

January 8, 2003

MEMORANDUM TO: Cynthia A. Carpenter, Chief
Inspection Program Branch
Division of Inspection Program Management
Office of Nuclear Reactor Regulation

FROM: John W. Thompson */RA/*
Performance Evaluation and Assessment Section
Inspection Program Branch

SUBJECT: FORTHCOMING MEETING WITH INDUSTRY TO DISCUSS THE
OPEN ISSUES WITH THE MITIGATING SYSTEMS
PERFORMANCE INDICATOR (MSPI) PILOT AND ONGOING
REACTOR OVERSIGHT PROCESS (ROP) ISSUES

DATE AND TIME: January 21 and 23, 2002
8:00 a.m. - 4:00 p.m.

LOCATION: U. S. Nuclear Regulatory Commission
One and Two White Flint North
Auditorium (January 21); Room 09B4 (January 23)
11555 Rockville Pike
Rockville, Maryland

PURPOSE: To conduct a workshop on the MSPI pilot implementation issues,
inspection guidance changes, and MSPI guidance clarifications.
The meeting will also discuss ROP issues involving proposed SDP
proposed changes, ROP issues, and open and new Frequently
Asked Questions (FAQs).

CATEGORY 2:* This is a Category 2 Meeting. The public is invited to participate in
this meeting by discussing regulatory issues with the NRC at
designated points identified on the agenda.

PARTICIPANTS: Participants from the NRC include members of the Office of Nuclear
Reactor Regulation (NRR), the Office of Research (RES), and
Regions 1, 2, 3, and 4.

<u>NRC</u>	<u>INDUSTRY</u>
C. Carpenter D. Hickman P. Koltay	T. Houghton, et.al.
D. Gamberoni J. Thompson M. Satorius	

Attachment: Agenda

MEETING CONTACT: John W. Thompson
(301) 415-1011
jwt1@nrc.gov

* Commissions' Policy Statement on "Enhancing Public Participation in NRC Meetings,"
67 *Federal register* 36920, May 28, 2002

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**MSPI Workshop Outline
TWFN Auditorium
January 21, 2003**

Purpose of the workshop: To discuss the results of the MSPI benchmarking efforts, assess the significant areas of concern, and provide possible solutions. Licensee pilot participants should work to understand their MSPI results and where significant differences are noted with other pilot participants, try to understand the reasons for the differences.

MSPI Workshop Outline

- 8:00-8:30 a.m. Introductions (J. Thompson, NRR, P. Baranowsky, RES, S. Floyd, NEI)
- 8:30-9:00 a.m. High Level Overview (Donald Dube, RES)
- See Attachment 1: Status of benchmarking, General issues related to all plants (handling of running/standby pumps, PMT demands, failure rate topics, active components)
- 9:00-9:30 a.m. High Level Overview (Steve Floyd, NEI)
- Topics to be supplied
- 9:30-10:00 a.m. High Level Overview (Region)
- Topics to be supplied
- 10:00-10:15 a.m. Break
- 10:15-11:45 a.m. Top 5 Issues (Donald Dube, RES)
- System boundary issues
 - Should common cause failures be incorporated in the MSPI model?
 - Significance of very low F-V values for trains
 - Support system initiators and their impact on F-V values
 - Invalid indicators - significance of the false positive and false negative issues
- 11:45-12:30 p.m. Lunch
- 12:30-3:00 p.m. Breakout Sessions (All, split into groups of "like plants")
- Breakout groups to discuss and understand the issues involving:
- FV comparisons - SPAR model vs. Plant PRA
 - Invalid indicators - false positive and false negative issue
 - Significant differences between like plants
 - Identify remaining significant, unique plant issues
- | <u>CE Plants</u> | <u>Westinghouse Plants</u> | <u>BWRs</u> |
|------------------|----------------------------|--------------|
| Millstone 2 | Braidwood 1,2 | Hope Creek |
| Palo Verde 1,2,3 | Millstone 3 | Limerick 1,2 |
| San Onofre 2,3 | Prairie Island 1,2 | |
| | Salem 1,2 | |
| | South Texas 1,2 | |
| | Surry 1,2 | |
- 3:00 - 3:15 p.m. Break
- 3:15 - 4:00 p.m. Breakout Session Reports (All)

4:00 - 5:00 p.m.

