

Significance Determination Process Evaluation

Scope and Objectives - The staff of the U.S. Nuclear Regulatory Commission (NRC) performed an evaluation of the significance determination process (SDP) in accordance with Inspection Manual Chapter (IMC) 0307, "Reactor Oversight Process Self-Assessment Program." The staff used self-assessment metrics and other pertinent information to provide insights regarding the effectiveness of the Reactor Oversight Process (ROP) in fulfilling the regulatory principles of being predictable, understandable, objective, and risk-informed, and in supporting the NRC's 2004 performance goals of maintaining safety, enhancing public confidence, making regulatory activities more effective, efficient, and realistic, and reducing unnecessary regulatory burden. The staff also obtained input from internal stakeholders through an internal survey, counterpart meetings, focus groups, and the internal feedback process. In addition, the staff obtained external feedback through a *Federal Register* notice (FRN) solicitation for comments and through periodic meetings with the industry and other stakeholders.

Based on the metric results, stakeholder feedback, and other lessons learned through ongoing program monitoring, the staff identified certain issues and actions to improve the SDP. A summary of the status of implementation issues is included in Attachment 5 and these issues are discussed in further detail below. In addition, the annual ROP performance metric report provides the data and staff analysis for each of the program area metrics (reference ADAMS Accession No. ML050670162).

Program Evaluation per Strategic Plan - The staff committed in Appendix B to the fiscal year (FY) 2004–2009 Strategic Plan to perform a program evaluation of the ROP in FY 2005, and one aspect of the program specifically noted in the scope of the evaluation was the effectiveness of the SDP. SDP effectiveness was evaluated as part of this self-assessment as detailed below. Therefore, the staff considers the commitment to evaluate the SDP completed. However, the staff will continue to evaluate SDP effectiveness in accordance with the annual ROP self-assessment program as described in IMC 0307 and will make ongoing program improvements.

Summary of Previous Self-Assessment - In SECY-04-0053, "Reactor Oversight Process Self-Assessment for Calendar Year 2003," the staff described the status of the SDP and the ongoing initiatives to improve SDP efficiency and effectiveness. Specifically, the staff used the SDP Improvement Plan to address key stakeholder recommendations, including those from the SDP Task Group, an audit by the Office of the Inspector General (OIG), and internal and external feedback. The most significant of the plan's objectives completed in calendar year (CY) 2003 was the benchmarking of all site-specific risk-informed inspection notebooks. The timeliness of final significance determinations had improved in CY 2003, but did not meet the established goal. The staff anticipated continued challenges in CY 2004 with SDP timeliness in certain areas, particularly fire protection issues and SDP issues that involve complex engineering analyses. Several stakeholders expressed concern that the SDP results do not translate to the same level of significance across all cornerstones. Additionally, concerns expressed by external and internal stakeholders regarding the fire protection and shutdown operations SDPs resulted in significant changes to those processes.

Ongoing SDP Improvements - In CY 2004, the staff continued to implement initiatives to improve the SDP process and improve timeliness in issuing final SDP results. In particular, the staff continued to maintain the SDP Improvement Plan to incorporate stakeholder recommendations related to the enhancement of the SDP process and has made progress in many areas. The staff incorporated the SDP Improvement Plan into the Office of Nuclear Reactor Regulation (NRR) Director's Quarterly Status Report to increase management attention (ADAMS Accession No. ML043480029).

During the current period, the staff has made significant advances to complete the objectives of the SDP Improvement Plan. In particular, several important SDPs were revised or issued as new documents as discussed below. Three of the plan's objectives have been placed under the Risk Assessment Standardization Project (RASP) effort for resolution: (1) develop criteria for early recognition of the need for in-depth risk evaluation; (2) develop criteria for assessing licensee PRA quality; and (3) develop a low-power/shutdown operations model. These initiatives will continue to be tracked in the SDP Improvement Plan.

