POLICY ISSUE
INFORMATION

April 17, 2003 SECY-03-0057

FOR: The Commissioners

FROM: William D. Travers
Executive Director for Operations

SUBJECT: FY 2002 RESULTS OF THE INDUSTRY TRENDS PROGRAM FOR OPERATING POWER REACTORS AND STATUS OF ONGOING DEVELOPMENT

PURPOSE:

To inform the Commission of the results of the Nuclear Regulatory Commission's (NRC) Industry Trends Program (ITP) for FY 2002, and the status of ongoing development. The ITP supports the NRC's performance goals of maintaining safety and enhancing public confidence in the agency's regulatory processes.

SUMMARY:

The NRC staff implemented the ITP in 2001, and is continuing to develop the program as a means to confirm that the nuclear industry is maintaining the safety of operating power plants and to increase public confidence in the efficacy of the NRC's processes. The NRC uses industry-level indicators to identify adverse trends, evaluate them using agency databases, and take appropriate actions. One important output of this program is to report to Congress each year on the performance goal measure of "no statistically significant adverse industry trends in safety performance" as part of the NRC's Performance and Accountability Report. Based on the information currently available from the industry-level indicators originally developed by the former Office for Analysis and Evaluation of Operational Data (AEOD) and the Accident Sequence Precursor (ASP) Program implemented by the Office of Nuclear Regulatory Research (RES), no statistically significant adverse industry trends have been identified through FY 2002.

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The staff is continuing to use the AEOD and ASP indicators while it develops additional industry-level indicators that are more risk-informed and better aligned with the cornerstones of safety in the Reactor Oversight Process (ROP). These additional indicators will be developed in phases and qualified for use in the ITP and the annual Performance and Accountability Report to Congress. The results of this program, along with any actions taken or planned, are reviewed annually during the Agency Action Review Meeting (AARM) and reported to the Commission.

BACKGROUND:

This paper is the third annual report to the Commission on the ITP. The previous Commission reports were SECY-01-0111, "Development of an Industry Trends Program for Operating Power Reactors," and SECY-02-0058, "Results of the Industry Trends Program for Operating Power Reactors and Status of Ongoing Development." Additional information on the ITP program and the process for identifying and addressing adverse trends is in Attachment 1.

The NRC provides oversight of plant safety performance on a plant-specific basis as part of implementing the ROP. The ROP uses both plant-level performance indicators (PIs) and inspections. The ITP provides a means to assess overall industry performance using industry-level indicators. Issues that are identified from either the ROP or the ITP are evaluated using information from agency databases, and those assessed as having generic safety significance are addressed using existing NRC processes, including generic safety inspections in the ROP, the generic communications process, and the generic safety issue process.

The purposes of the ITP are to provide a means to assess whether the nuclear industry is maintaining the safety performance of operating reactors and, by clearly communicating that performance, to enhance stakeholder confidence in the efficacy of the NRC's processes. The specific objectives of the ITP are as follows:

(1) Collect and monitor industry-wide data that can be used to assess whether the nuclear industry is maintaining the safety performance of operating plants and to provide feedback on the ROP.

(2) Assess the safety significance and causes of any statistically significant adverse industry trends, determine if the trends represent an actual degradation in overall industry safety performance, and respond appropriately to any safety issues that may be identified.

(3) Communicate industry-level information to Congress and other stakeholders in an effective and timely manner.

The NRC currently uses the results of the ITP in the following ways.

(1) The NRC reports the industry indicators to Congress annually in the NRC's "Performance and Accountability Report, Fiscal Year 200X" (NUREG-1542 series) and in the NRC's "Budget Estimates and Performance Plan Fiscal Year 200X" (NUREG-1100 series). The indicators demonstrate how the agency has met the measure of "no

statistically significant adverse industry trends in safety performance" for the performance goal of maintaining safety.

(2) The NRC communicates overall industry performance to stakeholders by publishing the ITP indicators on the Nuclear Reactors portion of the agency's public Web site at *http://www.nrc.gov/reactors/operating/oversight/industry-trends.html*. The staff believes that communication of the industry-level indicators, when added to the information on individual plants from the ROP, enhances stakeholder confidence in the efficacy of the NRC's oversight of the nuclear industry.

(3) The results of the ITP are a key element of the review by senior NRC managers of the agency's oversight of operating facilities in the annual AARM.

(4) The staff informs the Commission of the results of the ITP in an annual report in the same timeframe as the AARM.

(5) The Commission uses the ITP indicators when presenting the status of industry performance to the NRC's oversight committees and at major conferences with industry.

(6) NRC managers use the ITP indicators to provide an overview of industry performance at various conferences with industry, such as the NRC's Regulatory Information Conference.

DISCUSSION:

The ITP is intended to monitor trends in industry safety performance so that the staff can identify and address adverse industry trends. The ITP accomplishes this using indicators of known conditions and issues that are compiled from the best available data. The staff monitors a comprehensive set of indicators; however, the staff recognizes that the ITP has limits as to what can be tracked and trended. Oversight of plant-specific conditions and events is provided by the ROP. The staff's approach recognizes that new and unforseen events will inevitably occur, such as the significant erosion of the reactor vessel head at Davis-Besse. The staff is mindful of the need to respond promptly to these events, as well as the need to review its regulatory processes in light of the issues revealed by these events.

RESULTS OF FY 2002 TREND ANALYSES

A key output of the ITP is that it provides the basis for agency monitoring and reporting to Congress against the performance goal measure of "no statistically significant adverse industry trends in safety performance," as established by the NRC's Strategic Plan. In early FY 2001, NRR assumed responsibility from RES for reporting on this measure as part of NRR's overall responsibilities in the Reactor Safety arena. The current bases for assessing performance against this measure are trends in the industry indicators developed by the former AEOD (henceforth referred to as the "AEOD indicators") and trends identified by the ASP Program. Notably, these indicators were among those cited as demonstrating improvements in industry safety performance that contributed to the agency's decision to revise the oversight process for operating power reactors.

Based on the AEOD indicators and the ASP Program results, no statistically significant adverse trends in industry safety performance were identified through the end of FY 2002. Graphs of the trends for each of these indicators are presented in Attachment 2. The results and graphs were also included in the NRC's Performance and Accountability Report for FY 2002.

In addition, as discussed in SECY-01-0111, the staff adopted a statistical approach using "prediction limits" to provide a consistent method to identify potential short-term year-to-year emergent issues before they manifest themselves as long-term trends. Although the ASP indicator in Figure A2-8 did not cross a prediction limit, there appears to be a relatively low number of precursors between 1997 and 1999 and an increasing number of potential precursors in 2000 and 2001. For 2000 and 2001, the staff's analyses are only preliminary and the number of ASP events may decrease as the analyses are finalized. Nonetheless, the staff intends to follow the ITP process discussed in Attachment 1 to analyze these short-term variations in the number of ASP events. The evaluation will be a joint project between NRR and RES as part of the ITP. The evaluation may include a review of the risk significance of the events, types of facilities involved, a categorization of causes and factors for analyzed events and conditions, the time period for analysis, and whether any additional actions are appropriate.

In SECY-02-0058, the staff analyzed two indicators that had exceeded their prediction limits for FY 2001, but did not identify any safety issues associated with exceeding those limits. In early FY 2002, the staff reviewed its methods for setting prediction limits and modified them to use data starting in about 1996 instead of 1988, since this more recent timeframe was assessed to be more representative of current industry performance. In general, the modification had the effect of raising the prediction limits for FY 2002 to about the level of industry performance in 1996. No AEOD indicators exceeded their prediction limits during FY 2002.

ITP PROGRAM DEVELOPMENT

1. Incorporation of Additional Industry Operating Experience

The NRC's Davis-Besse Lessons Learned Task Force (DBLLTF) provided a number of recommendations to improve NRC utilization of operating experience information. The staff is currently assessing its processes for handling this information, including the ITP, to determine what changes or enhancements may be appropriate, and will highlight any necessary changes to the ITP in the next annual report to the Commission.

For example, the staff is assessing whether operating experience information from various agency databases can be used to develop additional indicators that can provide improved feedback to the ROP, particularly the inspection program. The staff is updating the data that have been published in various NUREG-series reports for system reliability studies, component reliability studies, common-cause failure studies, and other special studies for which industry-wide trends were reported. This work is anticipated to be completed over the next 1–2 years. In addition, as a means of providing greater stakeholder access to this information, the staff is developing a Web-based system to replace the current paper-based system of NUREG-series reports.

