# TEMPORARY INSTRUCTION 2515/149

## MITIGATING SYSTEMS PERFORMANCE INDEX PILOT VERIFICATION

CORNERSTONE: MITIGATING SYSTEMS

APPLICABILITY: This temporary instruction (TI) applies to all holders of operating licenses for light water nuclear power reactors participating in the Mitigating Systems Performance Index (MSPI) pilot program.
(Limerick 1/2, Millstone 2/3, Hope Creek, Salem 1/2, Surry 1/2, Braidwood 1/2, Prairie Island 1/2, Palo Verde 1/2/3, SONGS 2&3, & South Texas 1/2)

### 2515/149-01 OBJECTIVE

The objective of this TI is to verify that participating licensees have correctly implemented the MSPI pilot guidance for reporting unavailability and unreliability of the monitored safety systems (see MSPI guidance documents Appendix A). This information collection will help the NRC staff decide whether to adopt the MSPI.

### 2515/149-02 BACKGROUND

02.01 Purpose of the MSPI

The MSPI was developed to replace the Safety System Unavailability (SSU) indicators currently in use in the ROP. The SSU indicators have several weaknesses, including the following: (1) the use of design basis functions rather than risk-significant functions; (2) the use of thresholds developed from generic plant models rather than from plant-specific models; (3) the use of fault exposure unavailable hours as a surrogate for unreliability rather than monitoring unreliability directly, and (4) the cascading of support system unavailability to the monitored systems rather than monitoring support systems separately. The MSPI monitors the unavailability and the unreliability of the same four safety systems that comprise the SSU; it also monitors the cooling water support systems for those four safety systems.

02.02 Objectives of the Pilot Program

a. To satisfy the NRC's performance goals:
   1. Maintain safety. The MSPI should be capable of discerning significant departures from expected performance that warrant additional attention.
   2. Increase public confidence. The MSPI should be at least as understandable as the current SSU indicators.
   3. Improve the efficiency and effectiveness of NRC activities and processes. Fewer NRC resources are spent resolving MSPI issues (i.e., SDPs, FAQs, feedback forms, etc.) than would have been spent on SSU issues.
   4. Reduce unnecessary regulatory burden . Overall licensee resources applied to the ROP, Maintenance Rule, and PRA applications are less than the resources currently applied to those applications.

b. To exercise the full calculational methodology to determine the ability of licensees to report the MSPI data accurately and with minimal need for clarification.

c. To compare calculated MSPI values to those obtained from the SPAR Rev. 3 models and to the current SSU PI data reported under the ROP and ascertain whether the MSPI provides an acceptable indication of system performance and resolves the concerns with the SSU PIs.

d. To identify the number of situations in which a single failure results in an MSPI crossing the green/white threshold.

e. To define acceptable false positive and false negative rates.

f. To evaluate the appropriateness of the plant-specific baseline values used in the MSPI.

g. To evaluate data collection inconsistencies between the MSPI, the Maintenance Rule, and PRA applications.

h. To evaluate the potential for the MSPI to produce unintended consequences.

i. To validate the baseline unavailability and unreliability values used in the MSPI.

02.03 MSPI Pilot Plants

| Region I | Region II | Region III | Region IV | |
|---|---|---|---|---|
| Limerick 1,2 | | Surry 1,2 | Braidwood 1,2 | Palo Verde 1,2,3 |
| Millstone 2,3 | | | Prairie Island 1,2 | San Onofre 2,3 |
| Hope Creek | | | | South Texas 1,2 |
| Salem 1,2 | | | | |

02.04 MSPI Pilot Systems

BWRs: EAC
HPCI/HPCS/FWCI

RCIC
RHR
cooling water support systems (ESW and CCW or their equivalents)

PWRs: EAC
HPSI
AFW
RHR
cooling water support systems (ESW and CCW or their equivalents)

02.05 MSPI Pilot Success Criteria. The MSPI success criteria listed below will be met if there is general agreement among internal and external stakeholders.

a. The occurrence of a single failure of an MSPI monitored component by itself, absent any other failures or unavailability, should rarely exceed the green/white MSPI threshold as measured from the baseline value. The term "rare" is defined as minimizing the inconsistencies across plants, within plants, and within systems such that there is no undue burden on resources, and the objective of having consistent publicly displayed results can be achieved.

b. False positive and false negative rates can be established for the chosen statistical method, and instances where the MSPI cannot meet the criteria are rare.

c. Instances where the results from the MSPI calculational methodology are not consistent with the SPAR-3 models are rare and the differences are explainable.

d. The MSPI pilot plant participants can identify and compile the risk significant functions for the monitored systems in a readily inspectable format and can compile a set of predetermined success criteria for those risk significant functions.