Status of Individual SDPs - During this period, the following SDPs were available to all stakeholders:

- IMC 0609, Appendix A, "Significance Determination of Reactor Inspection Findings for At-Power Situations"
- IMC 0609, Appendix B, "Emergency Preparedness Significance Determination Process"
- IMC 0609, Appendix C, "Occupational Radiation Safety Significance Determination Process"
- IMC 0609, Appendix D, "Public Radiation Safety Significance Determination Process"
- IMC 0609, Appendix F, "Fire Protection Significance Determination Process"
- IMC 0609, Appendix G, "Shutdown Operations Significance Determination Process"
- IMC 0609, Appendix H, "Containment Integrity Significance Determination Process"
- IMC 0609, Appendix I, "Operator Requalification Human Performance Significance Determination Process"
- IMC 0609, Appendix J, "Steam Generator Tube Integrity Findings Significance Determination Process"

Five of these nine appendices (A, F, G, H, and J) are risk-informed based on changes to core damage frequency. Appendices B, C, D, and I are more deterministic. In CY 2004, the staff issued two new SDPs, Appendix G (shutdown operations) and Appendix J (steam generator tube integrity), issued major revisions to Appendices F (fire protection) and H (containment integrity), and made minor revisions to Appendix A (reactor safety at-power). Training of inspectors and Senior Reactor Analysts (SRAs) on the implementation of these

SDPs was completed before or as the documents were issued. In addition, the staff is currently developing SDPs covering the areas of maintenance rule implementation and spent fuel storage.

The fire protection SDP was significantly revised in May 2004. The technical effort to fully revise the fire protection SDP was led by a contractor from Sandia Laboratories, with significant contributions from the NRC staff, including NRR, the Office of Research (RES), and regional specialists. There were several attachments to the SDP, including a worksheet for recording the Phase 1 review and more specific guidance for particular scenarios and analyses. All regional inspectors expected to participate on fire protection team inspections and at least one SRA from each region participated in the 3-day training course specifically designed for implementation of the SDP. Improvements are expected in the timeliness of finalizing fire protection issues using the new SDP. The containment integrity SDP was also significantly revised to make it more user friendly and risk-informed. Initial feedback from external and internal stakeholders for these SDP changes has been positive.

The staff issued the shutdown operations SDP in May 2004. This SDP included three attachments: the first attachment consisted of Phase 1 operational checklists for pressurized water reactors (PWRs) and boiling water reactors (BWRs), and the second and third attachments were Phase 2 SDP templates for PWRs and BWRs during shutdown. Before issuing these documents, the staff held a public workshop in January 2004. Comments received from this workshop were included as appropriate in the templates and the associated basis document. The new SDP allows the assessment of inspection findings identified during plant shutdown to be done by regional SRAs instead of relying on NRR staff for all findings during plant shutdown.

The staff also issued the steam generator tube integrity SDP in May 2004. The document provides guidance for a Phase 2 assessment and criteria for the inspectors to determine when a Phase 3 evaluation should be considered. The maintenance rule implementation SDP is in the final review process and is scheduled to be issued during the second quarter of CY 2005. The spent fuel storage SDP is under development. A new completion date for this SDP will be established during the second quarter of 2005.

SDP Timeliness - The timeliness of final significance determinations is one of the critical measures of SDP effectiveness. The existing timeliness goal is that final significance determinations will be completed within 90 days after the issuance of the inspection report detailing the finding. The percentage of completed findings meeting the goal has declined from CY 2003, remaining below the percentage goal. This decline is due in part to the impact of closing several of the longstanding issues as discussed further in the performance metric discussion. Several significant initiatives relied upon by the staff to improve the timeliness, such as the revised fire protection SDP and improvement in the containment SDP, have been completed. However, due to the short time period since those documents became available in June 2004, their impact on improving timeliness is not yet known. Since fire protection issues were a significant contributor to the delays in resolving findings, the staff expects improvements with the availability of the new SDP. The impact of the fire protection SDP on the time it takes to resolve issues will be assessed during the next 12-month period.

The staff also recognizes that the new and revised SDPs will not fully resolve the timeliness issues. Therefore additional initiatives are being considered. These include expanding the definition and scope of Phase 2, improving guidance on risk-informed decision making based

on the best available information within agreed-upon time constraints, and grading the timeliness requirements based on the complexity and risk significance of the finding. Additionally, the staff is considering revising the 90-day timeliness metric to include the average time to finalize all greater-than-green findings. As a result of these changes, the staff anticipates notable improvement in SDP timeliness but recognizes continued challenges ahead. The objectives outlined in the SDP Improvement Plan are designed to enhance the tools needed for the continued improvement in timely arrival at a final significance determination.

