatory activities. The OIG made three recommendations to ensure that the models sufficiently represent the as-built, as-operated plants and that software used to run the models has been verified and validated. The staff implemented an updated SPAR model quality assurance plan and revised the risk assessment standardization project (RASP) handbook in response to the OIG recommendations. The staff has responded to all three OIG recommendations, and the OIG considers the issues resolved.

The staff also is working with industry representatives to improve the SPAR models. The Office of Nuclear Regulatory Research and the Electric Power Research Institute (EPRI) executed an Addendum to the Memorandum of Understanding (MOU) to conduct cooperative research for PRA. Several of the initiatives in this effort are intended to resolve technical issues that account for differences between the 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 2007 and FY 2008 events to support the agency's Strategic Plan goals for monitoring performance.

For the SPAR Model Development Program, the staff will continue to implement enhancements to the Revision 3 internal event models for full power operations. The staff plans to complete these enhanced models in 2008. The staff is also working with industry representatives to

resolve PRA technical issues common to both licensee PRA and SPAR models. This effort is expected to span the next 3 years.

Additional modeling capability (e.g., external events, LP/SD scenarios, and containment systems) will continue to be added into SPAR models. The staff will utilize 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 representative sets of models that contain external events, LP/SD scenarios, and the modeling of containment systems by 2009. The staff will evaluate the need for additional plant models after the use of this representative set as part of the SDP, ASP, and MD 8.3 processes.

Standardized risk assessment guidelines as part of the RASP handbook will be revised by the end of calendar year 2007 to meet the needs of the SDP, and the staff will continue to work with industry representatives to better resolve differences in the use of risk models in event assessments.

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 SPAR Model Development 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. The staff uses SPAR models to support the Reactor Oversight Process, the ASP Program, the MD 8.3 evaluations, and the Generic Safety Issue resolution process. The staff also uses SPAR models to perform analyses in support of risk-informed reviews of license amendments.

COORDINATION:

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

/RA William F. Kane for/

Luis A. Reyes
Executive Director
for Operations

Enclosures:

1. Status of the ASP Program and the SPAR Model Development Program
2. Results, Trends, and Insights from the ASP Program

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ADAMS Accession No.: ML072070469

WITS #199200101/EDATS: SECY-2007-0361

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