Improved Guidance/Action Items (All)

- Identify areas/issues to look out for
- Top items to focus future resources
- Activities and schedules for remaining 6 months

Attachments:

1. RES presentation slides
2. Licensees/Regions MSPI questions

Mitigating System Performance Index Pilot
December 11, 2002 Public Meeting Summary
Office of Research Presentation

Topic 1 Status of Independent Verification

- Review of 3rd QTR 2002 data submitted by all plants
- In-depth benchmarking of NEI spreadsheets with SPAR models for two-unit plant
- Started a matrix of "Invalid Indicators" for all components for in-scope systems for all plants
- Comparison of Pilot Plant component failure rates to other sources including Table 2 of Appendix F of NEI 99-02
- Started comparison of all FV/UR for all components
- On-target for late March 2003 completion of verification

Topic 2 Other On-Going Activities

- Determining the effect on MSPI results with and without common cause failure contribution to importance measure
- Comparing MSPI results to SDP and ASP results for a limited set of events
- Will assess feasibility of rolling up individual mitigating systems into a "higher level" indicator
- Will assess issue of importance measures for support systems as initiators (CCW, SW)

Topic 3 General Observations

- Some active components not modeled in PRA
- Components modeled in PRA but not included in MSPI
- Many FV/UR of zero
- Possible model truncation issues (SPAR model benchmark using 1E-15/hr ~ 1E-11/yr)

Topic 4 Specific Observations

- Pooling of data for like components and then entering the pooled data for each individual component results in double counting failures and demands component type coded incorrectly
- SPAR model and Plant PRA FV/UR's show significant differences; an area for further review
- Preferable if FV, UA and UR were shown separately in the worksheets

Topic 5 Invalid Indicators

- Based on limited sampling, as many as 20 to 30% of the MSPI systems may have at least one component that would give an invalid indicator based on the current approach (0 to 1, or n to n+1)
- Of the order of 5 to 15% of all components within scope of MSPI may pose an invalid indicator problem based on the current analytical approach
- “Invalid indicator” is a strong function of FV/UR
- The higher the FV/UR, the higher the likelihood of posing as an invalid indicator
- FV/UR greater than about 5 are problematic

Topic 6 Ideas to Address Invalid Indicators

- For URI, increase the data collection period from 12 to 20 quarters
- Expand the component population of like types to improve the statistics of small numbers
- Change the *Prior Distribution*
- Use plant-specific baselines
- Adjust the thresholds to ensure low probability of false positives and false negatives
- Identify up front the components with Invalid Indicators and use statistical tests of adverse trending rather than the URI and UAI measures

Topic 7 Component Failure Rates

- From Pilot Plant data for last 12 quarters, component failure rates are 2 to 8 times lower than industry prior per Table 2 of Appendix F of NEI 99-02
- Sole exceptions are diesel driven pump failure rates owing to limited population in Pilot Program
- No proposed changes to Table 2 at this time

Topic 8 Example of Active Components Not Needed to be Included in MSPI

- MOVs on infrequently used test line that receive automatic isolation on SI signal
(Test frequency) x (test duration) x (MOV FTC)
(4 test/yr) x (2hr/test) (1yr/8760hr) x (2.1E-3)
~ 2E-6
- Many orders of magnitude below train or even system unavailability & unreliability

Topic 9 Summary

- Appreciate prompt input of Pilot Plant data
- Still a few simplified system diagrams outstanding
- In the fundamental expression for the MSPI: $URI = CDF \Sigma [FV/UR] (UR - UR_{BL})$
most of the variance between models is in FV/UR
- Will need to work together to understand the differences

Some MSPI Questions and Answers

1. What MSPI specific documentation should be compiled by the licensee for purposes of this pilot?

Answer: Pilot licensees should have separately compiled simplified P&ID drawings of the monitored systems where the active components have been identified. The default component/train/system success criteria and critical parameters are assumed to be the assumptions in the PRA, and if the PRA was not used, then the default is the design/licensing basis. If a different bases was assumed for the MSPI, or if it is ambiguous as to what was used, then the licensee should compile a list of these differences and have it in an easily accessible format for inspection or audit purposes. In addition, a copy of this list should be sent to Donald Dube, RES.