During the last period the staff revised the SDP guidance to allow preliminary categorization of potentially significant finding as "potentially greater than green," rather than a specific color. For the current period the staff monitored the impact of the change on timeliness. Of the three findings preliminarily designated in the choice letter as greater than green, two were finalized within the timeliness guidelines with no appreciable improvement in the overall timeliness of finalizing findings. The staff will continue to monitor the effectiveness of this change as more cases are run through the new process.

Staff Response to Commission SRM of December 2004 - On December 9, 2004, the Commission was briefed by the staff on the status of key reactor safety and licensing activities. On December 23, 2004, the Commission issued a staff requirements memorandum (SRM) that requested that the staff perform certain actions, two of which were related to the SDP (see SRM-M041209). As a result, the staff provided up-to-date information to the Commission on the timeliness of SDP evaluations during February 2005. Specifically, the staff provided a list of findings for which the SDP evaluation exceeded 180 days and the reasons for the delay in completing the evaluation.

The second request was for the staff to provide the Commission with an evaluation of the effectiveness of recent changes made to improve the timeliness of the fire protection SDP. As discussed above, inspectors and SRAs have indicated that the new fire protection SDP issued in May 2004 is providing the expected guidance for evaluating the significance of fire protection findings. A formal evaluation will be conducted to determine whether the SDP meets its intended purpose, including facilitating timely significance evaluations. The results of this evaluation will be included in the CY 2005 ROP self-assessment Commission paper.

Phase 2 SDP Notebooks and SPAR Models - Initial efforts to benchmark and standardize the Phase 2 risk-informed inspection notebooks (herein referred to as the notebooks) have been completed. However, there were important lessons learned during the early stages of the benchmarking effort, resulting in a better product as the process matured. All 71 notebooks had been revised and issued as Revision 1 by September 30, 2003. Also, the associated benchmark reports for each notebook were posted to the NRR internal Web page for NRC staff use. In retrospect, it became important to standardize all benchmarked notebooks to match the quality of the last notebooks benchmarked (approximately the last third completed). This standardization effort is currently underway and will be completed in 2005, at which time Revision 2 of the risk-informed notebooks will be issued. The Revision 2 notebooks will address any major changes in the licensees' probabilistic risk analyses (PRAs) to date. It is expected that the notebooks will continue to be evaluated and updated in response to future licensee-implemented changes to plants and the PRA models.

Each Revision 2 notebook will include or reference basic pre-solved tables. These tables will identify the value of each sequence when a particular component or human action is degraded.

A spreadsheet for each notebook will be completed and available for staff review and use after release of the Revision 2 notebooks. Each spreadsheet contains approximately 40 to 50 plant-specific key components and operator actions. The selected items were components and equipment issues typically encountered in inspection activities through the ROP or tested the notebook's model and logic. The spreadsheet and corresponding pre-solved table represent the solution and answer key to these items. In addition, the staff will incorporate large early release frequency (LERF) risk aspects in both the notebooks and the associated spreadsheets. The pre-solved tables are expected to be completed by the end of CY 2005.

As discussed above, the staff continues to make improvements to the Phase 2 notebooks through the previously described benchmarking and standardization effort to provide increased levels of reliability and predictability with results that are understood by all stakeholders. Additionally, the Office of Nuclear Regulatory Research (RES) has completed development of all Level 1 Revision 3i Standardized Plant Analysis Risk (SPAR) models and has coordinated with NRR to schedule onsite quality assurance (QA) reviews during notebook benchmarking visits to develop a more reliable Phase 3 SDP analysis tool for at-power internal events. Development of SPAR models for issues related to low power/shutdown conditions, LERF, and external events is also planned and included in the RASP.

