

Performance Indicator Program Evaluation

Scope and Objectives - The staff of the U.S. Nuclear Regulatory Commission (NRC) performed an evaluation of the performance indicator (PI) program 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.

The staff's previous ROP Self-Assessment Commission paper, dated April 6, 2004, identified potential problems in the PI area with regard to the efficiency and effectiveness of the Frequently Asked Question (FAQ) process, and the effectiveness of the PI program in identifying licensee performance problems. As a result, the staff stated the intention to reassess the PI program during CY 2004. This attachment reports the results of the reassessment. The staff also committed in the fiscal year (FY) 2004–2009 Strategic Plan to perform a program evaluation of the ROP in FY 2005, including an evaluation of the usefulness of current performance indicators for enhancing agency planning and response. The assessment provided in this attachment completes that action.

Additionally, over the life of the ROP, and based on the metric results, stakeholder feedback, and other lessons learned through ongoing program monitoring, the staff has identified a number of other issues and actions regarding the PI program. A summary of the status of those ongoing issues and actions is included in Attachment 5 and is also 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).

Summary of Previous Self-Assessment - In SECY-04-0053, "Reactor Oversight Process Self-Assessment for Calendar Year 2003," the staff discussed the status of efforts in calendar year (CY) 2003 to define and implement a new PI called the Mitigating Systems Performance Index (MSPI), which is intended to replace the Safety System Unavailability (SSU) PIs. The staff also described the backlog of FAQs for resolving interpretations in PI guidance, primarily concerning the Scrams With Loss of Normal Heat Removal (SWLONHR) PI. The staff documented issues in several other PIs that need simplification or clarification and discussed the overall declining trend in greater-than-green PIs. In addition, survey results had indicated that many stakeholders believe that the PIs are ineffective at identifying significant performance problems.

Historical Perspective - When the ROP was being developed (1998–2000), it was decided that there would be two primary inputs into the process to assess the performance of operating reactors. One input would be PIs. The task group working on the formation of the ROP sought

to identify PIs as a means of measuring performance of key attributes where possible. Where such a PI could not be identified, or the PI proposed was not sufficiently comprehensive, inspection activities were proposed, resulting in inspection findings being the second input into the assessment of licensee performance. Together, PI results and inspection findings, in combination with other defining principles of the ROP, would provide adequate margin in the assessment of license performance, so that appropriate licensee and NRC actions could be taken before unacceptable performance occurs.

Participation by reactor licensees in the PI program was not made mandatory by rulemaking, but rather was agreed to by the industry. A joint NRC/industry working group was established to oversee the PI program and resolve program questions (so-called “frequently asked questions,” or FAQs). NEI was asked to write the PI guidance document, NEI 99-02.

The 18 PIs in the PI program are spread over the seven cornerstones of the ROP. If licensee performance is acceptable for a given PI, the PI is defined as “green.” If performance in a particular PI declines to beyond a predetermined threshold, that PI then becomes “white.” Further decline in performance for some of the PIs can result in the PI being “yellow” or “red.” The thresholds for the transition from one color to another were defined during program development, and some are performance-based and risk-informed, while others were based upon expert panel elicitation. Industry representatives and other public stakeholders were provided an opportunity to comment on the PI thresholds that were established by the staff.

A major goal of the ROP is to promptly assess licensee performance and when called for redirect NRC inspection resources to poorer performing plants. It is therefore important that the PI results be finalized and reported in a timely fashion. Licensees report PI data three weeks after the end of each calendar quarter. The staff processes the data and posts it on the NRC’s public Website, so that the data is available within five weeks of the end of the quarter. As part of the NRC baseline inspection program, the inspection staff confirms the accurate reporting of PI data by each licensee, on a sampling basis. This is an annual inspection requirement and may not occur until well after a given quarter of PI data has been submitted by a licensee.

When the PI program was developed, the green-white thresholds were set, using industry performance data from 1995 to 1997, such that about 5 percent of the plants would exceed the green-white threshold — that is either white, yellow, or red — for each PI, given continuing industry performance similar to those years. The years 1995 to 1997 were chosen as a period in which industry performance was considered acceptable to the NRC for the purposes of establishing ROP thresholds.