e. The active components in the monitored systems are appropriate for inclusion in the MSPI and are a manageable number of components under the MSPI.

f. By the end of the pilot, MSPI data can be accurately reported and quality checked.

g. By the end of the pilot, inspection procedures and MSPI pilot guidelines are sufficiently detailed to minimize MSPI questions and NRC feedback.

h. MSPI questions and NRC feedback do not reveal any unresolvable issues.

i. Data collection inconsistencies between the maintenance rule and the MSPI can be reconciled in order to eliminate or significantly reduce separate reporting.

j. Differences between the linear approximation models generated by licensee PRAs and those generated by the NRC SPAR models can be reconciled.

k. The MSPI produces no new unintended consequences that cannot be resolved.

The pilot program consists of six months of data collection and reporting by the pilot plants concurrent with about six months of table top exercises. Upon completion of these efforts, the staff will evaluate the results against the success criteria over the next four to six months. If the staff determines that the pilot program has been successful the MSPI will be incorporated into the ROP PI program. The MSPI will then provide the measure of risk associated with any event or condition that involves the failure of no more than one component or the unavailability of no more than one train. The color assigned to such events or conditions will be determined by the MSPI and no SDP analysis will be performed on those events or conditions. For more complicated events, however, involving more than one failure or unavailability of more than one train, the SDP will be used to determine the risk significance of the event.

2515/149-03 INSPECTION REQUIREMENTS

03.01 General. There are no regulatory requirements for this program and licensee participation is voluntary. However, participating licensees have agreed to follow the guidance and reporting format described in Appendix A to this TI to ensure consistency in reporting and to aid in validation of the pilot results. The NRC has developed a Web site (http://www.nrc.gov/NRR/OVERSIGHT/ASSESS/mspi.html) to keep all stakeholders informed of pilot program activities. The site contains links to the guidance documents and other important information. The NRC will continue to update this Web site as new information becomes available. The site will not stipulate additional inspection requirements beyond those identified in this TI.

On a sample basis, the inspector will audit the development of the MSPI PIs for the support cooling water system and one of the systems currently monitored in the SSU PI using the inspection criteria described below. Each participating plant should have developed, prior to September 1, 2002, a list of its Maintenance Rule high safety-significant (or risk-significant) functions and success criteria for all systems monitored in the MSPI.

03.02 Risk-Significant Functions. Using the guidance in Appendix A, the inspector will confirm that the licensee has correctly identified the risk-significant functions for trains or segments that are modeled within the audited systems.

03.03 Success Criteria

a. For each risk-significant function identified in Section 03.02, the inspector will confirm that the licensee has correctly identified the PRA success criteria at the train or segment level.

b. For each train or segment evaluated above, the inspector will confirm that the licensee has developed success criteria that is consistent with and/or supported by the licensee's PRA analyses.

c. The senior reactor analyst (SRA) will verify that the PRA functional success criteria for the MSPI are consistent with the SDP and SPAR model assumptions.

03.04 Unreliability Boundary Definition

a. The inspector will use the guidance in Appendix A to identify all active components that could fail the train or system. This list will be compared with the licensee's list and all discrepancies will be discussed with the SRA.

b. The inspector will ensure that all of the active components identified above are accounted for in the site-specific NEI spreadsheet.

c. The SRA will compare the licensee's list of active components to the SDP and SPAR models to verify completeness and consistency.

03.05 Train/Segment Unavailability Boundary Definition

a. The inspector will confirm that the licensee has clearly defined the scope of the trains or segments that are being monitored for tracking unavailability.

b. The inspector will confirm that these boundaries are consistent with the guidance in Appendix A.

03.06 Entry of Baseline Data - Planned Unavailability

a. The inspector will review the NEI spreadsheet, related operating logs and related condition reports to independently confirm the accuracy of the licensee's planned unavailability input data.

b. The inspector will confirm that the data inputs to the MSPI calculation is entered according to the guidance listed in Appendix A, as amended to accurately reflect plant-specific train and segment definitions and values.

c. The inspector will confirm that the unavailability time listed in the plant-specific spread sheet did occur and will confirm that unavailability time described in the logs/condition reports is accounted for in the totals.

03.07 Entry of Baseline Data - Unplanned Unavailability. The inspector will confirm that the information in Table 1 of Appendix A (Historical Unplanned Maintenance Unavailability Train Values) is correctly entered into the spreadsheet for the applicable trains.

03.08 Entry of Baseline Data - Unreliability. The inspector will confirm the information in Table 2 of Appendix A (Industry Priors and Parameters for Unreliability) is correctly entered into the spreadsheet for the active components.