The SPAR models have evolved from the event tree-based models originally developed for the Accident Sequence Precursor (ASP) Program. This evolution process has resulted in the SPAR models being developed independently of the licensees' PRAs. Subsequent benchmarking of the SPAR models against licensee PRAs revealed differences between the baseline core damage frequencies (CDFs) estimated by the SPAR models and the corresponding baseline CDFs obtained with the licensees' PRAs. The staff determined that most differences are influenced by generic modeling issues but some are attributed to plant-specific issues. The staff ranked the modeling issues based on their relative impact on the baseline CDF and the number of plants affected by each issue. The most recent update of the Revision 3 SPAR models includes a set of limitation screens for each model. This recent feature of the SPAR models provides the analyst/user with an understanding of how the results of an analysis performed with the specific SPAR model should be interpreted in light of the outcome of the benchmarking of the SPAR model against the licensee's PRA.

Consideration of the contribution to overall risk due to external events is a requirement of the SDP for findings that may be greater-than-green. The method for performing this portion of the analysis is currently developed on a case-by-case basis, which has been an additional challenge to meeting SDP timeliness goals. Development of a methodology which could be used to account for the added risk contribution from external events is under consideration by a task group. Based on a pilot program, the task group is evaluating the two potentially viable methodologies. An assessment tool incorporating one of the methodologies for use by inspectors and SRAs is several years away. A simple methodology that would help inspectors evaluate the risk contribution from external initiators as part of the reactor safety Phase 2 process is also being contemplated but is not currently available.

OIG Audit and SDP Task Group - The NRC's Office of the Inspector General (OIG) completed an audit of the SDP, as documented in OIG-02-A-15, "Review of NRC's Significance Determination Process," dated August 21, 2002. The OIG recommended various refinements to help ensure the successful implementation of the SDP. The audit yielded 11 recommendations, which the staff incorporated into the SDP Improvement Plan for tracking

purposes. The staff provided two updates to the OIG, most recently in January 2005. Upon review of the January 2005 update, the OIG agreed to close all recommendations based on the significant progress in the SDP.

In addition, the agency established the SDP Task Group in late 2002 to complete an independent and objective review of the SDP. The SDP Task Group developed 30 recommendations generally aimed at improving the Phase 2 evaluations using the risk-informed inspection notebooks. To date, the staff has revised the SDP guidance or other portions of the ROP to incorporate 26 of the task group's recommendations. The staff is tracking the four remaining recommendations using the SDP Improvement Plan. Two of the recommendations, addressing licensee PRA quality and guidance for more detailed risk evaluations, continue to be evaluated for potential implementation.

SDP Performance Metrics - The staff maintains nine metrics to monitor the quality of the SDP. The following five metrics met their established criteria: (1) the SDP results are predictable and repeatable and focus stakeholder attention on significant safety issues, (2) the SDP outcome is risk-informed and accepted by stakeholders, (3) SDP tools for evaluating inspection findings reflect current plant design and licensee operating practices, (4) the resources expended (direct charges and support activities) are appropriate, and (5) the appropriateness of regulatory impact from the SDP. Four of the nine SDP metrics failed to meet program expectations, including: (1) final significance determinations are timely, (2) results of the same color are perceived by the public to translate to the same level of significance for all cornerstones, (3) the inspection staff is proficient and find value in using the SDP, and (4) SDP results are communicated accurately to the public.

The percentage of final significance determinations completed within 90 days of transmitting the inspection report detailing the finding, decreased from 73 percent in FY 2003 to 48 percent for this period, falling well below the intermediate goal of 80 percent set for FY 2004. However, if the closure of the 15 backlogged issues is removed from the timeliness equation, the result for final significance determinations opened during the 2004 reflects a 78 percent completion rate within 90 days. The longstanding open issues were mostly due to the lack of adequate SDP tools, and the effects of the improved and new SDPs are not yet reflected in the results. Additional improvements are expected from the standardized notebooks, the pre-solved Phase 2 tables, and the enhanced training regimen associated with each new SDP and SDP revision. The staff is also considering important changes to how the timeliness metric is measured, including a timeliness goal that will reflect the complexity and potential risk significance of the issues.