Historical Results and Analysis -The results of the PI program for the 18 existing PIs since initial implementation are summarized as follows:

- The percentage of PIs that were reported as greater than green since program inception is 0.60 percent
- The percentage of PIs that were reported as greater than green in CY 2004 is 0.47 percent
- The highest percentage of PIs that were reported as greater than green occurred in CY 2000, at 1.18%

- Six PIs have been all green at all plants since program inception:
 - BI01, Reactor Coolant System Activity
 - EP02, Emergency Response Organization Participation
 - PR01, RETS/ODCM Radiological Effluent Indicator
 - MS04, Safety System Unavailability, Residual Heat Removal System
 - Two physical protection PIs

- Eight PIs have been all green at all plants following the first year of full program implementation (2000):
 - BI01, Reactor Coolant System Activity
 - EP02, Emergency Response Organization Participation
 - PR01, RETS/ODCM Radiological Effluent Indicator
 - MS04, Safety System Unavailability, Residual Heat Removal System
 - MS05, Safety System Functional Failures
 - All three physical protection PIs

Based on the above data, and on reviews of more detailed data on individual PI's, the staff concludes that the PI program has succeeded in focusing industry attention in selected areas. For example, the "Emergency Response Organization Drill/Exercise Performance" PI data demonstrates improved industry performance since the program was implemented. Several other PIs also show an improving trend. However, the number of PIs that are consistently green at all plants bring into question the present value of those PIs to the program.

The staff also assessed the contribution made by the PI program in redirecting NRC inspection resources and management focus to poorer performing licensees.

- Since program implementation, a number of facilities have been placed in the multiple/degraded cornerstone column of the Action Matrix (column 4) or under the oversight of an IMC 0350 panel, thereby identifying those plants as poor performers. The number of PIs that were greater than green before each plant was placed in their respective performance category, are as follows:
 - Davis-Besse PIs were all green prior to Davis-Besse being placed under IMC 0350 oversight.
 - Cooper PIs were all green prior to Cooper entering column 4.
 - Point Beach 1 & 2 - each unit had two white PIs in the two years prior to both units entering column 4. The white PIs did not contribute to Point Beach entering column 4.
 - Perry had two white PIs in the three years prior to entering column 4. The white PIs did not contribute to Perry entering column 4.
 - Oconee Unit 1 had one white PI in the year prior to entering column 4. The white PI contributed to Oconee Unit 1 entering column 4.

- Indian Point 2 had a yellow PI and two white PIs in 2000, which placed the unit in column 3 (degraded cornerstone). The PIs did not contribute to Indian Point 2 entering column 4.

Based on the historical results, the staff has concluded that the PI program has not contributed to the early identification of poor performing sites to the degree envisioned by the staff. However, the staff considers the Unplanned Power Changes and Safety System Functional Failures PIs to be leading indicators. The staff also believes that the Scrams With Loss of Normal Heat Removal PI has the potential to be a leading indicator of declining performance.

Process Issues - The process for resolving PI issues has also not been consistently timely nor efficient. The lack of clear concise guidance for selected PIs has contributed to the timeliness and efficiency issues. The staff has had trouble dealing with a number of potentially white PIs with which interpretation issues have arisen. This is partly because the PI guidance document is subject to interpretation and the joint NRC/industry working group has had difficulty agreeing on which events or conditions are to be included in the PI calculation.

When a question arises about whether an event or condition should be reported in the quarterly PI report, it is referred to the joint NRC/industry working group to decide. As noted above, these questions are called FAQs. As of April 2005, there were 24 FAQs open. A licensee may interpret the PI guidance in NEI 99-02 in such a way that a condition or event is not reported in the quarterly PI report. The licensee need not involve nor notify the NRC staff in making this determination. As part of the baseline inspection program, the NRC inspection staff will perform the PI verification inspection on a sampling basis sometime during the next 12 months and may, if the issue is identified in the sample, disagree with the licensee's interpretation. However, this disagreement might not occur for up to a year or more after the event in question, so that by the time the question reaches the working group as an FAQ, it is already untimely.

The working group meets once a month and can take several meetings to gather data and discuss an issue before attempting to reach consensus. If consensus can be reached, then the issue is resolved and the answer to the question may become a precedent for future questions. If a consensus cannot be reached, the issue is then raised to the NRR Director, Division of Inspection Program Management (DIPM), to decide. Note that prior to 2004, there was no process to resolve questions for which a consensus could not be reached. Although the process was put in place in 2004, the industry does not view the process as retroactive, so there remain a number of old open questions that are yet to be resolved.