In addition, partly in response to a recommendation by the DBLLTF, the staff intends to assess how to more effectively incorporate foreign operating experience information into the ITP. The staff will build on the international work on PIs described in SECY-02-0030, “Summary Report on NRC’s Historical Efforts To Develop and Use Performance Indicators.” This would include enhanced participation with efforts of the Nuclear Energy Agency of the Organization for Economic Cooperation and Development, principally through its Committee on the Safety of Nuclear Installations and its Committee of Nuclear Regulatory Authorities.

2. Development of Additional, More Risk-informed Indicators

The staff has continued to develop additional indicators that are more risk-informed and better aligned with the cornerstones of safety in the ROP. For example, the staff has continued development of industry-level indicators from the data that licensees submit for the plant-level ROP PIs. However, since the ROP was only implemented in April 2000, there is still insufficient data for reliable long-term trending (<4 years) of these indicators. Nonetheless, based on a review of the indicator data submitted to date, no significant short-term trends have emerged.

As discussed in SECY-02-0058, the staff developed additional risk-informed indicators for the initiating events cornerstone, consisting of multiple indicators of initiating events for both pressurized water reactors (PWRs) and boiling water reactors (BWRs). This effort involved updating the data that was most recently published in NUREG-5750, “Initiating Events at U.S. Nuclear Power Plants: 1987–1995.” In general, the number of initiating events has continued to decline over the past decade. During FY 2002, the staff built on this work in developing an overall industry-level indicator for the initiating events cornerstone. An overall indicator can provide a better representation of the overall risk from initiating events than multiple individual indicators of initiating events with varying degrees of risk significance. For example, it is possible that there could be an increase in loss of feedwater events in any given year, but the overall risk from all initiating events may actually have declined if the contribution to risk from that single indicator is low and the contribution to risk from all other initiating events has declined.

This overall indicator of initiating events, called the Industry Initiating Events Performance Indicator (IIEPI), consists of an index of the most risk significant industry initiating events. This set of events is defined in NUREG-1753, “Risk-Based Performance Indicators: Results of Phase 1 Development,” as those events that contribute >1 percent to industry core damage frequency and that have occurred at least once during the period 1987–1995. An index was developed for BWRs that has 9 risk-significant initiating events, and a similar index was developed for PWRs that has 10 events (the additional category of events is steam generator tube ruptures). Each initiating event is weighted in the index based on its relative contribution to industry core damage frequency. Although the indicator is being developed to monitor industry-level performance, it could potentially be adapted to monitor plant-level performance as well, similar to the Mitigating Systems Performance Index (MSPI) that is currently being assessed in a pilot program as part of the ROP PIs. The IIEPI is discussed in more detail in Attachment 3.

The staff has given briefings on the IIEPI concept during periodic ROP working group public meetings, and has briefed two subcommittees of the Advisory Committee on Reactor Safeguards (ACRS). The staff has received valuable feedback during these meetings, and no major concerns have been identified to date. The staff intends to increase its interactions with stakeholders on the IIEPI during this fiscal year, working towards a pilot program and possible implementation within 1–2 years.

3. Risk-Informed Response Thresholds

In SECY-01-0111, the staff stated that it was developing risk-informed thresholds, to the extent practicable, which would be used to determine the appropriate agency response to trends in indicator data. This could enable the staff to establish a more objective and predictable agency response in a manner analogous to the ROP's Action Matrix. The use of thresholds would also preclude a scenario in which the improving trends in indicators have leveled off, presumably when the practical performance limits of operating plants have been reached, and then a small decline in performance results in an adverse trend that would necessitate a report to Congress as an adverse trend, notwithstanding the fact that industry performance is better than it was before the trends leveled. In the staff requirements memorandum (SRM) related to SECY-01-0111 dated August 2, 2001, the Commission directed the staff to develop risk-informed thresholds for the industry-level indicators "as soon as practicable."

The staff formed an interoffice working group to examine the feasibility of developing thresholds for indicators in all cornerstones of safety. For the initiating events and mitigating systems cornerstones, risk-informed thresholds appeared to be possible since NRC risk analysis tools, such as the Standardized Plant Analysis Risk (SPAR) models, were available. However, in light of the development of more risk-informed indicators for the initiating events cornerstone (e.g., the IIEPI) and the mitigating systems cornerstone (e.g., the MSPI as part of the plant-specific ROP PIs), the staff prioritized its resources on developing those potential replacement indicators rather than on developing risk-informed thresholds for the current set of ITP indicators.

In addition, the working group examined development of thresholds for indicators in other cornerstones of safety and for the AEOD indicators, which do not lend themselves to development of risk-informed thresholds due to lack of risk models. The working group used a statistical approach based on prediction limits for ITP indicators to explore whether thresholds could be established. Although thresholds using a statistical approach were developed, the staff encountered some difficulty in determining the appropriate level for regulatory action. For example, a statistical approach to setting the threshold for the alert notification system reliability indicator in the emergency protection cornerstone resulted in a threshold of about 97 percent, compared to the current actual industry performance of about 99 percent. However, if the reliability dropped below the threshold to 96 percent, the staff would likely not take regulatory action on an industry-wide basis because the reliability is still high and appears acceptable. The staff intends to seek stakeholder input, including input from the ACRS, while continuing staff actions to develop thresholds.

4. Potential Single Integrated Indicator of Industry Performance

Attachment 4 shows an integrated indicator, known as the Action Matrix Summary. It is a histogram that shows the number of plants in each column of the NRC's Action Matrix since initial implementation of the revised ROP. This single indicator provides a representative picture of industry performance because it effectively rolls up both performance indicators and inspection findings from the ROP in all cornerstones of safety.

The staff is considering establishing a new strategic plan performance goal measure that would count the number of plants with significant performance issues, and would use the Action Matrix Summary indicator for reporting against the measure. For example, the measure could be "no more than 5 plants in the multiple/degraded cornerstone column or above." Consistent with the intent of the Government and Performance Results Act to tie agency actions to performance measures, this measure has the advantage that the staff is already taking actions to address safety issues for these plants in an objective and predictable manner in accordance with the Action Matrix for the ROP.

This measure is in addition to the existing performance goal measure of "no adverse industry trends." The staff is pursuing this performance goal measure for use in the NRC's Budget Estimates and Performance Plan for FY 2005 (also known as the Blue Book and Green Book). However, in accordance with reporting guidelines from the NRC's Office of the Chief Financial Officer (OCFO), reporting for this measure would commence in the NRC's Performance and Accountability Report for FY 2004.

5. Improved Data Collection and Reporting

Licensees report operating experience data to the NRC, including data for the ROP plant-level indicators, licensee event reports (LERs), and monthly operating reports. Licensees also report additional data to other organizations such as the Institute of Nuclear Power Operations (INPO). The staff uses all of these reports as data sources for the indicators used in the ITP, and the databases are essential to investigating safety issues when trends in the ITP indicators are identified. The databases are also used as part of the bases for changes to ROP PIs and inspection procedures.

The staff continues to seek improvements and efficiencies in data collection and reporting by industry for both the ITP and the ROP. For example, RES coordinated with NRR to consolidate coding of LERs by two Department of Energy laboratories into one laboratory, thereby saving the agency about $500K per year. In addition, the staff is currently working extensively with industry to develop a consistent set of data elements, definitions, and reporting guidelines for reliability and unavailability data that would encompass the needs of all stakeholders. Finally, the staff is working with the industry Consolidated Data Advisory Committee of INPO to develop a common collection system for industry operating experience data that can be used by both the NRC and INPO. These development efforts are expected to continue over the next several years.

RESOURCES:

For FY 2003, NRR has budgeted 1.5 full-time equivalent (FTE) and $254K for the continued development and implementation of the ITP. For FYs 2004 through 2006, NRR estimates resource requirements of 1.5 FTE per year, with estimated contract assistance funding requirements of about $254K per year. NRR has included these requirements in its budget request submittals. For FY 2003, RES has budgeted 0.5 FTE and $270K for the development of risk-informed thresholds for indicators in the ITP. For FY 2004, RES budgeted 0.5 FTE and $240K, and for FY 2005 and FY 2006 estimates 0.5 FTE and $50–100K will be required. RES is developing the operational experience data and risk models as part of existing programs that are currently budgeted. Should additional resources be needed to accomplish these tasks, the staff will reprogram the resources from within the current budget using the NRC's Planning, Budgeting, and Performance Management process.