The continued negative perception by the majority of external survey respondents that the SDP results do not translate to the same level of significance across all cornerstones resulted in a second failed metric. In particular, the emergency preparedness and public radiation safety SDPs were thought to be deterministic and not appropriately characterized by risk insights. The staff believes that a relative parity has been achieved among the cornerstones, based on the potential impact on public health and safety and the designated NRC response to specific findings. However, the staff's inability to effectively clarify the staff's objectives and criteria on this issue to the stakeholders over a period of several years needs to be evaluated.

The 2004 internal survey indicated that the inspection staff continues to express skepticism regarding its proficiency in using the SDP. Although the numbers improved over the previous survey from 2004, the satisfaction levels remain below staff expectations for SDP training, SDP usability, clarity of program documents, and the appropriateness of resource expenditures. Therefore, the resultant metric was not met. Each of these measures is expected to improve as the staff becomes more proficient with the revised and new SDPs, the standardized risk-informed inspection notebooks, and the Phase 2 pre-solved tables.

The metric monitoring the accuracy of postings on the public Website has a goal of zero errors. There were three inaccurate postings on the public Website during this period as a result of inadequate quality control while making entries to the Website. Appropriate corrections were implemented and these instances appear to be isolated occurrences. Additionally, IMC 0306 requires that all reports that update the status of an issue be assigned a report number and associated with the original finding to provide traceability of an issue from discovery to final resolution. These reports include the initial inspection reports, final significance determinations, supplemental inspection reports, and any other reports that discuss the specific issue. NRR identified several instances where this practice was not being followed and is working with the regions to resolve these specific issues and prevent their recurrence in the future.

The staff continues to pursue these issues and expects to realize improvements as the process evolves. The staff continues to address these and other issues through the SDP Improvement Plan.

Internal Survey Results - Several inspectors continued to express concerns regarding the viability of SDP results as timely and reliable indicators of licensee performance. The comments are based on personal experience and generally converge on the following as shortcomings of the process:

- The sum of SDP-generated significance for findings as assessed in accordance with the Action Matrix is generally not reflective of the licensee's performance. The reason for this is mostly due to the process failure to account for minor and green findings in the overall assessment.
- The SDP documents continue to be overly complex for the average inspector.
- The original intent of the process to risk-inform inspection findings was not fully achieved. Instead the process developed into a risk-based assessment.

In summary, the concerns expressed by internal stakeholders, generally inspectors, have not changed from the 2002 survey results. However, corrective actions were developed and incorporated into the SDP Improvement Plan using the results of the 2002 survey and the recommendations resulting from the OIG audit and the SDP Task Group. Significant changes have been made by revising existing SDPs such as the fire protection SDP and issuing new SDPs such as the shutdown operations SDP, as previously described in this document. In addition, the commitment to complete training on any new or significantly revised document before issuance is another program improvement implemented during this period. Since the use of the SDPs is infrequent, the survey does not reflect the impact of these recent improvements and the staff believes that many of the inspectors' concerns have been addressed in these changes.

External Survey Results - Participants in the external ROP survey included 11 industry representatives, 6 State or local government agencies, and 4 private citizens or public interest groups. Several respondents specifically answered 'no' to achieving equivalency between the cornerstones when risk informing findings. Most respondents believe that the structure for risk informing reactor safety-related findings tends to produce consistent results for similar issues. However, many respondents indicated that the SDP did not yield equivalent results for issues of similar significance in all ROP cornerstones. Some SDPs, mostly in the emergency preparedness and public radiation safety cornerstones, were thought to be deterministic and not appropriately characterized by risk insights.

More detail on the results of the internal and external surveys is provided in Attachment 6. Further staff analysis of the survey responses is included in the annual ROP performance metric report (reference ADAMS Accession No. ML050670162).

Self-Assessment Conclusions - In conclusion, the SDP continues to serve as an essential component of the ROP, although continued improvements are needed. Although timeliness in reaching final significance remains a challenge, the revised and new SDPs with the associated training, the standardized risk-informed inspection notebooks, the Phase 2 pre-solved tables, the enhanced SPAR models, and other SDP process changes are all intended to achieve efficiencies and streamline the process. The staff will continue to monitor planned SDP improvements and developments via the SDP Improvement Plan.