

TECHNICAL BASIS FOR PERFORMANCE INDICATORS

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1. INTRODUCTION

Performance indicators (PIs), together with risk-informed baseline inspections, are intended to provide a broad sample of data to assess licensee performance in the risk-significant areas of each cornerstone. They are not intended to provide complete coverage of every aspect of plant design and operation. It is recognized that licensees have the primary responsibility for ensuring the safety of the facility. Objective performance evaluation thresholds are intended to help determine the level of regulatory engagement appropriate to licensee performance in each cornerstone area. Furthermore, based on past experience it is expected that a limited number of risk-significant events will continue to occur with little or no indication of declining performance. Follow up inspections will be conducted to ensure that the cause of these events are well understood and that licensee corrective actions are adequate to prevent recurrence.

As described in Commission paper SECY-99-007, the Agency established a task group to identify appropriate PIs. The PIs selected for each cornerstone, along with performance thresholds, are described in Figures 1 through 15 of this Attachment. These thresholds were selected for consistency with the performance threshold conceptual model provided in Exhibit 12 of the main body of this paper. They correspond to levels of performance requiring no additional regulatory oversight (the "Licensee Response Band" above the Green/White threshold), performance that may result in increased oversight (the "Increased Regulatory Response Band" below the Green/White threshold), performance that will result in specific NRC actions (the "Required Regulatory Response Band" below the White/Yellow threshold), and performance that represents an unacceptable loss of safety margin (below the Yellow/Red threshold). For some PIs, White/Yellow or Yellow/Red thresholds were not identified, because the indicators could not be directly tied to risk data. It should be noted that should licensee's performance result in a PI reaching the Red Band, margin would still exist before an undue risk to public health and safety would be presented.

Once the PIs and corresponding thresholds were selected, a task group performed a benchmarking analysis to compare the indicators against several plants that had been previously designated by the Agency as having either poor, declining, average, or superior performance. The analysis indicated that the PIs could generally differentiate between poor and superior plants, but were not as effective at differentiating average levels of performance. In some instances, the cause of the poorly rated plants was due to design or other issues for which valid PIs have not been developed. Issues such as these are within the scope of the risk-informed baseline inspection program.

2. BASIS FOR SELECTING INITIAL SET OF PIs

Where possible, the task group sought to identify PIs as a means of measuring the performance of key attributes in each of the cornerstone areas. In selecting PIs, the task group tried to select indicators that: (1) were capable of being objectively measured; (2) allowed for the establishment of a risk-informed threshold to guide NRC and licensee actions; (3) provided a reasonable sample of performance in the area being measured; (4) represented a valid and verifiable indication of performance in the area being measured; (5) would encourage appropriate licensee and NRC actions; and (6) would provide sufficient time for the NRC and licensees to correct performance deficiencies before the deficiencies posed an undue risk to public health and safety.

3. BASIS FOR SELECTING PI THRESHOLDS

The concept for setting performance thresholds includes consideration of risk and regulatory response to different levels of licensee performance. The approach is intended to be consistent with other NRC risk-informed regulatory applications and policies (e.g. Regulatory Guide [RG] 1.174 as well as consistent with regulatory requirements and limits. The thresholds were selected to be risk-informed to the extent practical, but also accommodate defense-in-depth and indications based on existing regulatory requirements and safety analyses. Thresholds were established so that sufficient margin exists between nominal performance bands to allow for licensee initiatives to correct performance problems before reaching escalated regulatory involvement, and sufficient margin exists to allow for both NRC and licensee diagnostic, and corrective actions to be effectuated in response to declining performance. Thresholds have been established sufficiently above the point of unsafe plant operation to allow the NRC sufficient opportunity to take appropriate action to preclude operation in this condition.

The four performance bands and their general performance characteristics are as follows:

- The Green band is characterized by acceptable performance in which cornerstone objectives are fully met; nominal risk with nominal deviation from expected performance. Performance problems would not be of sufficient significance that escalated NRC engagement would occur. Licensees would have maximum flexibility to "manage" corrective action initiatives. The threshold for this band would involve performance that would be outside the normal range of industry historical performance and risk.
- The White band would be entered when licensee performance is outside the normal performance range, but would still represent an acceptable level of performance. Cornerstone objectives met with minimal reduction in safety margin; outside bounds of nominal performance; within Technical Specification Limits. Degradation in performance in this band is typified by changes in risk of up to $\Delta 10^{-5}$ Core Damage Frequency (CDF) or $\Delta 10^{-6}$ Large Early Release Frequency (LERF). The CDF and LERF threshold characteristics were selected to be consistent with RG 1.174 applications.
- The Yellow band involves a decline in licensee performance that is still acceptable with cornerstone objectives met, but with significant reduction in safety margin; Technical Specification limits reached or exceeded. Degradation in performance in this band is typified by changes in risk of up to $\Delta 10^{-4}$ CDF or $\Delta 10^{-5}$ LERF. These threshold characteristics and required regulatory response are also selected to be consistent with risk-informed regulatory applications and mandatory actions for regulatory compliance.
- The Red band is typified by changes in performance that are indicative of changes in risk greater than $\Delta 10^{-4}$ CDF or $\Delta 10^{-5}$ LERF. Plant performance represents an unacceptable loss of safety margin. It should be noted that should licensee's performance result in a PI reaching the Red Band, margin would still exist before an undue risk to public health and safety would be presented.

As described in Commission Paper SECY-99-007, Attachment 2, Appendix H, PI thresholds in some instances could be directly tied to probabilistic risk assessment data, such as those for scrams and safety system unavailability. A sample of plants with probabilistic risk analysis (PRA) models available was selected to cover a spectrum of "typical" designs. Normal performance ranges were identified and core damage frequency sensitivity analyses were performed to evaluate the effects of departures from normal performance. This

information was used to set PI threshold values that corresponded to the nominal and declining performance bands.

PRA models were used to provide a risk-perspective on the thresholds for the Initiating Events and Mitigating Systems cornerstones. This was done by performing sensitivity studies to investigate how the CDF of the plants varies as the values of the PIs change. The analyses were performed by NRC staff or their contractors with the SAPHIRE code, using seven NRC-developed simplified models (SPAR models) and six licensee PRA models that were available at Idaho National Engineering and Environmental Laboratory. In addition, results from twelve licensee PRA models were provided by the Nuclear Energy Institute (NEI). While, for most cases, the PRA results were able to provide information relevant to establishing the White/Yellow and Yellow/Red thresholds, in some cases, the CDF results were insensitive to large changes in the parameters corresponding to the PIs. For these cases, an alternate approach to choosing thresholds was required.

To determine the Green/White threshold, it was necessary to define what was acceptable performance. The Green/White threshold for the PI was chosen to be commensurate with a generically achievable level of performance and takes into consideration the statistical variability arising from the random nature of the contributing events as seen across the entire population of plants. For the purpose of establishing the Green/White threshold, histograms were provided by NEI of the maximum value recorded for each PI for all the plants. The threshold was determined by the simple approach of choosing a value to no more than two significant figures that is such that about 95% of the plants have observed data values that would be in the Green band, and is therefore established on a generic basis. This method depends only on the number of plants with less than acceptable performance, but not on determining by how much their performance exceeds the norm. Alternative approaches, such as using the mean plus two standard deviations of the PI values to set the threshold puts more weight on the actual values of the PIs, and could be biased by the poor performers in a non-conservative direction. This threshold value may be higher or lower than the value of the corresponding parameter used in licensee's PRAs. That the threshold is reasonable from a risk standpoint was demonstrated by the fact that use of the threshold in the sample of PRA models used for the sensitivity studies would have resulted in an increase in CDF of less than 10^{-5} /reactor year.