COORDINATION:

The Office of the Chief Financial Officer has reviewed this paper and concurs with the resource estimates.

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

/RA/

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Attachments:
1. Description of the ITP process
2. FY 2002 Trend Results Based on AEOD and ASP Indicators
3. Description of the Industry Initiating Events Performance Indicator
4. Action Matrix Summary

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Description of the Industry Trends Program (ITP) Process

1. Background

The U.S. Nuclear Regulatory Commission (NRC) provides oversight of plant safety performance on a plant-specific basis using both inspection findings and plant-level performance indicators (PIs) as part of its Reactor Oversight Process (ROP). Individual issues that are identified as having generic safety significance are addressed using other NRC processes, including the generic communications process and the generic safety issue process. As discussed in SECY-01-0111, "Development of an Industry Trends Program for Operating Power Reactors," the NRC's Office of Nuclear Reactor Regulation (NRR) initiated the ITP to complement these processes by monitoring and assessing industry-level trends in safety performance.

The purposes of the ITP are to provide a means to confirm that the nuclear industry is maintaining the safety performance of operating reactors and, by clearly demonstrating that performance, to enhance stakeholder confidence in the efficacy of the NRC's processes. The objectives of the ITP are as follows:

- Collect and monitor industry-wide data that can be used to assess whether the nuclear industry is maintaining the safety performance of operating plants and to provide feedback on the ROP.

- Assess the safety significance and causes of any statistically significant adverse industry trends, determine if the trends represent an actual degradation in overall industry safety performance, and respond appropriately to any safety issues that may be identified.

- Communicate industry-level information to Congress and other stakeholders in an effective and timely manner.

A key output of the ITP is that it provides the basis for agency monitoring and reporting in the Nuclear Reactor Safety arena against the performance goal measure of "no statistically significant adverse industry trends in safety performance," as defined by the NRC's Strategic Plan. The agency reports these results annually to Congress in the Performance and Accountability Report, Fiscal Year 200X" (NUREG-1542 series). In early FY 2001, NRR assumed responsibility from the NRC's Office of Nuclear Regulatory Research (RES) for reporting on this measure as part of NRR's overall responsibilities in the Reactor Safety arena. The current bases for assessing performance against this measure are trends in the industry indicators developed by the former NRC Office of Evaluation of Operational Data (AEOD) and trends identified by the ASP Program. Notably, these indicators were among those cited as demonstrating improvements in industry safety performance that contributed to the agency's decision to revise the ROP.

In developing the ITP, the staff used the following general concepts for its approach:

- The indicators were developed using information available from current NRC programs. In the future, indicators will be developed in stages, and will provide information for each ROP cornerstone of safety.

- Industry trend information is derived from quantitative, industry-wide data.

- Trends are identified on the basis of long-term data, rather than short-term data. This minimizes the impact of short-term variations in data, which may be attributable to such factors as operating cycle phase, seasonal variations, and random fluctuations.

- Trends and contributing factors are assessed for safety significance. The results of inspections, analyses of significant events and abnormal occurrences, and other analyses may be used to facilitate an evaluation of the trends. The agency's response is commensurate with the safety significance.

- While additional indicators are being developed, a subset of high-level indicators may be used for the report on adverse trends to Congress in the NRC's Performance and Accountability Report. For reporting on the performance measure of "no statistically significant adverse industry trends in safety performance," indicators will be qualified for use in phases. Until they are qualified, the staff will continue to use the AEOD indicators and ASP results. Additional indicators from the ITP will be incorporated for use in accordance with a controlled process for making such changes to the NRC's Performance Plan. In addition, the staff intends to consider refinements to the performance measure as the indicators and more risk-informed methods of assessing their safety significance are developed.

2. ITP Process

A flowchart of the ITP process is shown below

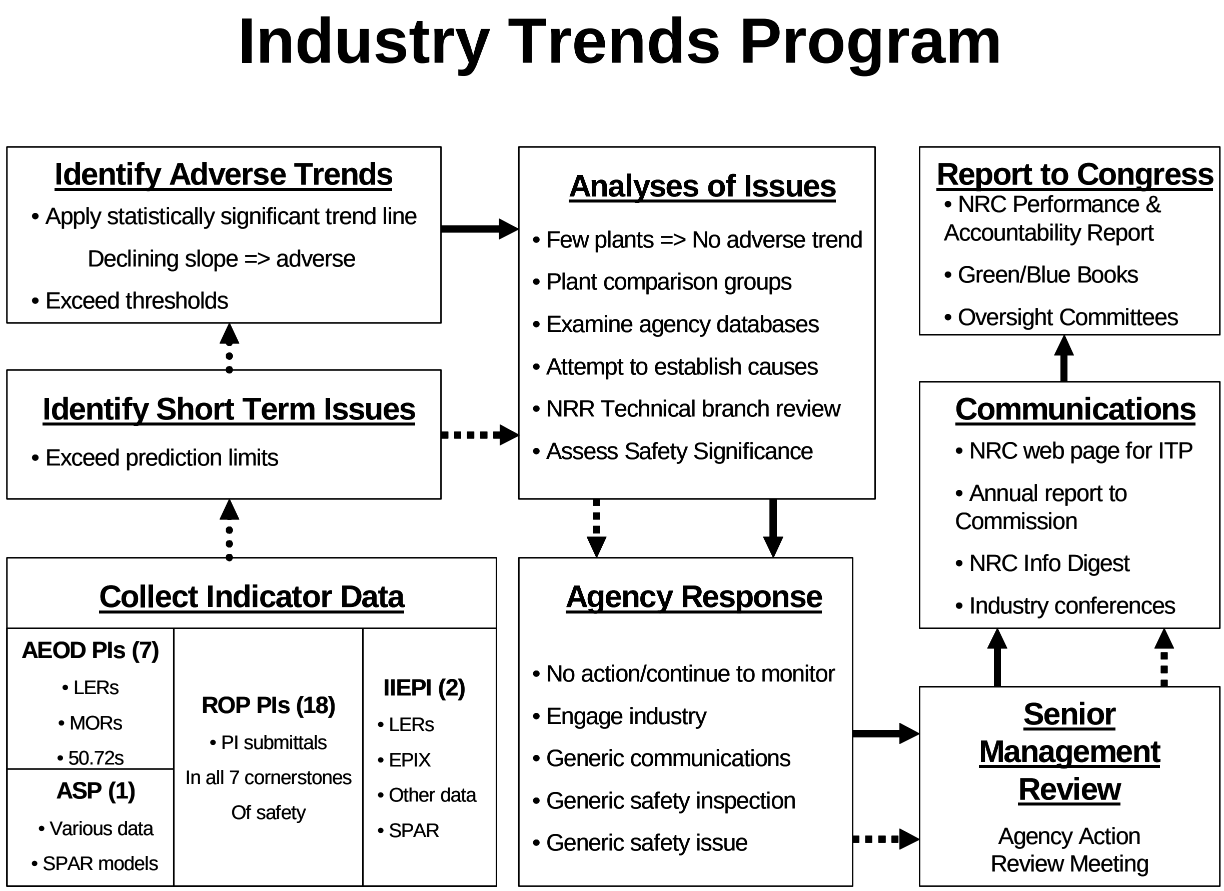


Figure 1-1 Industry Trends Program process flowchart

Collect Indicator Data

In developing the ITP, the staff used information currently available from existing NRC programs to develop an initial set of indicators for identifying adverse industry trends. The indicators consisted of the 7 indicators in the AEOD indicator program and the results of the ASP program. In addition, the staff is developing more risk-informed industry-wide indicators using data from the 18 plant-level indicators submitted by licensees for the ROP PI program. The staff also identified potential indicators for initiating events that are anticipated to be available from RES operating experience data. These indicators are being consolidated into an Industry Initiating Events Performance Indicator (IIEPI).