03.09 Entry of Performance Data - Unavailability

a. The inspector will confirm the licensee's accuracy of estimate of critical hours by comparing that estimate with the critical hours reported in the Scrams per 7,000 Critical Hours PI or the critical hours reported in the monthly operating reports.

b. Using operating logs, corrective maintenance records, and condition reports, the inspector will confirm that the licensee's estimate of unavailability data for each component of the audited system is accurate.

c. The inspector will confirm that this data is being accurately entered into the plant- specific NEI spreadsheet.

03.10 Entry of Performance Data - Unreliability

a. For the selected audited systems, based on a review of related maintenance and test history, the inspector will confirm the accuracy of the failure data (demand failures, run/load failures, and failures to meet the risk-significant mission time, as applicable) for the identified active components for the most recent 12 quarters.

b. The inspector will confirm that valid demands and valid failures on demand for monitored at-power functions that occur while the reactor is shut down are included if the system was not able to perform the functions at power.

c. The inspector will confirm that failure data is correctly entered into the site-specific NEI spread sheet.

03.11 MSPI Calculation

a. The SRA will confirm that each monitored train has an associated unavailability Fussell-Vesely (F-V) coefficient derived from the licensee's updated PRA that was qualified for use by the staff prior to start of the MSPI pilot.

b. The inspector will confirm that the licensee is calculating a system-level unavail-ability index that accounts for any time a train was out of service for corrective or preventive maintenance.

c. The SRA will confirm that each monitored active component has an associated unreliability F-V coefficient derived from the licensee's updated PRA that was qualified for use by the staff prior to start of the MSPI pilot.

d. The inspector will confirm that the licensee is calculating a system-level unreliability index that includes the appropriate start and run demands and failures (and load demands and failures for EDGs) as described in Appendix A, to include the appropriate demands and failures that occur while the reactor is shutdown.

2515/149-04 GUIDANCE

Inspectors should confirm that licensees follow the guidance contained in Appendix A of this TI, including the guidance on the expected level of quality and accuracy of the data. However, licensees are exempt from the requirements of 10 CFR 50.9 for purposes of this voluntary MSPI pilot program.

Licensees will continue to report the existing SSU PIs in accordance with the guidance contained in NEI 99-02, Revision 2.

The MSPI pilot will require participating licensees to effectively capture the most recent three years of data prior to the start of the pilot program to ensure sufficient data for MSPI calculational purposes. The data can be captured by using 6 months of actual data with the additional data captured through best-estimate means.

04.01 General

a. During the 6-month pilot program, performance data will be collected and reported monthly but aggregated quarterly. That is, the report for the first month in a quarter will contain data for that month only, but the second and third monthly reports for the same quarter will contain the sum of the data for the current month and all previous months in that quarter.

b. Questions raised during the pilot by the licensees or other stakeholders will be addressed through the MSPI Working Group. The working group will plan to hold public meetings monthly to handle any questions or concerns resulting from the MSPI pilot program.

c. For purposes of this pilot, old or existing SSU FAQs will be applicable during the pilot, unless they conflict with specific MSPI pilot guidance.

d. Inspectors may continue to use the feedback process to address questions or issues pertaining to the MSPI pilot program. Send the forms via e-mail to REACTOROVERSIGHT with a copy to the appropriate regional branch chief.

04.02 Risk-Significant Functions. For PWR pilot participants, RHR unavailability will only be included for the risk-significant safety functions required for at-power accident mitigation. Depending on the plant-specific definition of what is a required risk-significant function for at-power accident mitigation, RHR unavailability may be incurred during power operation for a function that is only required by technical specifications to be operable when the reactor is shutdown. Refer to Appendix A for additional guidance for PWR RHR unavailability.

04.03 Success Criteria. Any inconsistencies or omissions should be noted in the inspection report and reported to the regional projects branch chief. If there are no inconsistencies between the licensee's MSPI list and the SPAR model and SDP, then a notation in the inspection report should state this observation.

The licensee may use design-basis success criteria in lieu of best-estimate PRA success criteria.

04.04 Unreliability Boundary Definition. Any inconsistencies or omissions should be noted in the inspection report and reported to the regional projects branch chief. If there are no inconsistencies between the licensee's MSPI list and the SPAR model and SDP, then a notation in the inspection report should state this observation.

04.05 Train/Segment Unavailability Boundary Definition. The unavailability boundary can be defined by marking train or segment boundaries on piping and instrument drawings.

04.06 Entry of Baseline Data - Planned Unavailability. The licensee will calculate the plant-specific baseline planned unavailability using ROP data from 1999-2001. ROP data is collected and sorted by system, allowing licensees to track unavailability without additional resource burden. These values are expected to remain fixed unless the licensee changes its maintenance philosophy with respect to online maintenance or preventive maintenance. Any change in the baseline planned unavailability should be noted in the inspection report.