There is no clear regulatory definition of unacceptable risk in numerical terms that can be used to define unacceptable performance. However, in RG 1.174, the NRC has established acceptance guidelines for allowing changes to the licensing basis that relate to changes in CDF and LERF. Specifically, for CDF, an increase in the range of 10^{-6} to 10^{-5} /reactor year would be acceptable, under certain conditions and with staff review and approval, while changes resulting in an increase greater than 10^{-5} /reactor year would not be acceptable. While these acceptance guidelines are intended for permanent changes to the licensing basis, it was consistent to also apply these to changes resulting from operating practices, using the argument that if the degradation in performance were uncorrected, it would lead to a permanent increase in CDF. Furthermore, a change in CDF of 10^{-5} /reactor year is used in the staff's regulatory analyses as one element in determining the requirement for a backfit. Thus, it was decided that the White/Yellow threshold should be determined on the basis of sensitivity analyses to identify that mean value of the PRA parameter associated with the PI that would increase CDF by an amount that corresponds to a substantially declining performance, which has been chosen as 10^{-5} /reactor year. For the PI to be a meaningful indicator, this increase must be significant compared with the expected statistical variation captured by the setting of the Green/White threshold. In comparison with the way the Green/White threshold is determined, this approach is somewhat conservative in that it does

not increase the value to compensate for the expected statistical variation. However, since this is only an indicator of performance rather than a criterion for regulatory action, this is considered appropriate.

A truly unacceptable performance would likely correspond to a change in CDF well in excess of 10^{-5} /reactor year, and is chosen as corresponding to a change in CDF of 10^{-4} /reactor year. The Yellow/Red thresholds were determined by identifying the PI values that would correspond to increases in CDF of 10^{-4} /reactor year.

Other PI thresholds could not be specifically tied to probabilistic risk data. In such cases, the PI thresholds were tied to regulatory requirements or were based on the professional judgement of the NRC staff. For example, under the barrier integrity cornerstone, reactor coolant system (RCS) activity is a good measure of the integrity of the fuel cladding, but the performance thresholds chosen were based on technical specifications.

For two PIs (Unplanned Power Changes and Safety System Failures [SSFs]), no thresholds have been identified for the Yellow and Red Bands because the indicators could not be directly tied to risk data. These two indicators have provided good correlation with plant performance in the past and they are considered to be leading indicators of the more risk-significant indicators: (Unplanned Scrams, Scrams with Loss of Normal Heat Removal, and Safety System Unavailability). (Note, the Scrams with Loss of Heat Removal PI has been eliminated and replaced with Unplanned Scrams with Complications.) The Barrier Integrity cornerstone PIs (RCS Activity and RCS Leak Rate) do not have thresholds identified for the Red Band because their lower thresholds are based on regulatory requirements (technical specifications). Individual plant technical specifications would require plant shutdown within a short time after the regulatory limits were exceeded. The Emergency Preparedness, and Occupation and Public Radiation Safety cornerstones do not have thresholds identified for the Red Band. There is no risk basis for a determination that a certain degraded level of performance reflected by these indicators can be correlated into mandatory plant shutdown. It is expected that declining performance in the areas monitored by these indicators would be arrested by increased licensee corrective actions and by increased NRC attention up to and including the issuance of orders.

The Unplanned Scrams with Complications PI does not have Yellow or Red bands because the PI is not tied directly to risk significance. However, it does monitor the cumulative effect of scrams that have the potential to present additional challenges to plant operations staff and therefore may be more risk significant than uncomplicated scrams. During development of this PI it was benchmarked against significant events tracked by the industry trends Accident Sequence Precursor program for data available from 2003 through mid-2004, and MD 8.3, "Incident Investigation Program" for data available for 2005 through mid-2006. The PI was triggered for all ASP events and all MD 8.3 reactive inspections involving reactor scrams when there was sufficient information provided. This indicated that the PI had the ability to detect and trigger on events the NRC considered risk significant and probably lower threshold precursor events as well. The PI was also benchmarked against industry plant scram data provided by NEI from 1995 to 2000. This benchmarking showed that the PI would result in approximately 5% of the industry with a white indicator. The PI was also based on a rolling 4 quarters, representing more current performance than the 12 quarters used by the Loss of Normal Heat Removal PI.

4. GENERIC PIs AND THRESHOLDS vs. PLANT SPECIFIC

As described in Section 3 above, the thresholds were selected to be risk-informed to the extent practical. Because of significant differences among plants in both Nuclear Steam Supply System (NSSS) and balance-of-plant equipment, and operations, the change in risk associated with a particular PI value may vary considerably from one plant to another. A more risk-informed process would therefore use detailed individual plant models to determine the appropriate plant-specific thresholds. The NRC has a program currently underway to develop such models for each plant (the SPAR Rev. 3 models). Currently about 60 such models have been developed, with about 30 verified with the respective licensees. The Mitigating System Performance Index (MSPI) is a new more risk-informed performance indicator and has replaced the safety system unavailability indicators.

5. BENCHMARKING OF INITIAL SET OF PIs

An initial benchmarking analysis was performed by NEI on a set of eight plants that they categorized as excellent, average, or declining performers, plus eight NRC watch list plants. The indicators they used were the ones originally proposed in their draft white paper, (RCS Activity, RCS Leakage, Containment Leakage, Unplanned Scrams, Safety System Actuations [SSAs], and Transients) except the Reliability and Availability of Risk-Significant systems, structures, and components and Shutdown Operating Margin. Since NEI did not have unavailability data at the time, they used SSFs from the NRC PI program as a surrogate. They used monthly or quarterly data from July 1995 through June 1998 for RCS activity, RCS leakage, and containment leakage provided by the plants. NEI also used annual data from 1990 to 1997 on Scrams, SSAs, and SSFs from the Office for Analysis and Evaluation of Operational Data (AEOD) annual reports, and data from 1990 to 1995 on Transients from an Nuclear Utilities Service (NUS) database of licensee monthly reports. NEI documented insights from their analysis of these data, including typical PI characteristics for each plant performance category which showed a correlation between the PIs and performance. These insights were obtained primarily from the SSF and Transients indicators. They concluded that the set of indicators provided an overall perspective of safety performance, and that the indicators do distinguish between levels of performance in enough of the indicators simultaneously to be a viable assessment tool.

Once the PIs and corresponding thresholds were selected for the Initiating Events, Mitigating Systems, and Barrier Integrity cornerstones by the NRC task group, the NRC staff performed additional independent benchmarking analysis to answer the following questions:

1. Do the PIs as a set differentiate between superior, average, declining trend, and watch list plants as designated by the Senior Management Meeting (SMM) process?
2. How effective are individual PIs at differentiating between plants with different levels of performance as designated by the SMM process?
3. Do the PIs demonstrate timely response (i.e., do not go directly from green to red)?
4. Do the PIs show declining trends for plants in SMM designated performance categories prior to SMM actions? If so, which ones are most effective? If not, would they be expected to show a declining trend?
5. Do the PIs show declining trends prior to accident sequence precursor (ASP) events? If so, which ones are most effective?
6. How well does the set of PIs conform to those selected by Arthur Andersen for use in the trending methodology that was used in the SMM process?
7. Do small decreases in the Green/White thresholds capture more of the watch list and declining trend plants (sensitivity analyses)?