Identify Short-Term Issues

In addition, as discussed in SECY-01-0111, in FY 2001 NRR adopted a statistical approach using "prediction limits" to provide a consistent method to identify potential short-term emergent issues before they manifest themselves as long-term trends. The prediction limits are values established at the beginning of a FY that set an upper bound on expected performance for that year for each indicator. Actual indicator values during the year can then be monitored and compared to the prediction limits. Indicators that cross the prediction limits are investigated to determine the factors contributing to the data. These factors are assessed for their safety significance and used to determine an appropriate agency response. However, should very obvious adverse trends emerge in the short-term data, the staff does not wait until the end of the annual reporting period to initiate a review.

Identify Adverse Trends

For purposes of assessing whether there are any statistically significant adverse industry trends, only long-term data is used. The trending of long-term data minimizes reacting to potential "false positive" indications that may emerge in short-term data. "Short-term" was defined to be less than four years to ensure that sufficient data (i.e., data for at least two typical nuclear plant operating cycles) is available so that valid trends can be distinguished from operating cycle effects such as refueling outages and from random fluctuations in the data and to allow sufficient data for the use of statistical methods. The staff expects that any variations beyond these will result from plant-specific issues which can be addressed under the ROP.

The staff applies common statistical techniques to the long-term indicator data to identify trends. These techniques have been previously adapted and used extensively by the former AEOD and by RES in reactor operating experience analyses over the past several years. In general terms, a trendline is fitted to each indicator using regression techniques. Once a statistically significant fit of a trendline is made to each indicator, the slope of the trendlines is examined. Improving or flat trendlines are not considered adverse and need not be investigated further. Degrading trendlines are considered adverse.

Analyses of Issues

Once an adverse trend is identified, the staff conducts an initial analysis of information readily available in the databases used to compile the indicator data to determine whether the trend is unduly influenced by a small number of outliers and to identify any contributing factors. If the trend is the result of outliers, then it is not considered a trend requiring generic actions, and the agency will consider any appropriate plant-specific actions using the ROP. For example, the affected plants unduly influencing the adverse trend may have already exceeded plant-level thresholds under the ROP, and the NRC regional offices would conduct supplemental inspections at these plants to ensure the appropriate corrective actions have been taken. If the plants did not exceed any thresholds, while the NRC would not take regulatory actions beyond the ROP, the NRC would gather additional information on the issue within the scope of the ROP using risk-informed baseline inspections. The results of these inspections would be examined to determine if a generic issue existed requiring additional NRC review or generic inspections.

If no outliers are identified, the staff conducts a broader review to assess whether larger groups of facilities are contributing to the decline and to assess any contributing factors and causes. For example, the data review is expanded to include a review of various plant comparison groups, contributing factors such as the operational cycle stage of the facilities (shutdown, at-power, startup from refueling, etc.), and the apparent causes for the data (equipment failures, procedure problems, etc.). The staff will also conduct a more detailed review of applicable licensee event reports. Should a group of plants be identified, the staff will examine the results of previously conducted inspections at these plants, including any root causes and the extent of the conditions.

Once this information is reviewed, the staff assesses the safety significance of the underlying issues. The staff is mindful that trends in individual indicators must be considered in the larger context of their overall risk significance. For example, a hypothetical increase in automatic scrams from 0.4 to 0.7 per plant per year over several years may be a statistically significant trend in an adverse direction. However, it may not represent a significant increase in overall risk since the contribution of a small number of scrams is relatively low, and it is possible that overall risk may actually have declined if there were reductions in the frequency of more risk-significant initiating events or the reliability and availability of safety systems had improved. Depending on the issues, the staff may perform an additional evaluation using the most current risk analysis tools or an evaluation by the ASP Program.

Agency Response

Until thresholds for ITP indicators are developed to establish the significance of indicator data, should a statistically significant adverse trend in safety performance be identified or an indicator cross a prediction limit, the staff will determine the appropriate response using the NRC's established processes for addressing and communicating generic issues. These processes are described in SECY-99-143, "Revisions to Generic Communications Program."

In general, the issues will be assigned to the appropriate branch of NRR for initial review. The branch will engage NRC senior management and initiate early interaction with the nuclear power industry. Depending on the issue, the process could include requesting industry groups such as NEI or various owners groups to provide utility information. As discussed in SECY-00-0116, "Industry Initiatives in the Regulatory Process," industry initiatives, such as the formation of specialized working groups to address technical issues, may be used in lieu of, or to complement, regulatory actions. This can benefit both the NRC and the industry by identifying mutually satisfactory resolution approaches and reducing resource burdens.

Depending on the issues, the NRC may consider generic safety inspections at plants. In addition, the issues underlying the adverse trend may also be addressed as part of the generic safety issue process by RES. After this interaction, the NRC may consider additional regulatory actions as appropriate, such as issuing generic correspondence to disseminate or gather information, or conducting special inspections for generic issues. The process also includes consideration of whether any actions proposed by the NRC to address the issues constitute a backfit.

Senior Management Review

The industry trends program, results, and agency response are reviewed annually during the Agency Action Review Meeting (AARM). In general, the AARM is intended to review the appropriateness and effectiveness of staff actions already taken, rather than to make decisions on agency actions. NRC senior managers review the industry trends information and, if appropriate, recommend any additional actions beyond those implemented by the staff.

Communications With Stakeholders

The NRC communicates overall industry performance to stakeholders by publishing the ITP indicators on the Nuclear Reactors portion of the agency's public Web site at *http://www.nrc.gov/reactors/operating/oversight/industry-trends.html*. The staff believes that communication of the industry-level indicators, when added to the information on individual plants from the ROP, enhances stakeholder confidence in the efficacy of the NRC's oversight of the nuclear industry.

The staff informs the Commission of the results of the ITP in an annual report in the same timeframe as the AARM. The indicators are also published annually in the NRC's "Information Digest 200X" (NUREG-1350 series). In addition, NRC managers have historically presented industry indicators and trends at major conferences with industry.

Reports to Congress

The NRC reports the industry indicators to Congress annually in the NRC's "Performance and Accountability Report, Fiscal Year 200X" (NUREG-1542 series), and in the NRC's "Budget Estimates and Performance Plan Fiscal Year 200X" (NUREG-1100 series). The indicators demonstrate how the agency has met the measure of "no statistically significant adverse industry trends in safety performance" for the performance goal of maintain safety. Adverse trends would be reported, but indicators that exceeded prediction limits need not be included in these reports since these are tools to monitor industry performance rather than desired thresholds of performance.

In addition, the Commission has historically used the ITP indicators when presenting the status of industry performance to the NRC's oversight committees.

FY 2002 Trend Results
Based on AEOD and ASP Indicators

Indicators Originally Developed by the Former Office of AEOD and Accident Sequence Precursor (ASP) Indicators