One significant reason for differences between the staff and industry is that industry often believes operator recovery actions should be credited. The staff concern is with the subjective nature of assessing the likely success of operator actions, and with the recognition that PIs can effectively measure equipment performance, but that PIs poorly track human performance that is not concisely defined. For these reasons the staff believes that operator actions should generally not be credited for PIs.

Another option available to the staff when the staff concludes that a PI is not being properly reported is to implement Inspection Procedure (IP) 71150, "Discrepant or Unreported Performance Indicator Data." Under this process the staff declares a licensee's PI data report invalid and colors the associated PI gray until the staff determines the correct color through

inspection. During 2004, the staff implemented the discrepant PI process for the first time. The associated inspection found that the licensee had taken steps inappropriate for the program, which influenced the PI result. The PI was subsequently colored white. Two other cases of potentially discrepant PIs are currently under review by the staff that could be treated similarly.

Future Staff Actions on Process Issues - During CY 2005, the staff intends to interact with NEI and other stakeholders at a senior management level to define steps to improve the effectiveness and efficiency of the program, and to identify enhancements to the program intended to increase its contribution to the identification of plants with poorer performance. To accomplish this goal, there should be consideration as to whether the present PIs are accomplishing what was originally intended; the guidance on PIs must be made precise, clear, and well organized so as to minimize the likelihood of alternate interpretations; FAQ responses must also be written in a manner that minimizes mis-interpretation and should be promptly incorporated into the PI guidance; and the entire process must be more timely.

Mitigating Systems Performance Index - The Mitigating Systems Performance Index (MSPI) is being developed by the staff and the industry to replace the existing Safety System Unavailability (SSU) PIs. In a staff requirements memorandum (SRM) dated May 27, 2004, the Commission provided direction to the staff regarding MSPI. During 2004, the staff continued to work with stakeholders to resolve issues identified during the MSPI pilot program. A major concern from the pilot program was the industry position that the Significance Determination Process (SDP) should not be used for events or conditions monitored by the MSPI. After industry representatives agreed to retain the SDP for MSPI issues, many of the other concerns of the staff were either minimized or resolved. While there are a few remaining issues to be worked out, the MSPI is now scheduled for implementation in 2006 following a series of three industry sponsored workshops in 2005. NEI has the lead responsibility for working with all operating reactors to prepare them to implement MSPI. The first workshop was held in early February. NRC staff observations from the workshop are summarized below.

1. Some licensees appeared to be just beginning to learn about MSPI. This may result in an increased level of effort to prepare all licensees for MSPI implementation in 2006.
2. The NRC staff and industry have agreed on criteria for licensee PRAs to be considered adequate for use with MSPI. Industry comments at the workshop indicate that there are important, open PRA issues relevant to MSPI at an estimated 50 percent of the plants, with some facilities having as many as 30 or 40 issues to resolve.

The issue of PRA quality was discussed at the March 2005 ROP working group meeting and industry indicated that it could not meet the PRA quality criteria previously agreed upon, by the MSPI implementation date. The staff is evaluating the industry position and will discuss alternatives at future ROP working group meetings. This could potentially impact the MSPI implementation date.

Scram With Loss of Normal Heat Removal PI - There is a backlog of 11 FAQs regarding the Scram With Loss of Normal Heat Removal (SWLONHR) PI. Several of them are more than three years old, which means they no longer contribute to the PI calculation, and hence the color of the PI (the PI counts SwLONHR over the previous 12 quarters).

The staff's intent for this PI is to separately count scrams that are more complicated than routine scrams. The more risk-significant scrams are assessed under other processes. There are currently two PIs that the staff considers to be leading indicators: Unplanned Power Changes and Safety System Functional Failures. The staff believes that this PI has the potential to also be a leading indicator of declining performance. A plant that has a history of complicated scrams may be more likely to have a risk-significant scram.