To perform its analysis, the NRC compared the indicators against the following set of 17 plants that had been previously designated by the NRC SMM as superior performers, average, trending, and watchlist plants:

| | | | |
|-----------|---------------------------------------|-------------|--|
| Superior: | Callaway Vogtle 1&2 | Average: | Davis-Besse Point Beach 1&2 TMI 1 |
| Trending: | Cooper D.C. Cook 1&2 Hope Creek | Watch List: | Crystal River Indian Point 3 Maine Yankee Millstone 1, 2, 3 |

This independent analysis confirmed that the PIs could generally differentiate between poor and superior plants, but were not as effective at differentiating average levels of performance. The unplanned power changes and SSF PIs appeared to be the most closely tied with prior NRC judgements about performance. In some instances, the cause of the plants rated poorly by the agency was due to design or other issues for which valid PIs have not been developed. It is expected that these plants would continue to be identified by the inspection program. The results of this benchmarking by the industry and the NRC is described in more detail in Commission Paper SECY-99-007, Attachment 2, Appendix I.

Benchmarking analysis was conducted to evaluate the Drill/Exercise Performance (DEP) and Alert and Notification System (ANS) Reliability PIs for the Emergency Preparedness cornerstone. For the DEP analysis, data was collected from 70 plants from 1994 through 1997. For the ANS Reliability analysis, siren data was obtained from 20 plants from 1995 through 1997. Benchmarking results showed that in general, the plants identified by this analysis were consistent with those identified as having a deteriorating trend in emergency preparedness (EP) performance.

To benchmark the Occupational Exposure Control Effectiveness PI, 14 sites were identified whose performance in occupational radiation protection activities was considered to be below or declining from industry standards. Additionally, 12 sites were identified who were considered to be good performers in occupational radiation protection activities. NEI provided data from 1996 through 1998 on 9 of the 14 poor performers and 7 of the 12 good performers. The staff also collected the systematic assessments of licensee performance (SALP) categories in Plant Support for these plants, since plants with a SALP score of 2 or 3 in that functional area normally have poor radiation protection programs. The PI data for the 16 plants was analyzed by the staff to compare the highest PI values to the thresholds and to identify the corresponding performance band. The benchmarking analysis showed reasonable agreement with the perceived performance of the plants.

To benchmark the Radiological Effluent Technical Specifications (RETS)/ Offsite Dose Calculation Manual (ODCM) Radiological Effluent Occurrence PI, the NRC and NEI both identified 15 sites whose performance in effluent monitoring and offsite releases was considered to be below or declining from industry standards. The staff also identified 12 sites considered to be good performers. NEI provided data from 1995 through 1997 on 11 of the 15 poor performers and 6 of the 12 good performers. The PI data for the 17 plants was analyzed by the staff to compare the highest PI values to the thresholds and to identify the corresponding performance band. The benchmarking analysis showed some agreement with the perceived performance of the plants. The plants considered to be good performers

had generally low PIs and none of them entered the White band; 4 of the 11 plants considered to be poor performers had PIs in the White band.

6. BASIS FOR EACH CURRENT PI AND THRESHOLD

Figures 1 through 15 provide detailed information regarding each PI, including its objective, the cornerstone key attributes it measures, the calculational method, the current performance thresholds and their basis, and the significant changes to the PI and/or threshold and their bases. NEI 99-02 also describes the data and calculations for each PI and describes the quarterly indicator reports that are to be submitted for use in the assessment process.

Additional detail regarding the background and development of some of the PIs are as follows.

6.1 Drill/Exercise Performance PI

The concept for the DEP PI began as three separate indicators:

- Accurate and timely classifications
- Accurate and timely notifications
- Accurate and timely protective action recommendations (PARs).

The percentage success rate of these would be measured in drills, exercises and actual events. This would largely be accomplished through licensee self assessment programs (i.e., the critique program). The definition of a "drill" was problematic as many sites use many different types of drills. The broadest definition of a drill that would be acceptable to NRC was sought. The drill would require a formal assessment of the measured activities and documentation suitable for inspection. It should be noted that while industry acceptance was obtained, several programs had to make significant changes to meet the criteria.

An analysis of the typical number of opportunities for the above three PIs proved informative:

Assuming:

- one unit plant
- six shifts of operators
- two training cycles per year would include EP drill elements
- seven full scale drills in two years

This results in about 60 opportunities/year:

8 opportunities per full scale drill (3 classifications, 3 notifications, 1 PAR and 1 PAR notification) for a total of 56.

2 opportunities (1 classification and 1 notification) per shift training evolution for each of 6 crews, twice per year for a total of 96 over 2 years.

This results in about 60 opportunities per year as follows: 25 classifications, 25 notifications, 5 PARs and 5 PAR notifications.

The results of this analysis indicated that this number of opportunities would not support 3 separate PIs. Separating the PIs was an attempt to diagnose performance problems,

rather than create a licensee response band, wherein the licensee could diagnose and correct performance problems. There was no need to separate the PIs because these measures indicate the status of the same underpinning elements (e.g., training, qualifications, equipment, procedures, correction of weaknesses identified in drills). These EP program elements must be adequate for a high level of success in performing the risk significant activities measured by the PI. It was determined that defining 3 separate PIs would be too fine a measurement. Rather, the focus should be on licensee success in implementing the most risk significant elements of EP, which would allow the measurements to be combined into one PI. This became the DEP PI. When combined, the projection of 60 opportunities per year, measured over two years, appeared to provide a good sample of meaningful performance.

The creation of "unintended consequences" was a concern during PI development. The working group developing the PIs remained conscious of the possibility that PI measures would drive performance or resources in a manner that was not risk-informed. The DEP PI was recognized as driving resource allocation in an appropriate manner. NRC regulations establish a minimum number of drills and this was the level of DEP PI reporting that was mandated by the PI. However, most licensees perform many more drills than required by the regulatory minimum, and in any case, the number of drills are not limited by regulation or the PI. The result is that if the licensee saw declining performance, additional drills could be scheduled to improve the PI value. There was some initial concern within the NRC that this could detract from the meaningfulness of the PI. A limit on the number of opportunities counted in the PI was discussed. However, the objective of the EP Cornerstone provided insight in that it is licensee proficiency that is important, not the number of drills. Implementation of additional drills to enhance proficiency is in keeping with the objective and was eventually seen as an advantageous design feature. Said another way, there is no regulation to require additional drills when performance declines, but the PI encourages licensees to take this action voluntarily to keep the PI Green.

6.1.1 Drill/Exercise Performance PI Thresholds

The 90% Green band threshold was selected by a group of subject matter experts including NRC, State and industry personnel. It was based on a proposal from NRC staff from data collected from EP exercise inspection reports for the period 1994 through 1997. While licensees conduct many additional drills, NRC inspection report data was only available for the exercises. Success rates for the DEP measured activities could be inferred from inspection reports if it is assumed that inspectors would have identified any significant problems with classification, notification or PAR development. The absence of findings was considered successful performance of the DEP activities. It was estimated that each exercise represented 10 DEP opportunities (4 classifications, 4 notifications and 2 PARs.) Given these assumptions, the data included some 1410 opportunities with 51 failures for a success rate of 96%.

The standard deviation of the success rate was calculated as the square root of the average success rate, or 9.7%. It was recognized that this may not be a mathematically rigorous use of the standard deviation. However, the results suggested a range of performance that would be expected given natural variations in such performance. Said another way, if the success rate was worse than about 96% minus 9.7%, or 87%, the performance is not within "normal" variation and should be investigated further. Given the lack of rigor in this analysis, it was decided to conservatively round up the estimate to 90% (i.e., performance at less than a 90% success rate warrants additional NRC oversight of corrective actions associated with Emergency Response Organization [ERO] performance). Performance above a 90%

success rate defines the licensee response band and corrective actions may be left to the licensee with NRC oversight through the baseline inspection program.

The group of subject matter experts agreed with the 90% threshold as a high standard appropriate for EP programs and yet flexible enough to provide a viable licensee response band. It should be noted that the calculational method of the DEP PI threshold encourages a higher number of opportunities (e.g., if performance failures cluster in a single drill, the PI value is less likely to cross the threshold if there are a larger number of total opportunities than if there are a smaller number of opportunities). This feature encourages more drills and contributes to the objective of the EP Cornerstone.