ATTACHMENT 2

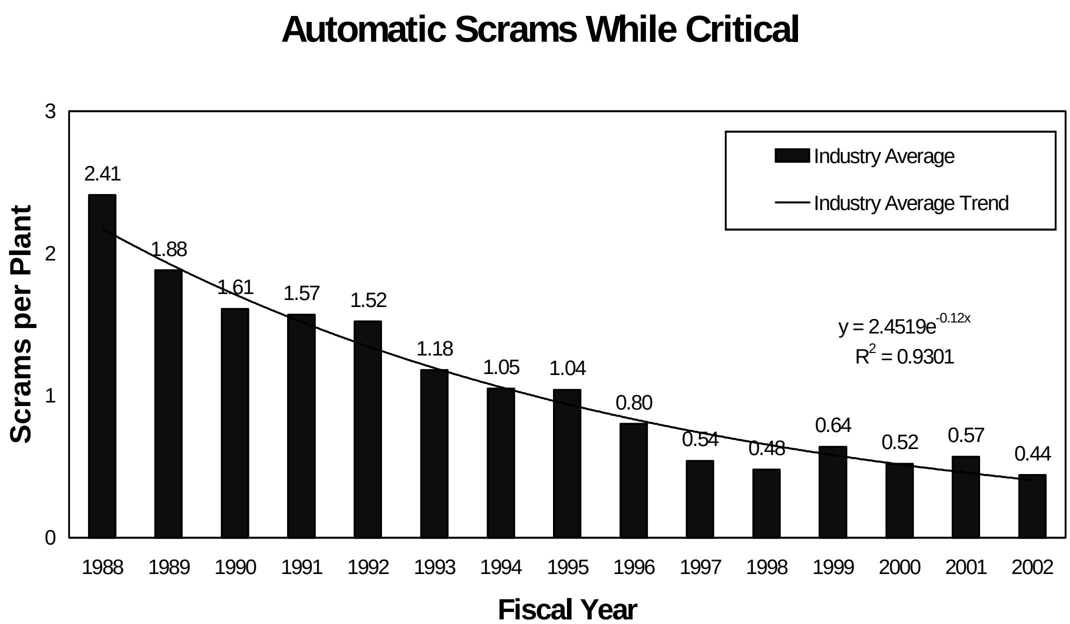


Figure A2-1

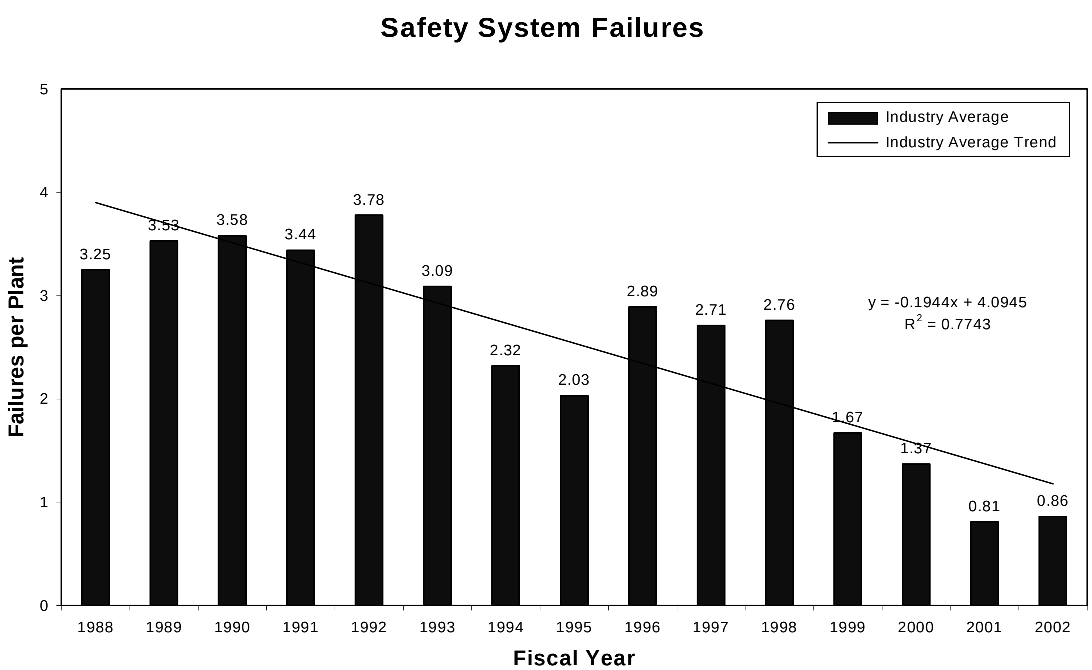


Figure A2-2

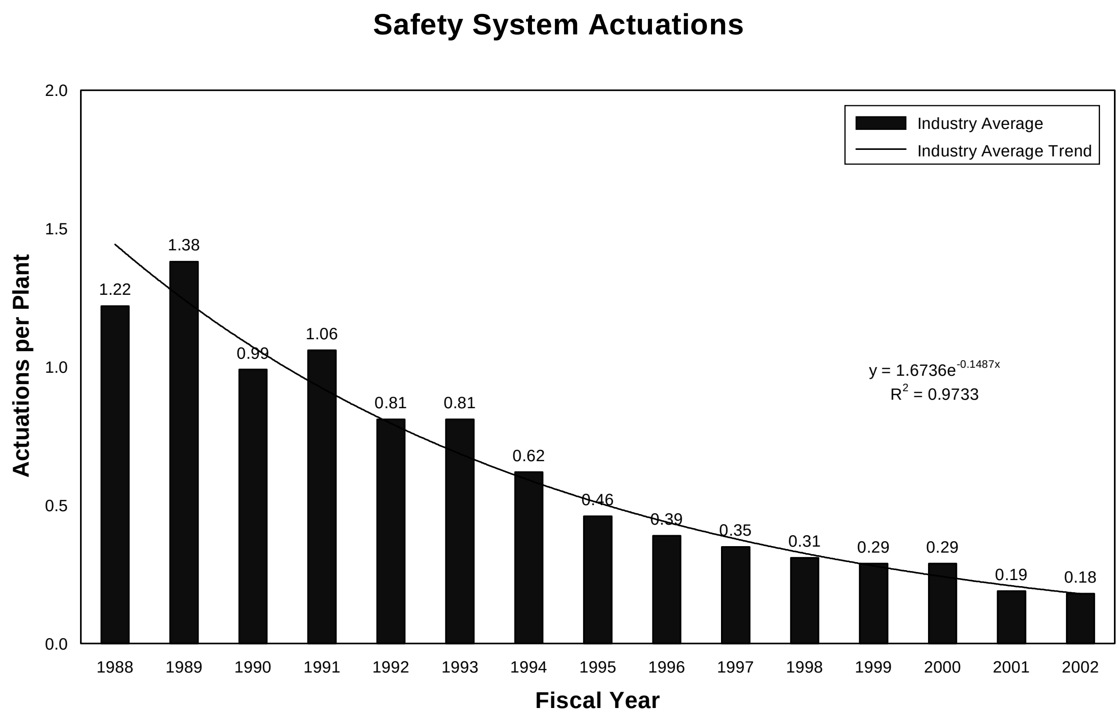


Figure A2-3

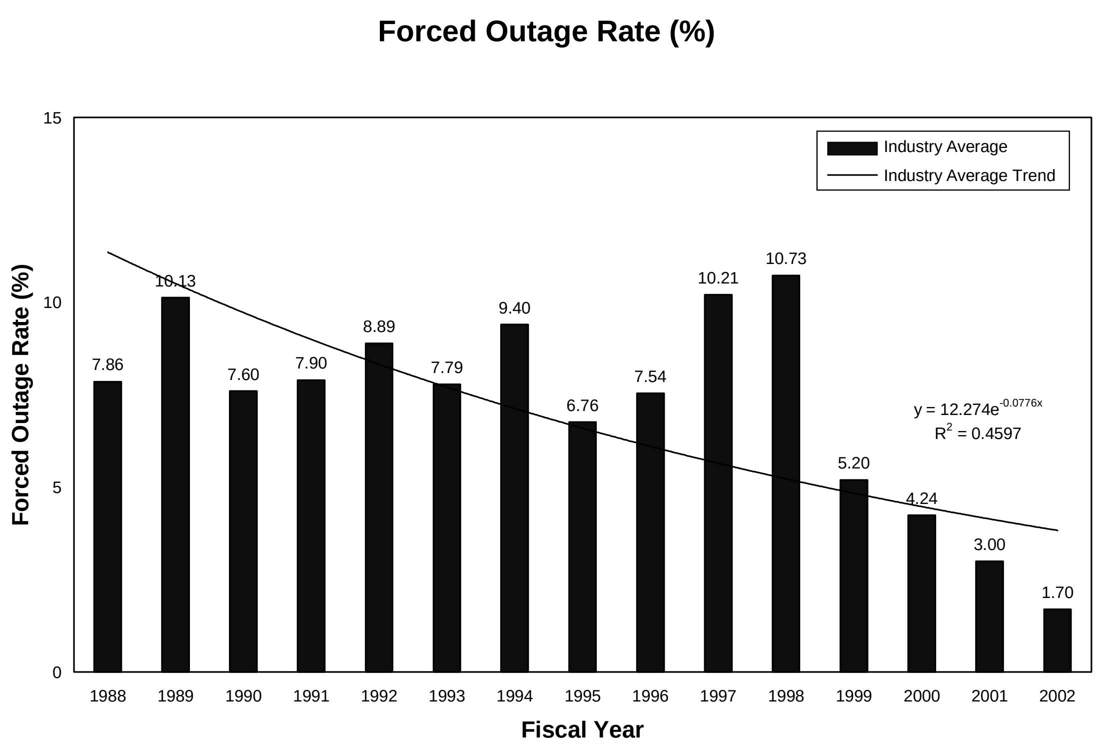


Figure A2-4

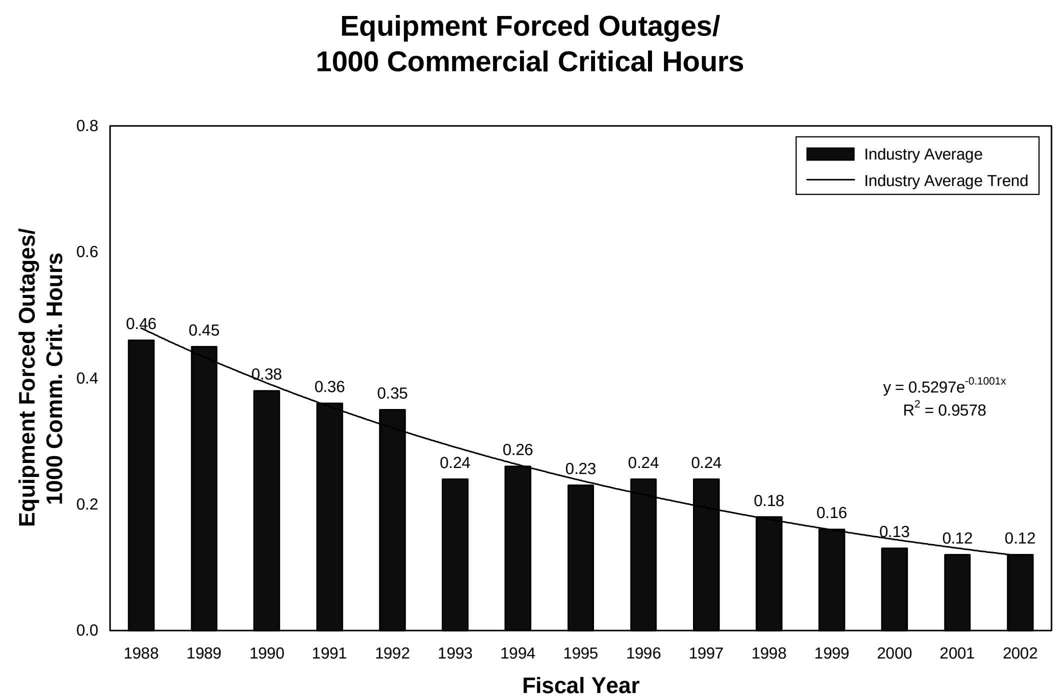


Figure A2-5

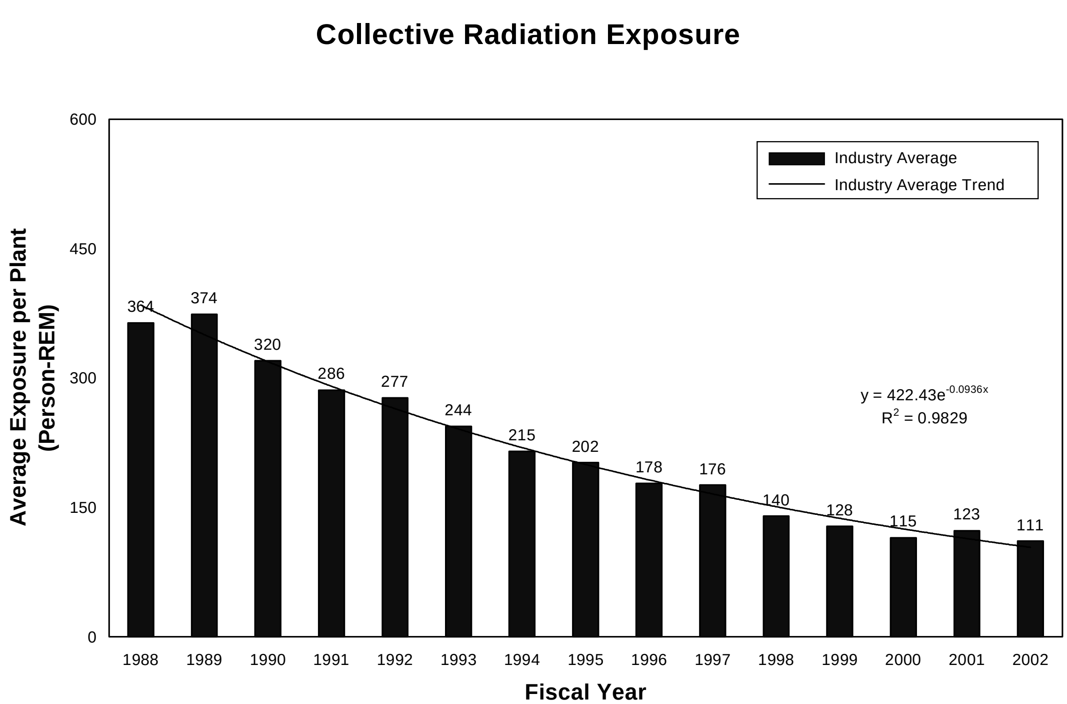


Figure A2-6