To address a number of issues with this PI, a task force was formed with members from both the NRC and the industry. The task force is evaluating whether to count events or conditions that require operators to depart from their normal scram recovery procedure, as a possible modification to the PI definition. Such deviations would include failure of two or more control rods to fully insert, failure of the turbine to trip, loss of any ESF bus, a safety injection actuation signal, unrecoverable loss of all main feedwater, and unrecoverable loss of all steam dumps to the condenser.

Safety System Functional Failures - The Safety System Functional Failure (SSFF) PI counts all events or conditions that could have prevented the fulfillment of the safety function of structures or systems needed to shut down the reactor, remove residual heat, control the release of radioactive material, or mitigate the consequences of an accident, as required to be reported in accordance with 10 CFR 50.73(a)(2)(v). Every quarter licensees report (as ROP PI data) the number of events that they determine could have prevented the fulfillment of any of those functions; however they do not report the Licensee Event Report (LER) numbers or any other information about those events. The Idaho National Laboratory (INL) receives all LERs and also determines which events meet the definition of SSFFs. The number of SSFFs reported by licensees is about 20 percent lower than the number identified by INL. The industry representatives on the NRC/industry working group volunteered to look into this discrepancy. They formed a task force that reviewed all LERs determined to be SSFFs by either licensees or INL or both. The staff is currently reviewing the task force report; preliminary results indicate that there may be differences between the staff and many licensees regarding interpretation of the reporting requirements of 10 CFR 50.73(a)(2)(v), as described in NUREG-1022, Rev. 2.

Status of Davis-Besse Lessons Learned Task Force (DBLLTF) Item: Reactor Coolant System (RCS) Leakage PI - The DBLLTF recommended that the staff continue ongoing efforts to review and improve the usefulness of the barrier integrity PIs (reference DBLLTF item 3.3.3.3) and evaluate the feasibility of establishing a PI that tracks the number, duration, and rate of primary system leaks that have been identified but not corrected. One of the primary tasks of the NRC/Industry working group is to continuously review and improve all the PIs. With regard to the RCS Leakage PI, the NRC/industry working group has formed a task group to develop a proposal for a new PI. The group has agreed that this PI should monitor unidentified leakage rather than identified leakage and that the measured values of unidentified leakage should be averaged over an appropriate time interval to identify baseline values and trends. However, the appropriate averaging methodology has not yet been determined. The second part of the recommendation requires a feasibility evaluation of establishing an additional PI for tracking number, duration and rate of primary system leaks. If determined to be feasible, a proposed PI will be developed and submitted to the PI working group, but preliminary discussions seem to indicate that such a measure would not be feasible.

Other PIs That Require Simplification or Clarification - The staff plans to evaluate the Unplanned Power Changes per 7,000 Critical Hours PI to determine whether power changes

that were avoided because the NRC issued a Notice of Enforcement Discretion or a temporary technical specification change should be included. In addition, the staff plans to clarify the guidance regarding the 72 hour rule for planning a power reduction and the 20 percent power change minimum requirement for counting the change as a PI. This effort is currently on hold due to higher priority work.

The RCS Activity PI was intended to monitor the integrity of the fuel cladding as a barrier to the release of fission products from the fuel. There are technical problems with the way the PI is constructed, and the staff has been looking into the use of the World Association of Nuclear Operators fuel reliability PI. This effort is on hold due to higher priority work.

The staff is also considering reinstating the containment leakage PI, which monitored the results of local leak rate tests type B and C. It was removed from the PI program following the ROP pilot program for the following reasons: (1) there is lack of uniformity across the industry in the test methods used and the data collected because licensees may choose between two methods for performing leak rate tests; (2) the tests are normally conducted during refueling outages, so the data are end-of-cycle numbers which may or may not be indicative of the worst-case leakage in the previous operating cycle; and (3) licensees are required to restore containment leak rates to within acceptable limits prior to restart. Nevertheless, there may be some value in this PI if it encourages licensees to become more uniform in their test methodology, and even a backward look at containment integrity could be of value by identifying recurrent issues. For these reasons, the staff plans to reevaluate the containment leakage PI. This effort is also on hold due to higher priority work.

In addition, the staff will reassess the possibility of using deterministic rather than risk-based thresholds for the Initiating Events PIs, particularly for the white/yellow and yellow/red thresholds, as recommended by the Advisory Committee on Reactor Safeguards (ACRS). As part of its continuing reassessment of the PI program, the staff will also look into the feasibility of new indicators, including those for cross-cutting issues, as recommended by the ACRS and other stakeholders.