The Yellow band threshold was chosen in a similar manner. A success rate less than three standard deviations ($3 \times 9.7\%$) below the average was seen as performance that would require NRC involvement with corrective actions. This results in a success rate of about 67% which was conservatively rounded up to 70%.

The NRC staff proposed that a Red band threshold was not appropriate. Performance in the Red band is best determined by inspection and not voluntary PIs.

Finally, there was an initial NRC proposal to split the White and Yellow band thresholds into short-term (six month) and long-term (24 month) thresholds. When this was discussed with project management and NRC PI experts, they suggested a split threshold was too fine an analysis given the available data set. Additionally, none of the other PI were considering splitting short-term and long-term thresholds and the lack of consistency was a concern. The short-term threshold was therefore eliminated.

6.2 ERO Drill Participation PI

Development of this PI flowed from the Performance Assessment Workshop outcome that some measure of ERO readiness would make an appropriate PI, and proceeded through public meetings between NRC and industry representatives. The PI was configured by NRC staff and presented to the industry. It met with some resistance because it appeared to be an activity measure, was not required by regulation, and penalized sites with large EROs that exceeded regulatory requirements. On the other hand, NRC staff considered it a necessary compliment to the DEP PI because:

- DEP requires only a small number of opportunities and there are no requirements regarding the participants in these opportunities. A small number of participants performing in one exercise/year could meet the Green band threshold, as long as their failure rate was less than 10%. There are no requirements to rotate participants and the same team could participate every year. They could be coached through numerous "dress rehearsals" and only then would their performance be assessed for DEP. This would not be representative nor sufficient for NRC oversight (i.e., it would not create a licensee response band).
- DEP measures the most risk significant areas of EP. However, there are several other areas that are important, and were previously inspected but are not covered by the DEP PI (e.g., damage control, worker protection, accident assessment, procedure quality, training program, facility readiness). A premise of the ERO PI is that broad participation in drills by ERO members will result in their identifying weaknesses in areas not covered by the DEP PI. Inspection of the licensee corrective action program ensures that these weaknesses are getting corrected and

inspection of drill critiques ensures weaknesses are getting identified. The premise contends that broad ERO participation and the focused NRC inspections noted above are more effective in the identification and correction of weaknesses than the previous NRC oversight through infrequent direct inspection.

The ERO PI was defined in a manner that provided licensee flexibility. Only key ERO positions were to be tracked, a generous Green band threshold was established and flexibility in configuring drills for training purposes was provided.

A key aspect of ERO is that it is linked to DEP (i.e., for participation to contribute to the ERO PI, the success rate of classification, notification and PAR development must also contribute to the DEP PI). In a sense, DEP and ERO are a PI set. An attempt was made to combine the two PI, but this complicated the system and added little value. This linkage and industry acceptance of the PI creates a robust licensee response band. The PI allows the following statement for the Green band for the EP program:

At least 80% of the ERO participates in drills and they have a success rate of at least 90% in the most risk significant aspects of the EP Cornerstone.

This is a strong statement about the EP program that could not be made under the previous oversight program. Under the old Core Inspection Program, a team of inspectors would observe one exercise every two years and directly judge performance.

6.2.1 ERO Drill Participation PI Thresholds

There was no historical data available to NRC for drill participation. Some licensees did keep such data, but the standards used were not universal and even if the data could be obtained, it would not be standardized between sites. Given the purpose of the PI and the fact that there is no regulatory requirement for anyone to perform in a drill, a generous threshold was considered adequate. The 80% White band threshold was proposed by NRC and accepted by industry but questioned by internal NRC stakeholders. Some inspectors felt it was too generous to be meaningful. It was agreed to test the thresholds through the pilot program and initial implementation to determine if adjustments were warranted.

The Yellow band threshold was set at 60% based on the similar spread of the DEP PI thresholds. However, many industry stakeholders questioned whether any Yellow band was appropriate for this PI, for the reasons discussed above. The threshold was sufficiently generous to allay concerns that any licensee could cross the threshold without significant degradation of the EP program. There was no consideration of a Red band threshold as it was thought that inspection was the proper mechanism to identify findings of such significance.

6.3 Alert and Notification System Reliability PI

This PI was developed out of the recognition that some measure of licensee performance in the maintenance of EP related equipment was appropriate. When the spectrum of EP related equipment is considered, the ANS manifests as the most risk significant. The objective of the EP Cornerstone can not be met unless there is a mechanism to rapidly notify the public of the need to take protective actions. That mechanism is the ANS and the emergency alert system (the system that uses local radio channels to alert the public of emergencies.) Generally, the licensee maintains the ANS and local authorities activate it.

Licensees must annually report ANS testing results to the Federal Emergency Management Agency (FEMA), usually via the State. The data was readily available and it was thought that this PI could be a simple extension of the report to FEMA and perhaps replace the need for that report. A few stakeholders stated that the annual siren test data almost never showed a problem and thus the PI would never indicate the need for additional action. However, one of the premises of the ROP development process was that a PI should not be rejected just because the industry does a good job in the area covered. Some PIs measure important performance even though that performance is excellent (e.g., routine radiological releases).

The definition of the PI turned out to be problematic since the licensee annual reports to FEMA are not standardized. The guidance for reporting is contained in FEMA/REP-10, "Guide for the Evaluation of Alert and Notification Systems for Nuclear Power Plants." The guidance asks for a simple average of all regularly conducted tests, which is interpreted to be successful tests divided by tests times 100, for a percentage which represents the simple average. FEMA considers 90% to be acceptable. However, many licensees report availability (e.g., days the sirens are operable divided by siren days times 100) for a percentage availability. Some licensees count the full time between siren tests as days lost when a siren is found inoperable, some count only the day of the test and the time to repair as lost. Under the guidance of the NRC Maintenance Rule, the time period of T/2, or half the time between tests is used to calculate availability. This last method is statistically correct, but is not known to be used by any EP programs for ANS statistics. The consensus view was that NRC could not ask for a PI definition that used a method different from the FEMA guidance, and so the FEMA guidance was used for the PI. This measurement is defined as "reliability" under the language of the NRC Maintenance Rule and is a measure of successful tests.

Stakeholders have expressed concern over the use of reliability because periods of known outage are not captured by the PI (e.g., when a siren is found out of service but repaired before the next test). It may be noted that availability is not conservative in all cases, for example:

When a siren fails and is repaired the same day, only 1 day of availability (out of 365) is lost. Where as with reliability, when a siren fails during a test, 1 of 26 annual tests is lost.

Overall it would seem that availability is a better measure because it more accurately reflects the status of the ANS. However, a change in Federal guidance is considered necessary before a change to the PI would be appropriate and the minor nature of the flaw in the current PI definition did not seem to justify the level of effort necessary for the change.

A four-quarter rolling average was chosen for the PI to align with the rest of the ROP PIs. This creates a difference with FEMA reporting which is on an annual basis. Further, many licensees do not report reliability to FEMA. This PI complicated their reporting because they would have differing numbers for the PI and annual FEMA report. Even for those using the FEMA guidance definition, only the fourth quarter report matches the report to FEMA.

6.3.1 Alert and Notification System Reliability PI Thresholds

An analysis of FEMA ANS reporting data was performed. The reported percentages were used irrespective of the method of calculation used. Twenty plants submitted 3 years of data. The average was 98%. A reliability rate lower than 90% would be unacceptable to FEMA, per the FEMA/REP-10 guidance. The 90% rate appeared to define the "required

regulatory response band," or the Yellow band. It was thought appropriate to approximate the midpoint between the average reliability rate and the rate unacceptable to FEMA as the White band threshold and 94% was chosen. Most ANS systems operate well above 94%. In the 60 plant-years of data that were used to develop this threshold, only one plant was in the White band and no plants were in the Yellow band.