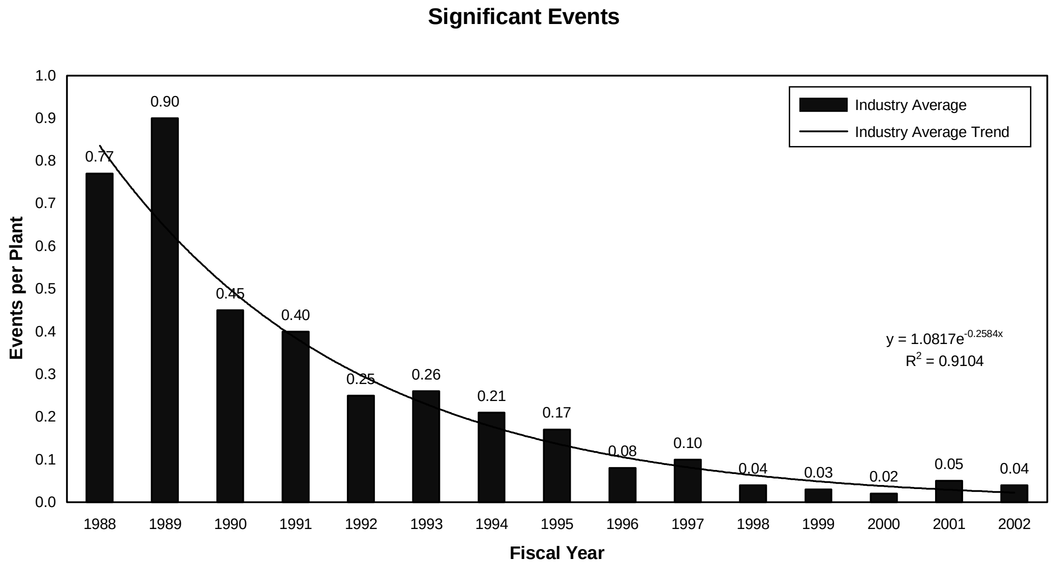

Significant Events
Events per Plant
Fiscal Year
Industry Average
Industry Average Trend
y = 1.0817e^-0.2584x
R^2 = 0.9104
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0
0.77
0.90
0.45
0.40
0.25
0.26
0.21
0.17
0.08
0.10
0.04
0.03
0.02
0.05
0.04
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002