INPO's Consolidated Data Entry Program - The staff completed its review of the Institute of Nuclear Power Operations' (INPO's) Consolidated Data Entry (CDE) Program and found that it is consistent with the staff's needs for licensee data used in various NRC programs. Use of CDE for the MSPI indicators is currently under development by INPO with licensee and staff involvement.

PI Program Performance Metrics - All but one of the PI metrics were met. The following seven metrics met their established criteria: (1) consistent results given same guidance, (2) timely indication of declining safety performance (based on PIs crossing multiple thresholds), (3) minimize potential for licensee actions taken in response to the PI program that adversely impact plant safety, (4) timely PI data reporting, (5) stakeholders perceive appropriate overlap of PIs and inspection programs, (6) reporting conflict reduction, and (7) clarity of PI guidance. The 'Number of Questions Regarding Interpretation of PI Guidance' metric declined steadily in 2002 and 2003. However, in 2004 the number of unresolved FAQs increased slightly. Many of these questions were related to the SWLONHR and the SSU PIs. The staff continues to work with stakeholders to resolve the open issues.

Internal Survey Results - Every two years the staff conducts a survey of NRC employees actively involved in the ROP. The 2004 internal survey produced three important themes with regard to PIs: (1) there are too few non-green PIs and the thresholds are too high to identify performance issues; (2) PI definitions allow for misinterpretation by licensees; and (3) the RCS leakage, SSU, and Alert and Notification System Reliability PIs are inadequate. The staff is aware of these issues and they are, in part, the reason for the ongoing program review to identify improvements to the PI program. The staff is also aware that the PI guidance must be made more clear, precise, and concise in order to minimize FAQs. The staff is currently working to develop an improved RCS leakage PI; to replace the SSU with the MSPI; and to improve the ANS Reliability PI.

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. The external survey used the same questions as the external survey of the past several years, which correspond directly to four of the PI metrics previous discussed:

1. Does the Performance Indicator Program promote plant safety?
2. Does appropriate overlap exist between the Performance Indicator Program and the Inspection Program?
3. Is the reporting of PI data efficient?
4. Does NEI 99-02, "Regulatory Assessment Performance Indicator Guideline" provide clear guidance regarding performance indicators?

Participants were provided the following six possible responses: very much, somewhat, neutral, somewhat less than needed, far less than needed, and not applicable.

Most of the responses to question #1 were "somewhat" to "very much" with a slightly declining trend from 2002 to 2004. The responses to question #2 were evenly divided among "very much," "somewhat," and "neutral" with a slightly declining trend. For question #3, the responses were mostly "neutral" with an improving trend. The responses to question #4 were mostly "somewhat" with an improving trend.

Similar to prior years, the responses to the external survey indicated that the public, largely represented by public advocacy groups, and the nuclear industry have different views on the efficiency and effectiveness of the PI program. The industry generally believes that the PI program is working well, while public advocacy groups have become increasingly concerned that the PIs are being managed by the licensees and have become ineffective as indicators of plant performance. The results of the survey also indicate that external stakeholders believe the efficiency of PI data reporting and the adequacy of the guidance document are both improving, but this is mostly a reflection of comments made by industry, and is therefore largely an industry self-assessment of their own performance.

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).

Program Evaluation per Strategic Plan - The staff committed in Appendix B to the FY 2004–2009 Strategic Plan to perform a program evaluation of the ROP in FY 2005, to include an evaluation of the usefulness of current performance indicators for enhancing agency

planning and response. This evaluation is described in this Commission paper and constitutes one of the three FY 2005 program evaluations of the ROP as delineated in the Strategic Plan. The staff considers this action complete. However, the staff will continue to evaluate the efficiency of the PI program and make program improvements in accordance with the annual ROP self-assessment program as described in IMC 0307.

Self-Assessment Conclusions - In conclusion, although the PI program continues to provide the NRC with objective indicators regarding plant performance, and in some areas has focused licensee attention, contributing to improved performance, the staff and some public stakeholders have become increasingly concerned with the untimeliness and inefficiency of the FAQ process, and with the capability of the current PIs to contribute to the identification of declining performance. Accordingly, the staff plans to engage senior industry management to define actions to address these issues.