There was consensus with industry that these thresholds were appropriate because crossing a threshold indicated a program for which additional NRC inspection was appropriate. The historically excellent performance of industry in ANS maintenance contributed to a lack of concern regarding these thresholds.

7. OTHER PI PROGRAM ASPECTS CONSIDERED BUT NOT USED

Table 1 lists several aspects of the PI program that were considered during the development of the ROP, but not used, and the basis for not including them in the new oversight process.

| 8. SECURITY CORNERSTONE

| There are three PIs in this cornerstone. However, although the NRC is actively overseeing
| the security cornerstone, the Commission has decided that the description of these PIs and
| their results will not be publicly available to ensure that potentially useful information is not
| provided to a possible adversary.

| Basis Summary Sheet | |
|--|---------------------------------------|
| Performance Indicator: Unplanned Scrams per 7000 Critical Hours | Cornerstone: Initiating Events |
| Objective: This indicator monitors the number of unplanned scrams. It measures the rate of scrams per year of operation at power and provides an indication of initiating event frequency. | |
| Cornerstone Key Attributes Measured: Human Error, Procedure Quality, Design, and Equipment Performance | |
| <p>Calculational Method: The number of unplanned scrams during the previous four quarters, both manual and automatic, while critical per 7,000 hours.</p> <p>value = $\frac{\text{total unplanned scrams while critical in the previous 4 qtrs} \times 7,000 \text{ hrs}}{\text{total number of hours critical in the previous 4 qtrs}}$</p> <p>The value of 7,000 hours is used because it represents one year of reactor operation at an 80.0% capacity factor.</p> | |
| <p>Thresholds and Basis: The White/Yellow and Yellow/Red thresholds were determined using risk sensitivity studies as discussed in SECY-99-007, Attachment 2, Appendix H. The Green/White threshold was established to identify outliers from industry norms.</p> <p>Green/White > 3.0 White/Yellow > 6.0 Yellow/Red > 25.0</p> | |
| <p>Significant Changes and Basis: None, With Explanation</p> <p>Some industry representatives indicated that including manual scrams in the current scram PIs could result in nonconservative decision-making by operators during a plant event for which a manual scram is warranted. NRC conducted a 6-month pilot test with a proposed replacement for the “unplanned scrams per 7,000 critical hours” indicator.</p> <p>The replacement PI would likely miss some of the scrams that would be captured by the existing PI. Changes to address this concern would further complicate the PI and require increased effort for the NRC and Industry to ensure that the indicators are accurately reported.</p> <p>Based on the results of the pilot test, the current indicator remains unchanged. See Regulatory Information Summary, 2002-04 for more details.</p> | |

Figure 1 Unplanned Scrams per 7000 Critical Hours Basis Summary Sheet

| Basis Summary Sheet | |
|--|---------------------------------------|
| Performance Indicator: Unplanned Scrams with Complications | Cornerstone: Initiating Events |
| Objective: This indicator monitors that subset of unplanned automatic and manual scrams while critical that require additional operator actions as determined by the flow chart in NEI 99-02 that are more risk significant than uncomplicated scrams. | |
| Cornerstone Key Attributes Measured: Human Error, Procedure Quality, Design, and Equipment Performance | |
| <p>Calculational Method: The indicator is determined using the values reported for the previous 4 quarters as follows:</p> <p>value = total unplanned scrams while critical in the previous 4 quarters involving the following six actions or conditions that have the potential to complicate the post trip recovery: reactivity control, pressure control (BWRs)/turbine trip (PWRs), availability of power to emergency busses, actuation of emergency injection sources, availability of main feedwater, and the use of emergency operating procedures (EOPs) to address complicated scrams.</p> | |
| <p>Thresholds and Basis: The Green/White threshold was established to identify outliers from industry norms.</p> <p>Green/White > 1.0</p> | |
| <p>Significant Changes and Basis:</p> <ol style="list-style-type: none"> 1. March 2000 - Per NEI 99-02, Rev. 0, lowered the Green/White threshold from 4.0 to 2.0 based on a review of the historical data submitted in January 2000. 2. Some industry representatives indicated that including manual scrams in the current scram PIs could result in non-conservative decision-making by operators during a plant event for which a manual scram is warranted. NRC conducted a 6-month pilot test with a proposed replacement for the "scrams with loss of normal heat removal" indicator. The replacement PI would likely miss some of the scrams that would be captured by the existing PI. Changes to address this concern would further complicate the PI and require increased effort for the NRC and Industry to ensure that the indicators are accurately reported. Based on the results of the pilot test, the definition and the clarifying notes of current indicator has been slightly modified to add clarity. See Regulatory Information Summary, 2002-04 more details. 3. July 2007 - Replaced Scrams with Loss of Normal Heat Removal (LONHR) PI with Unplanned Scrams with Complications (USwC). The LONHR PI had resulted in many Frequently Asked Questions (FAQs) since the initiation of the ROP and had been the subject of two prior regulatory issue summaries. The USwC is designed to identify facilities that are outliers in complications that can elevate the risk of an unplanned manual or automatic reactor trip or scram. The USwC PI is based on a one year rolling time-frame, such that it represents more current performance than the LONHR PI, which is based on three years. It is expected that the number of plants that receive increased regulatory oversight based on the new PI will be similar to that of the LONHR PI. See Regulatory Issue Summary 2007-12. | |

Figure 2 Unplanned Scrams with Complications Basis Summary Sheet

| Basis Summary Sheet | |
|---|---------------------------------------|
| Performance Indicator: Unplanned Power Changes per 7000 Critical Hours | Cornerstone: Initiating Events |
| <p>Objective: This indicator monitors the number of unplanned power changes (excluding scrams) that could have, under other plant conditions, challenged safety functions. It may provide leading indication of risk-significant events but is not itself risk-significant. The indicator measures the number of plant power changes for a typical year of operation at power.</p> | |
| <p>Cornerstone Key Attributes Measured: Human Error, Procedure Quality, Design, and Equipment Performance</p> | |
| <p>Calculational Method: The number of unplanned changes (initiated less than 72 hrs from the time of discovery of an off-normal condition) in reactor power of greater than 20% full-power, per 7,000 hours of critical operation excluding manual and automatic scrams.</p> <p>The indicator is determined using the values reported for the previous four quarters as follows:</p> $\text{value} = \frac{(\text{total number of unplanned power changes over the previous 4 qtrs}) \times 7,000 \text{ hrs}}{\text{total number of hours critical during the previous 4 qtrs}}$ | |
| <p>Thresholds and Basis: The threshold was determined using the industry mean plus one standard deviation based on data from July 1, 1995, through June 30, 1997. Only a Green/White threshold was established since this PI is not a direct measure of risk.</p> <p>Green/White > 6 White/Yellow - N/A Yellow/Red - N/A</p> | |
| <p>Significant Changes and Basis: March 2000 - Per NEI 99-02, Rev. 0, the Green/White threshold was lowered from 8 to 6 based on a review of the historical data submitted in January 2000.</p> | |

Figure 3 Unplanned Power Changes per 7000 Critical Hours Basis Summary Sheet

Basis Summary Sheet

Performance Indicator: Mitigating System Performance Index

Cornerstone: Mitigating Systems

Objective: The purpose of the Mitigating System Performance Index indicator is to monitor the readiness of important safety systems to perform their safety functions in response to off-normal events or accidents.