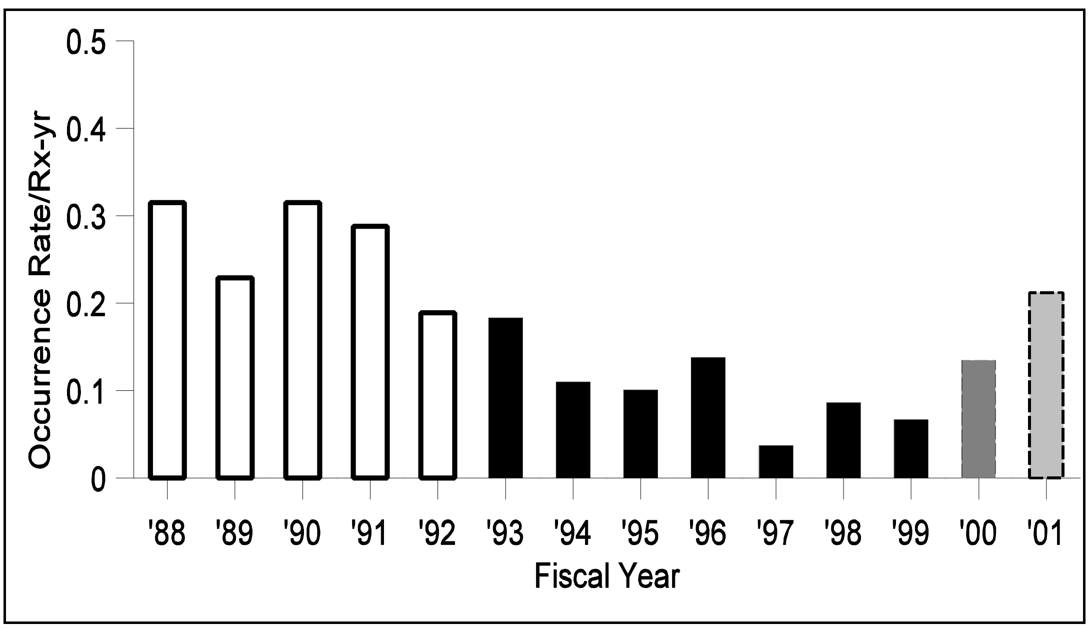
Figure A2-7

Accident Sequence Precursor Trends

Figure A2-8 below shows the occurrence rate per reactor-year for all Accident Sequence Precursor (ASP) events by fiscal year. No statistically significant trend was observed in the occurrence rate for all precursors (CCDP or ΔCDP $\geq 10^{-6}$) during the 1993–2001 period (shaded bars in the figure).

The trend is based on the number of all precursors starting in FY 1993. Data prior to FY 1993 are shown in the figure to provide historical perspective. Analyses for FY 2000 are preliminary with final analyses nearing completion (pending resolution of peer review comments). The data for FY 2001 are based on ongoing analyses that have undergone internal staff review. The number of ASP events may decrease as the analyses are finalized. RES has provided additional information on the ASP Program in SECY-03-0049, "Status of the Accident Sequence Precursor (ASP) and the Development of Standardized Plant Analysis Risk (SPAR) Models."

Nonetheless, the staff will investigate the nature of the precursors to determine if there is an explanation for the relatively low number of precursors between 1997 and 1999 and the increasing number of potential precursors in 2000 and 2001. This evaluation will occur after RES completion of the preliminary analyses of FY 2001 events. This evaluation will be a joint project between NRR and RES as part of the Industry Trends Program. The evaluation may include a review of the risk significance of the events, types of facilities involved, a categorization of causes and factors for analyzed events and conditions, the time period for analysis, and whether any additional actions are appropriate.



All precursors—occurrence rate per reactor-calendar year, by fiscal year. No trend was identified during the FY 1993–2001 period. The results for 2000 and 2001 are preliminary. A trend line is not shown in the figure because the trend is not statistically significant.

Figure A2-8

Description of the
Industry Initiating Events Performance Indicator

As discussed in SECY-02-0058, “Results of the Industry Trends Program for Operating Power Reactors and Status of Ongoing Development,” RES developed about 10 additional risk-informed indicators for significant initiating events for both PWRs and BWRs. The staff developed these indicators by updating data that were most recently published in NUREG-5750, “Initiating Events at U.S. Nuclear Power Plants: 1987–1995.” These indicators were selected because NUREG-1753, “Risk-Based Performance Indicators: Results of Phase 1 Development,” identified them as events that contributed >1% to industry core damage frequency. The list of risk-significant initiating events is provided below.

1. Loss of Offsite Power
2. Loss of Safety-related Vital AC Bus
3. Loss of Safety-related Vital DC Bus
4. Small/Very Small Loss of Coolant Accident
5. Loss of Feedwater
6. Loss of Instrument Air/Control Valve
7. General Transients
8. Stuck Open Safety/Relief Valve
9. Loss of Heat Sink
10. Steam Generator Tube Rupture (PWRs only)

During FY 2002, RES and NRR built on this work by developing an overall industry-level indicator for the initiating events cornerstone. An overall indicator can provide a better representation of the overall risk from initiating events than multiple individual indicators of initiating events with varying degrees of risk significance. For example, it is possible that there could be an increase in loss of general transient events in any given year, but the overall risk from all initiating events may actually have declined if the contribution to risk from that single indicator is low and the contribution to risk from all other initiating events has declined.

This overall initiating events indicator, tentatively called the Industry Initiating Events Performance Indicator (IIEPI), consists of an index of these risk-significant industry initiating events. An index was developed for BWRs that has 9 risk-significant initiating events, and a similar index was developed for PWRs that has 10 events. Each initiating event is weighted in the index based on its contribution to industry core damage frequency (CDF).

The contribution of each initiating event to CDF is determined by multiplying the frequency of occurrence by a risk weighting factor. The contribution of the 9 or 10 terms is then summed to get the overall index for initiating events. Mathematically, this can be shown for an individual plant by the following equation:

$$CDF = \sum_{i=1}^{m} B_i \lambda_i$$

where the risk weighting factor is represented by B_i, and the initiating event frequency is represented by λ_i. The risk weighting factor is a common measure used in probabilistic risk assessments (PRAs) called the Birnbaum importance measure.

An industry average CDF can be calculated by using average industry values for the Birnbaum importance measures and the initiating event frequencies. This is illustrated in Figure 1.

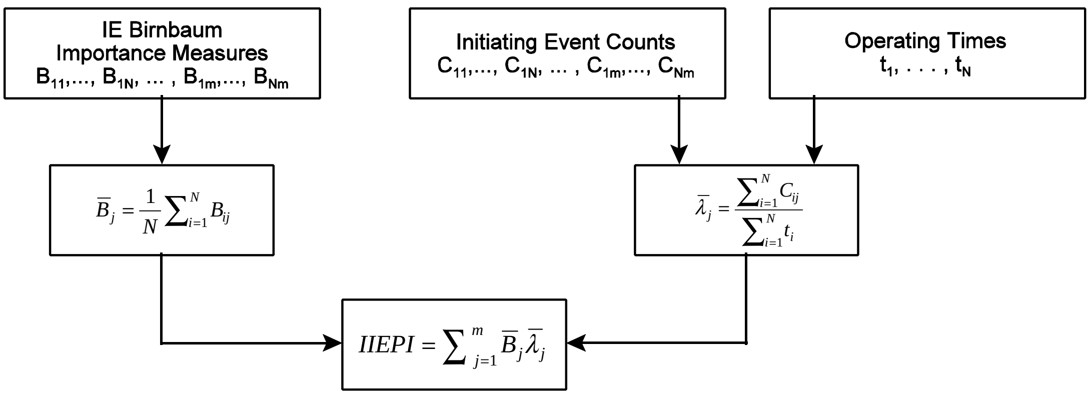


Figure A3-1 Integrated initiating event performance indicator calculations

In addition, should the concept be demonstrated successfully at the industry level, the indicator could potentially be adapted to monitor plant-level performance as well by using plant-specific values for either or both terms in the equation as appropriate. This approach would be similar to the Mitigating Systems Performance Index (MSPI) that is currently being assessed in a pilot program as part of the ROP PIs.

An interesting characteristic of the IIEPI is that it need not require any additional submission of data from licensees, even at the plant level. The staff currently receives all required information from existing data, including Licensee Event Reports (LERs) and Monthly Operating Reports (MORs), as shown in Figure 2.