04.07 Entry of Baseline Data - Unplanned Unavailability. The baseline unplanned unavailability is the historical industry average for the years 1999-2001, which has been calculated and is included in Appendix A, Table 1.

04.08 Entry of Baseline Data - Unreliability. The baseline values for unreliability are fixed values and are given in Appendix A, Table 2. They were derived from various staff technical studies documented in NUREG 5500 using data from 1987 through 1997.

04.09 Entry of Performance Data - Unavailability. As discussed in Appendix A, the licensee will calculate total critical hours during the previous 12 quarters and the hours each train or segment was unavailable to perform its risk-significant functions. For calculating the actual MSPI values, pilot participants will use the most recent 3 years (12 quarters) of data reported to the ROP, adjusted to match the definition of unavailable hours in the MSPI.

04.10 Entry of Performance Data - Unreliability. As discussed in Appendix A, the licensee will collect the most recent 3 years (12 quarters) of data to calculate an unreliability estimate for each active component. The unreliability component for valves includes only failures on demand. The unreliability component for pumps includes both failures on demand and failures to meet the risk-significant mission time. The unreliability component for emergency diesel generators includes failures on demand, failures to load/run, and failures to meet the risk-significant mission time.

04.11 MSPI Calculation. For the purposes of this pilot, the unavailability and unreliability F-V coefficients are constants and not subject to change over the course of this pilot, unless the licensees provides a rationale and basis for the change prior to doing so. Any change in the F-V coefficients should be noted in the inspection report.

## 2515/149-05 REPORTING REQUIREMENTS

Any significant inconsistencies identified as a result of the audit should be documented in the inspector's report. Regional and NRR management (the Projects Branch Chief and the NRR/DIPM/IIPB/PAS chief) should be notified via e-mail of the inconsistency. Examples of significant deficiencies include equipment that should be within the defined system boundary but was excluded, inappropriate functional success criteria and accounting rules, and incomplete risk-significant functions for any of the monitored safety systems.

Document any inconsistencies in the above guidance in accordance with IP 71151, "Performance Indicator Verification" and send a copy of the applicable sections to NRR/DIPM/IIPB, Attention: Don Hickman, or by e-mail to deh2@nrc.gov.

2515/149-06 COMPLETION SCHEDULE

Steps 03.02 through 03.11, including the first month of data, should be completed before December 22, 2002.

This TI should be completed by the end of the pilot data reporting period, on or before March 28, 2003.

2515/149-07 EXPIRATION

This TI will expire two years from the date of issuance. Before that date, this TI should be performed once at each licensee facility, where applicable.

2515/149-08 CONTACT

For questions regarding the performance of this TI and emergent issues, contact John Thompson (301-415-1011, jwt1@nrc.gov) or Don Hickman (301-415-8541 or deh2@nrc.gov).

2515/149-09 STATISTICAL DATA REPORTING

All direct inspection effort expended in connection with this TI is to be charged as baseline inspection hours assigned to IP 71151, “PI Verification.”

2515/149-10 ORIGINATING ORGANIZATION INFORMATION

10.01 Organizational Responsibility

This TI was initiated by NRR/DIPM/IIPB.

10.02 Support from the Office of Nuclear Regulatory Research (Research)

Research staff will validate the NEI spreadsheet and evaluate the need for an internal tool that would be used to independently calculate the MSPI PIs.

Research staff will assist the SRA in the comparison of the MSPI list of active components to the SDP and SPAR models for completeness and consistency.

Research staff will also assist the SRA in verifying that the PRA functional success criteria for the MSPI is consistent with the SDP and SPAR model assumptions.

Research staff will check the sensitivity of the MSPI PIs to demand failures over the full range of expected demands to confirm the indicator will not change threshold based on one failure and to confirm the PIs are sufficiently sensitive to demand failures.

10.03 Resource Estimate

The direct inspection effort to be expended in connection with this TI is estimated to be as follows:

Unavailability portion of the PI: 15 man-hours/unit inspection.

Unreliability portion of the PI: 15 man-hours/unit inspection.

10.04 Training

It is expected that inspectors of sites who are participants in this pilot PI program will have attended the July 23-25, 2002, public MSPI workshop or will be trained by personnel that did attend. No additional formal training is proposed for the performance of this TI.

END

Attachment A: Draft NEI 99-02 Mitigating Systems Performance Index (MSPI) Rev. 0

Attachment B: Draft NEI 99-02 Mitigating Systems Performance Index (MSPI) Rev. 0, Appendix F