Cornerstone Key Attributes Measured: Configuration Control, Equipment Performance, and Human Performance

Calculational Method: MSPI is the sum of changes in a simplified core damage frequency evaluation for a monitored system resulting from differences in unavailability and unreliability relative to updated industry standard baseline values. MSPI is a twelve quarter rolling average that uses risk-based performance thresholds of 1E-6, 1E-5, and 1E-4 CDF_{index}.

The performance indicator is calculated separately for each of the following four systems for each reactor type.

BWRs

- High Pressure Injection System (HPCI, HPCS)
- Heat Removal System (RCIC)
- Residual Heat Removal System (RHR)
- Emergency AC Power System (EDG)
- Support Cooling Water System

PWRs

- High Pressure Injection System (HPSI)
- Heat Removal System (AFW)
- Residual Heat Removal System (RHR)
- Emergency AC Power System (EDG)
- Support Cooling Water System

The indicator for each of these systems is the unavailability and unreliability over the previous 12 quarters.

Thresholds and Basis: The Safety System Unavailability thresholds determined following a sensitivity analysis of risk information as discussed in SECY-99-007, Attachment 2, Appendix H have been deleted and replaced by the MSPI thresholds:

| Indicator | (White) | (Yellow) | (Red) |
|---|------------------------------------|-----------------------------------|-------------------------------|
| | Increased Regulatory Response Band | Required Regulatory Response Band | Unacceptable Performance Band |
| Mitigating Systems Performance Index, Emergency AC Power Systems | > 1.0E-06 OR PLE = YES | > 1.0E-05 | > 1.0E-04 |
| Mitigating Systems Performance Index, High Pressure Injection Systems | > 1.0E-06 OR PLE = YES | > 1.0E-05 | > 1.0E-04 |
| Mitigating Systems Performance Index, Heat Removal Systems | > 1.0E-06 OR PLE = YES | > 1.0E-05 | > 1.0E-04 |
| Mitigating Systems Performance Index, Residual Heat Removal Systems | > 1.0E-06 OR PLE = YES | > 1.0E-05 | > 1.0E-04 |
| Mitigating Systems Performance Index, Cooling Water Systems | > 1.0E-06 OR PLE = YES | > 1.0E-05 | > 1.0E-04 |

| Basis Summary Sheet | |
|---|--|
| Performance Indicator: Mitigating System Performance Index | Cornerstone: Mitigating Systems |
| <p>Significant Changes and Basis:</p> <p>March 1999 - Per SECY-99-007A, the Green/White thresholds for both BWR RHR and PWR HPSI were raised from > 1.5 % to > 2.0 % to match the industry's year 2000 goals for those systems. The Green/White threshold for Emergency Power was raised from > 2.5 % to > 3.8 % to accommodate 2-week allowed outage times.</p> <p>March 2000 - Per NEI 99-02, Rev. 0, the following Green/White thresholds were changed based on a review of historical data submitted in January 2000.</p> <ul style="list-style-type: none"> • Emergency Power (both \leq 2 EDG and > 2 EDG) for All Plants, lowered from > 3.8 % to > 2.5 % • RHR for BWRs and PWRs lowered from > 2.0 % to > 1.5 % • HPSI for PWRs lowered from > 2.0 % to > 1.5 % <p>Per NEI 99-02, Rev.2:</p> <ul style="list-style-type: none"> • Fault exposure hours resulting from demand failures are excluded from this indicator; and, until reliability indicators are implemented, demand-failure events will be evaluated by means of the significance determination process (SDP). • Crediting operator recovery actions to reduce unavailable hours will be allowed under certain conditions. • Design deficiencies will be treated according to one of the two categories that they fall into (see NEI 99-02 for details) <p>April 2006 - NRC and the nuclear industry adopted a new risk informed performance indicator index (Mitigating System Performance Index [MSPI]) as a replacement for the safety system unavailability performance indicators.</p> | |

Figure 4 Mitigating System Performance Index Basis Summary Sheet

| Basis Summary Sheet | | | | | | | | | | | | | |
|--|--|---------------------|--------------------|---------------------|-------------------|------|-------|-----|-----|------|-------|-----|-----|
| Performance Indicator: Safety System Functional Failures | Cornerstone: Mitigating Systems | | | | | | | | | | | | |
| <p>Objective: This indicator monitors events or conditions that alone prevented, or could have prevented, the fulfillment of the safety function of structures or systems that are needed to:</p> <ul style="list-style-type: none"> (a) Shut down the reactor and maintain it in a safe shutdown condition; (b) Remove residual heat; (c) Control the release of radioactive material; or (d) Mitigate the consequences of an accident. | | | | | | | | | | | | | |
| Cornerstone Key Attributes Measured: Equipment Performance and Procedure Quality | | | | | | | | | | | | | |
| <p>Calculational Method: The number of events or conditions that alone prevented, or could have prevented, the fulfillment of the safety function of structures or systems in the previous four quarters.</p> <p>unit value = number of safety system functional failures in previous four quarters</p> | | | | | | | | | | | | | |
| <p>Thresholds and Basis: These thresholds were determined using the industry mean plus one standard deviation based on data from July 1, 1995, through June 30, 1997. Only a Green/White threshold was established since this PI is not a direct measure of risk.</p> <table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th></th> <th style="text-align: center;"><u>Green/White</u></th> <th style="text-align: center;"><u>White/Yellow</u></th> <th style="text-align: center;"><u>Yellow/Red</u></th> </tr> </thead> <tbody> <tr> <td>BWRs</td> <td style="text-align: center;">> 6.0</td> <td style="text-align: center;">N/A</td> <td style="text-align: center;">N/A</td> </tr> <tr> <td>PWRs</td> <td style="text-align: center;">> 5.0</td> <td style="text-align: center;">N/A</td> <td style="text-align: center;">N/A</td> </tr> </tbody> </table> | | | <u>Green/White</u> | <u>White/Yellow</u> | <u>Yellow/Red</u> | BWRs | > 6.0 | N/A | N/A | PWRs | > 5.0 | N/A | N/A |
| | <u>Green/White</u> | <u>White/Yellow</u> | <u>Yellow/Red</u> | | | | | | | | | | |
| BWRs | > 6.0 | N/A | N/A | | | | | | | | | | |
| PWRs | > 5.0 | N/A | N/A | | | | | | | | | | |
| <p>Significant Changes and Basis: March 2000 - Per NEI 99-02, Rev. 0, raised the Green/White threshold for BWRs from 5.0 to 6.0 based on a review of historical data submitted in January 2000.</p> | | | | | | | | | | | | | |

Figure 5 Safety System Functional Failures Basis Summary Sheet

| Basis Summary Sheet | |
|--|---------------------------------------|
| Performance Indicator: Reactor Coolant System Specific Activity | Cornerstone: Barrier Integrity |
| Objective: This indicator monitors the integrity of the fuel cladding, the first of the three barriers to prevent the release of fission products. It measures the radioactivity in the RCS as an indication of functionality of the cladding. | |
| Cornerstone Key Attributes Measured: Design Control, Configuration Control, Cladding Performance, Procedure Quality, and Human Performance | |
| <p>Calculational Method: The maximum monthly RCS activity in micro-Curies per gram ($\mu\text{Ci/gm}$) dose equivalent Iodine-131 per the technical specifications, and expressed as a percentage of the technical specification limit.</p> <p style="text-align: center;">unit value = $\frac{\text{the maximum monthly value of calculated activity}}{\text{Technical Specification limit}} \times 100$</p> | |
| <p>Thresholds and Basis: The thresholds for this indicator have a regulatory basis which is only indirectly linked to a risk basis and were set at 50 percent and 100 percent of the technical specification limit.</p> <p>Green/White > 50.0 % White/Yellow > 100.0 % Yellow/Red - N/A</p> | |
| Significant Changes and Basis: None | |