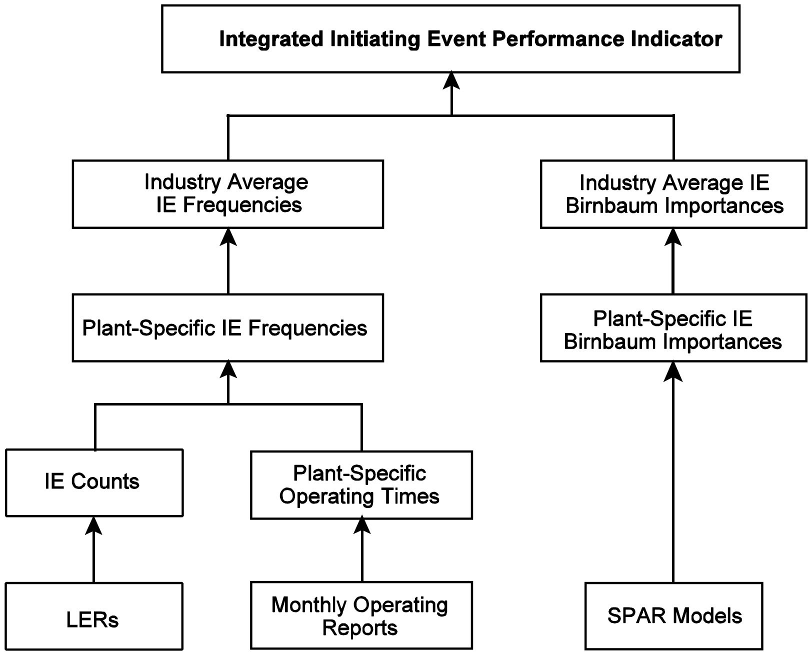


Figure A3-2 IIEPI data sources

An example of the IIEPI for PWRs is shown in Figure 3 for illustration only. These example calculations show the feasibility of the indicator. No attempt has been made to validate or verify these results.

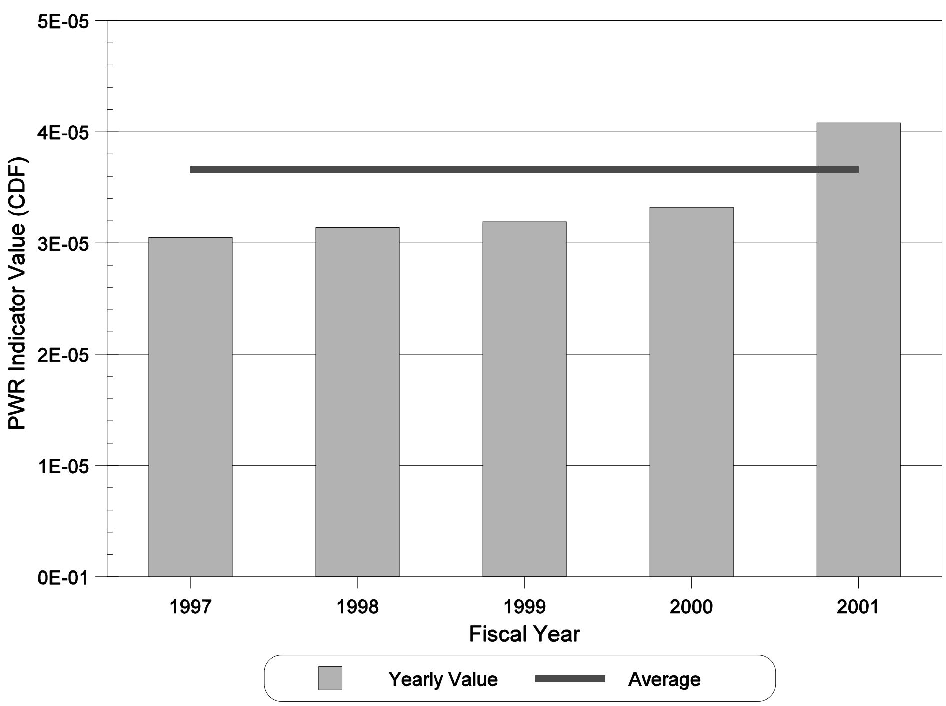


Figure A3-3 Example calculation for the IIEPI for PWRs

Action Matrix Summary

The NRC provided oversight of 103 operating power reactors using the Reactor Oversight Process (ROP). On average, approximately 75% of the plants were listed in the Licensee Response column of the ROP Action Matrix, which corresponds to the baseline level of NRC oversight. The chart below shows trends in the numbers of plants that are listed in the Regulatory Response, Degraded Cornerstone, Multiple/Repetitive Degraded Cornerstone, and Unacceptable Performance columns of the Action Matrix, which correspond to increasing levels of regulatory engagement with the licensee.

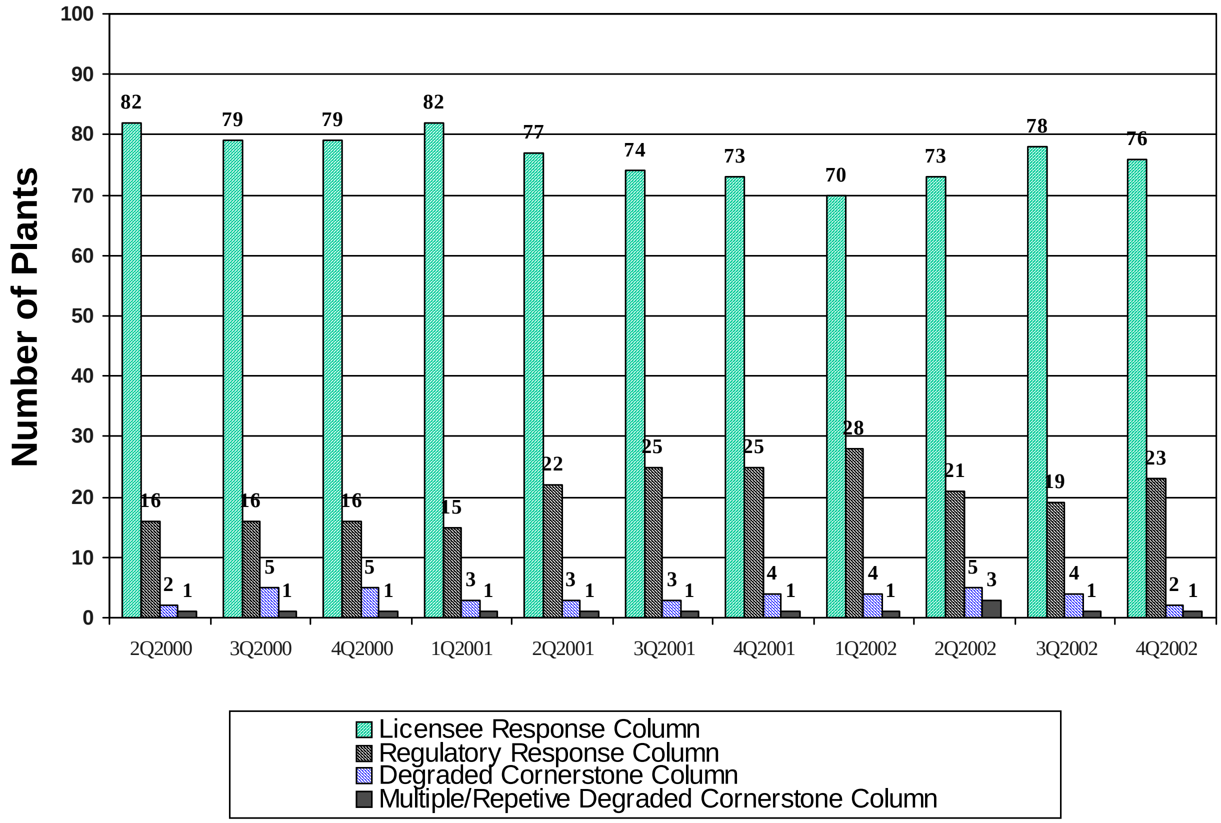


Figure A4-1

Notes for Figure A4-1:

1. This chart includes DC Cook units 1 and 2, beginning in 2Q/2001.
2. Davis-Besse is not included beginning in 2Q/2002 since under IMC 0350.
3. Data current as of January 2003.

The chart appears to show a slight migration of plants from the Licensee Response Column to the other columns in the Action Matrix. This can be attributed to several factors associated with the initial start up of the ROP. First, the staff has continued to work with industry to improve the ROP since initial implementation. These improvements include enhancements to its risk-informed inspection procedures, improved SDP Phase 2 notebooks, and improvements to the guidance for performance indicators. A second factor is that the staff is much more familiar with applying these risk-informed ROP tools and with the ROP processes. These factors have likely enhanced the ability of both the NRC and licensees to identify the most risk-significant aspects of licensee performance.

In addition, inspection findings that are determined to have greater than very low safety significance (green) are counted for 4 quarters when determining the appropriate column of the Action Matrix for licensees. Thus, for at least the first 4 quarters from the date of initial implementation of the ROP on April 2, 2000, the number of plants moving out of the Licensee Response Column has increased as inspection findings are accrued by plants under the ROP.