Additionally, licensees should also note where they have taken exception to the NEI 99-02 Appendix F guidance. For example, some active components that meet the MSPI definition of an active component may not be modeled in the PRA or included in the MSPI calculation. Licensee should explain in writing why this exception was taken and the reason for the exclusion or omission.

Finally, a listing of the active components with their F-V and F-V/UR values would be very useful.

By way of example, RES has found that the documentation compiled by Arizona Power for Palo Verde substantially meets the intent.

2. Do all of the success criteria for all active components need to be pre-identified in a data sheet format or do the success criteria only have to be pre-identified if it is a departure from the design basis? Also, what kind of justification for the success criteria is required?

Answer: All pilot participant licensees need to state in writing what their default values are (i.e., the PRA assumptions, the design/licensing basis, etc) for each of the monitored systems. Any departures/deviations from that default criteria needs to be documented. If the success criteria is the assumptions used in the PRA, and there are no exceptions, then a simple statement to that effect is all that is required for that particular monitored system or train.

3. Is a statement in the IPEEE (PRA) adequate basis to determine that a component is not active for MSPI? For example, the IPEEE states that HPCI is able to perform its safety function if the min flow valve fails to close. Is that sufficient documentation to conclude that the min flow valve is not active?

Answer: In general, external events evaluated by the IPEEE are not valid scenarios/events for inclusion into the MSPI. However, some external events, such as common cause contributions from unit cross ties and internal flooding and fires are dominant contributors to risk and could mask F-V importance measures of the monitored systems if the F-V values for that system are uncharacteristically small. This is a generic concern that is being evaluated by RES. Questions in this area should continue to be documented and submitted for further evaluation.

4. Is it a requirement to assemble all assumption, back-up material, and validation (e.g., all of the Fussell-Vesely values for every basic event, calculations?) Is that what “readily available for inspection” means?

Answer: No. However, readily available means having the documentation in a concise format and together and is easily accessible by inspectors. For purposes of how to document functional success criteria and other assumptions, it is adequate to state that the assumptions used by the licensee is the PRA or the design/licensing basis. All exceptions must be documented.

5. Should all of the “sub-components” in a “super-component” be pre-identified by component number and have pre-identified success criteria?

Answer: It depends. The staff expects that major active components be identified on the simplified P&ID drawings. Licensees should explain where the boundaries are for the critical sub-components (e.g., the last relay or circuit breaker, or interfacing system valve that is included in the system boundary).

6. Are historical EPIX estimates an adequate source of MSPI estimates, or does there have to be a written justification for the EPIX estimates?

Answer: Yes, estimates are acceptable, as long as they are conducted within established rules and PRA protocol. See NEI 99-02, Appendix F, page F-3 for specific guidance.

7. How should EPIX estimates be converted to numbers to be placed on the MSPI spreadsheet? For example, if the EPIX estimates is for a valve to be stroked 15 times in 18 months, 15 strokes divided by 6 quarters equals 2.5 demands per quarter. Is 2.5 demands per quarter a legitimate entry since there is no such thing as a half demand?

Answer: Fractional values are ok.

8. What do you do with active components that are not modeled in the PRA? Are they required to be added to the model? By when?

Answer: Depends. If a licensee chooses not to model an active component that meets the MSPI definition of an active component, and they explain why it was not included, it may be acceptable to not include the component. In these cases, all exceptions must be documented along with the basis for doing so. However, if the active component has a significant risk contribution, and whether or not it was modeled in the PRA, it generally should be included in the MSPI calculation. Reasons for not including the component should be discussed with the NRC regional SRA and RES. These instances will be dealt with on a case-by-case basis.

9. Guidance in NEI 99-02 says to include unit x-tie components as active components to be monitored if modeled in the PRA. No industry priors for electrical breakers were listed in Appendix F, Table 2, and breakers were not listed as a component type in the Excel spreadsheet, so they could not be added as active components.

Answer: RES will recommend a revision to Table 2 to include a generic failure rate for circuit breakers. Licensees should identify other components that may be missing from Table 2, and bring them to RES's attention.

10. Some licensees are unclear about whether to include the service water supplies to the auxiliary feedwater (AFW) pumps as active components. Some did and some did not. Plants have enough water in the condensate storage tanks (CST) to reach a stable cooled down condition, but might not have enough for the 24-hour mission time assumed in the PRA. Some assumed that the CST could be refilled but might not have the refill modeled beyond assuming that it would be 100% successful.