Figure 6 Reactor Coolant System Specific Activity Basis Summary Sheet

| Basis Summary Sheet | |
|---|---------------------------------------|
| Performance Indicator: Reactor Coolant System Leakage | Cornerstone: Barrier Integrity |
| <p>Objective: This indicator monitors the integrity of the RCS pressure boundary, the second of the three barriers to prevent the release of fission products. It measures RCS Identified Leakage as a percentage of the technical specification allowable Identified Leakage to provide an indication of RCS integrity.</p> | |
| <p>Cornerstone Key Attributes Measured: RCS Equipment & Barrier Performance</p> | |
| <p>Calculational Method: The maximum RCS Identified Leakage in gallons per minute each month per the technical specifications and expressed as a percentage of the technical specification limit.</p> <p style="text-align: center;">unit value = $\frac{\text{the maximum monthly value of identified leakage}}{\text{Technical Specification limiting value}} \times 100$</p> | |
| <p>Thresholds and Basis: The thresholds for this indicator have a regulatory basis as opposed to a direct risk basis and will be set at 50 percent and 100 percent of the technical specification limit.</p> <p>Green/White > 50.0 % White/Yellow > 100.0 % Yellow/Red - N/A</p> | |
| <p>Significant Changes and Basis: None</p> | |

Figure 7 Reactor Coolant System Leakage Basis Summary Sheet

| Basis Summary Sheet | |
|---|--|
| Performance Indicator: Drill/Exercise Performance | Cornerstone: Emergency Preparedness |
| Objective: This indicator monitors timely and accurate licensee performance in drills and exercises when presented with opportunities for classification of emergencies, notification of offsite authorities, and development of protective action recommendations (PARs). | |
| Cornerstone Key Attributes Measured: Facilities and Equipment, Procedure Quality, and Emergency Response Organization (ERO) Performance. | |
| <p>Calculational Method: The percentage of all drill, exercise, and actual event opportunities that were performed timely and accurately during the previous eight quarters.</p> <p>The site average values for this indicator are calculated as follows:</p> $\frac{\text{\# of timely \& accurate classifications, notifications, \& PARs from DE \& AEs* during previous 8 quarters}}{\text{The total opportunities to perform classifications, notifications \& PARs during the previous 8 quarters}} \times 100$ <p>*DE &AEs = Drills, Exercises and Actual Events</p> | |
| <p>Thresholds and Basis: The Green/White threshold was determined based on an analysis of emergency preparedness exercise inspection findings from 1994 to 1997. These inspection findings were analyzed to determine the successful performance and the number of opportunities. The threshold was then developed by taking the past 4 year average of successful performance, diminishing it by one standard deviation, and rounding it up. The White/Yellow threshold was then set 3 standard deviations below the industry average, rounded up.</p> <p>Green/White < 90.0 % White/Yellow < 70.0 % Yellow/Red - N/A</p> | |
| <p>Significant Changes in Scope or Basis: March 1999 - Per SECY-99-007A, the short term (6 month) portion of this indicator was dropped.</p> | |

Figure 8 DEP Basis Summary Sheet

| Basis Summary Sheet | |
|---|--|
| Performance Indicator: Emergency Response Organization Drill Participation | Cornerstone: Emergency Preparedness |
| Objective: This indicator measures the percentage of key Emergency Response Organization (ERO) members who have participated recently in drills and exercises or in an actual event. | |
| Cornerstone Key Attributes Measured: Facilities and Equipment, Procedure Quality, and ERO performance. | |
| <p>Calculational Method: The percentage of key ERO members that have participated in a drill, exercise, or actual event during the previous eight quarters, as measured on the last calendar day of the quarter.</p> <p>The site indicator is calculated as follows:</p> $\frac{\text{\# of Key ERO Members that have participated in a drill, exercise or actual event during the previous 8 quarters}}{\text{Total number of Key ERO Members}} \times 100$ | |
| <p>Thresholds and Basis: No past data was readily available to help set the threshold values. A group of emergency preparedness experts composed of NRC and industry representatives came to an agreement to utilize these thresholds for ERO readiness.</p> <p>Green/White < 80.0 % White/Yellow < 60.0 % Yellow/Red - N/A</p> | |
| <p>Significant Changes in Scope or Basis: March 1999 - Per SECY-99-007A, the indicator was modified to state that only key ERO positions are included. Additionally, the long term (36 month) portion of this indicator was dropped.</p> | |

Figure 9 ERO Drill Participation Basis Summary Sheet

| Basis Summary Sheet | |
|---|--|
| Performance Indicator: Alert and Notification System Reliability | Cornerstone: Emergency Preparedness |
| <p>Objective: This indicator monitors the reliability of the offsite Alert and Notification System (ANS), a critical link for alerting and notifying the public of the need to take protective actions. It provides the percentage of the sirens that are capable of performing their safety function as measured by the testing program.</p> | |
| <p>Cornerstone Key Attributes Measured: Facilities and Equipment</p> | |
| <p>Calculational Method: The percentage of ANS sirens that are capable of performing their function, as measured by periodic siren testing in the previous 12 months.</p> <p>The site value for this indicator is calculated as follows:</p> $\frac{\text{\# of successful siren tests in the previous 4 quarters}}{\text{total number of siren tests in the previous 4 quarters}} \times 100$ | |
| <p>Thresholds and Basis: The Green/White threshold was determined based on an analysis of yearly sirens availability for 1995, 1996 and 1997 for approximately 20 plants. Based on this data, a group of emergency preparedness experts composed of NRC and industry representatives came to an agreement to utilize a 94% threshold. The White/Yellow threshold is based on the FEMA acceptance criteria for siren reliability, i.e., an ANS operating below this level is unacceptable and an action plan for correction must be submitted to FEMA.</p> <p>Green/White < 94.0 % White/Yellow < 90.0 % Yellow/Red - N/A</p> | |
| <p>Significant Changes in Scope or Basis: March 1999 - Per SECY-99-007A, this indicator was changed to measure siren reliability by calculating the percentage of successful siren tests rather than the percentage of time availability of the sirens. The FEMA guidance on ANS requires that testing data be submitted. While many sites calculate and submit availability measures, the guidance suggests a simple percentage based on reliability. Many sites simply comply with the FEMA guidance. It was thought appropriate to align the PI definition with the approved national guidance. The threshold was also reevaluated at this time and determined to be appropriate. Comments have been received regarding the appropriateness of the reliability measure because known periods of unavailability may not be covered by the PI. Additionally, the regulatory significance of unexpected or unknown siren outages are not captured as completely by reliability as would be the case if availability were used. NRC is considering pursuing a change to the FEMA siren guidance to require availability to be reported. If this is accomplished the PI definition would also be changed.</p> | |

Figure 10 ANS Reliability Basis Summary Sheet

| Basis Summary Sheet | |
|---|---|
| Performance Indicator: Occupational Exposure Control Effectiveness | Cornerstone: Occupational Radiation Safety |
| Objective: The indicator monitors the control of access to and work activities within radiologically-significant areas of the plant and occurrences involving degradation or failure of radiation safety barriers that result in readily-identifiable unintended dose. | |
| Cornerstone Key Attributes Measured: Plant Facilities/Equipment & Instrumentation, Program/Process, and Human Performance. | |
| <p>Calculational Method: The performance indicator is the sum of the following:</p> <ul style="list-style-type: none"> - Technical specification high radiation area (>1 rem per hour) occurrences - Very high radiation area occurrences - Unintended exposure occurrences <p>The indicator is determined by summing the reported number of occurrences for each of the three data elements during the previous 4 quarters.</p> | |
| <p>Thresholds and Basis: The thresholds are based on a review and analysis of quarterly occupational radiological occurrence data provided by 28 licensee sites for the period January 1996 through September 1998. Based on this data, an expert panel composed of NRC and industry representatives agreed to the following thresholds.</p> <p>Green/White > 2 White/Yellow > 5 Yellow/Red - N/A</p> | |
| <p>Significant Changes in Scope or Basis:</p> <p>March 1999 - Per SECY-99-007A, the short term (12 month) portion of this indicator was dropped.</p> <p>March 2000 - Per NEI 99-02, Rev. 0, revised the timeframe for the indicator from 12 quarters (36 months) to 4 quarters (12 months) and lowered the Green/White threshold from >5 to >2 and lowered the White/Yellow threshold from >11 to >5 based on a review of historical data submitted in January 2000.</p> | |

Figure 11 Occupational Exposure Control Effectiveness Basis Summary Sheet

| Basis Summary Sheet | | | | | | | | | | | | | | | | |
|---|---|------------------|------------|--------------|--|-------|------------|-------------------|------------|-------------|--|-----------|--------------|--|---|---------------|
| Performance Indicator: RETS/ODCM Radiological Effluent Occurrence | Cornerstone: Public Radiation Safety | | | | | | | | | | | | | | | |
| Objective: To assess the performance of the radiological effluent control program. | | | | | | | | | | | | | | | | |
| Cornerstone Key Attributes Measured: Plant Facilities/Equipment & Instrumentation, Program/Process, and Human Performance. | | | | | | | | | | | | | | | | |
| <p>Calculational Method: Radiological effluent release occurrences per site that exceed the values listed below:</p> <table style="width: 100%; border-collapse: collapse;"> <tbody> <tr> <td style="width: 25%;">Liquid Effluents</td> <td style="width: 50%;">Whole Body</td> <td style="width: 25%;">1.5 mrem/qtr</td> </tr> <tr> <td></td> <td>Organ</td> <td>5 mrem/qtr</td> </tr> <tr> <td>Gaseous Effluents</td> <td>Gamma Dose</td> <td>5 mrads/qtr</td> </tr> <tr> <td></td> <td>Beta Dose</td> <td>10 mrads/qtr</td> </tr> <tr> <td></td> <td>Organ Doses from I-131, I-133, H-3 & Particulates</td> <td>7.5 mrems/qtr</td> </tr> </tbody> </table> <p>Number of RETS/ODCM Radiological Effluent Occurrences per site in the previous four quarters.</p> | | Liquid Effluents | Whole Body | 1.5 mrem/qtr | | Organ | 5 mrem/qtr | Gaseous Effluents | Gamma Dose | 5 mrads/qtr | | Beta Dose | 10 mrads/qtr | | Organ Doses from I-131, I-133, H-3 & Particulates | 7.5 mrems/qtr |
| Liquid Effluents | Whole Body | 1.5 mrem/qtr | | | | | | | | | | | | | | |
| | Organ | 5 mrem/qtr | | | | | | | | | | | | | | |
| Gaseous Effluents | Gamma Dose | 5 mrads/qtr | | | | | | | | | | | | | | |
| | Beta Dose | 10 mrads/qtr | | | | | | | | | | | | | | |
| | Organ Doses from I-131, I-133, H-3 & Particulates | 7.5 mrems/qtr | | | | | | | | | | | | | | |
| <p>Thresholds and Basis: The thresholds were based on a review and graphical analysis of Licensee Event Report data associated with process radiation monitoring system activities provided by all sites for the period from January 1995 through December 1997. Based on this data, an expert panel composed of NRC and industry representatives agreed to the following thresholds.</p> <p>Green/White > 1 White/Yellow > 3 Yellow/Red - N/A</p> | | | | | | | | | | | | | | | | |
| <p>Significant Changes in Scope or Basis: March 1999 - Per SECY-99-007A, the long term (36 month) portion of this indicator was dropped.</p> | | | | | | | | | | | | | | | | |

Figure 12 RETS/ODCM Radiological Effluent Occurrence Basis Summary Sheet

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Figure 13 Not Used

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Figure 14 Not Used

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Figure 15 Not Used

| Table 1 PI Program Aspects Considered But Not Used | |
|---|--|
| PI Program Aspects Considered | Basis for Not Including in ROP |
| Safety System Actuations (SSA) PI | Based on benchmarking results, the SSA indicator did not differentiate between plants or add any new information. During the benchmarking, only one plant, a declining trend plant, was in the white band for this PI, and it was also in the white band for Transients. Lowering the SSA indicator threshold by one would capture two average plants and three watch list plants, all of which were identified by other PIs. In addition, the SSA indicator did not show a strong correlation to the discussion plants in the Arthur Andersen's analysis. For these reasons, a SSA PI was not included in the proposed set of indicators. More detailed information on the benchmarking results can be found in Commission Paper SECY-99-007, Attachment 2, Appendix I. |
| Containment Leakage PI | <p>The barrier integrity PIs are fundamentally different from the other indicators used in the ROP. They are intended to provide indications of the integrity of the three barriers to the release of radioactive material from the reactor core. They use readily available information that licensees are required to collect by technical specifications (TS). The thresholds are set as percentages of the TS limit. However, in practice, plants typically operate very far below the TS limits, so that the Green/White threshold would rarely be exceeded. In addition, because licensees use a variety of methods to measure compliance with these TS (e.g., some measure as-found containment leakage while others record only as-left leakage), the data reported can vary considerably from plant to plant.</p> <p>The Containment Leakage PI was therefore eliminated because of the varied methods used to calculate containment leakage and the lack of valid data points, since meaningful information is only obtained during outages. The key attributes of containment barrier integrity previously covered by this PI are covered by baseline inspection procedure (IP) 71111.22, Surveillance Testing, which includes reviewing containment isolation valve leakage testing.</p> |
| Inclusion of effluent radiation monitors as a Performance Indicator | This aspect was rejected because the use of the effluent radiation monitors does not prevent the licensee from being able to assess the dose from radiological effluent releases. Other methods involving sampling, analysis and calculations are reliable and accurate. |

Table 1 PI Program Aspects Considered But Not Used (continued)

| PI Program Aspects Considered | Basis for Not Including in ROP |
|--|--|
| EP Drill Objectives Met | This is an outcome measure but the number of drill objectives in a drill package is non-standard and meeting the objective is subjective and variable between sites. |
| EP Corrective Actions Completed On Time | This is an outcome measure but, criteria for documentation of corrective actions varies widely and the criteria for "on time" is not standard. Differences in site programs were seen as too great to standardize this measure into a PI. |
| EP Training Conducted | This is an activity measure rather than an outcome measure in that completion does not necessarily ensure performance. |
| EP Facility and/or Equipment Status | Used in many site PI but seen as non-standard across industry and subjective as to measure of success. |
| Successful ERO Activation Tests | Seen as potential PI, but programs differ greatly and there is no requirement for such tests. |
| 14-day Reporting Requirement for PI Data | The original requirement for reporting PI data was 14 days. Industry comment and feedback obtained during the 6-month pilot program indicated that the period should be extended to ensure accurate data reporting. As documented in Commission Paper SECY-00-0049, the reporting period for PIs was extended from 14 to 21 days from the end of each quarter. |

Table 2 Revision History For IMC 0308, Attachment 1

| Commitment Tracking Number | Issue Date | Description of Change | Training Needed | Training Completion Date | Comment Resolution Accession Number |
|----------------------------|-----------------------|--|-----------------|--------------------------|-------------------------------------|
| N/A | 11/08/07 CN 07-035 | This IMC has been revised to incorporate changes in response to Feedback Form 0308-1190 , updated for MSPI, Unplanned Scrams with Complications, updated Security Cornerstone including objectives, clarify definitions to performance band colors, delete reference numbers and incorporate editorial comments. | None | N/A | ML072830140 |
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