Answer: Sound engineering judgment could be used to exclude items such as alternate make-up to the CST. The probability of failing to make up to the CST drops significantly with time, especially as the licensee's Emergency Response Organization becomes fully staffed. For example, it would be reasonable to assume that if the time to begin refilling the CST were say 20 hours, and the required make-up rate were 200 GPM, and there were multiple paths available to provide alternate water, then this would be justification to exclude valve connections from the PRA model and the MSPI. However, a different conclusion would be reached regarding refilling the RWST in one hour following a large-break LOCA.

11. Some plants had several active components being monitored under MSPI that were not modeled in their PRAs. There was no guidance regarding how to assign appropriate F-V valves to those components. The licensees were unable/unwilling to make major revisions to their PRA models just to support the MSPI pilot. For some of the components, licensees

entered a zero F-V (which made monitoring component unavailability and unreliability a waste of time) and for some they made up what they thought would be a conservative F-V value.

Answer: An arbitrarily assigned F-V of zero is not acceptable. A conservatively assigned F-V **as an interim measure** would be acceptable provided there were adequate justification and documentation for the like. It is expected that at the next opportunity to update/revise the PRA model, that these active components would be included.

12. Most Westinghouse plant Emergency Operating Procedures have a step to close the safety injection accumulator isolation valves before depressurization and going on containment sump recirculation in order to prevent injection of nitrogen into the reactor cooling system and potentially impeding reactor cooling. Further research needs to be done regarding whether failure to close the valves could result in failure to meet success criteria for core cooling.

Answer: The closing of the safety injection accumulator isolation valves is a good practice recommended by Westinghouse but is not absolutely necessary to the successful mitigation of a LOCA. The presence of nitrogen retards condensation processes, but in and of itself would not result in core damage. The fact that a) the valves would not be closed in time to affect the accident progression during the most critical short-term (minutes) phase of a rapid large-break LOCA (and are not credited in the design basis LOCA analyses), and b) are not single-failure proof, are evidence that closing of the valves is not part of the system success criteria to prevent core damage.

13. There was no clear guidance on truncation limits for active components. If active components have a very low contribution to core damage frequency, they are not worth monitoring.

Answer: A truncation value of $1E-11$ /yr or less is recommended.

14. For systems with one pump normally running and one or more other pumps in standby (such as component cooling for many plants), guidance is needed to describe how to account for unavailability time.

Answer: Guidance will be provided for the January 21, 2003 workshop. It is safe to say that regardless of which approach is used, one must be sure to preserve a) the total CDF, b) the FV/UA for each train, especially if there are non-symmetric contributions to total CDF such as can arise when the AC and/or DC support systems are not symmetric. For example, one DC bus may provide control power for one steam-driven and one motor-driven pump, while the other DC bus powers just one motor-driven pump. In such cases, the FV for the two motor-driven pumps will be very different owing to the relative contributions to the CDF.

15. Potential problem with following the 8 steps at the end of Appendix F for calculating planned unavailability in the baseline data: In Steps 2 and 3, fault exposure and unplanned unavailability hours are subtracted from the total unavailable hours. In Step 7, cascaded hours are subtracted. If some of the fault exposure and unplanned unavailability hours were from cascaded support systems, they could be subtracted twice.

Answer: Good point. Licensees should be made aware of this.

16. Some plants reported start demands and run times for several pumps and stroke demands for many valves that were estimated based on normal surveillance schedules and typical surveillance completion times. Verification of the data by the inspectors found several cases where the estimated data was not the same as actual demands and run times. I believe the guidance should be clarified to state that actual data is required unless it is not obtainable.

Answer: The intent is to allow for reasonable means of approximating demands to the extent possible. Differences of up to 25% between estimate and actual are recognized as being possible and would, in general, not be a reason for concern. Factors of two or more between actual and estimates would be a concern. One possible way of estimating demands is by sampling and extrapolation. For example, assume thorough counting of demands for a population of six valves in a particular system was made over a 12-month period. And assume there were no unusual changes in operation (extended outages) and no significant changes to surveillance test procedures in that time frame. Extrapolating to 24-months by doubling the number of demands for this population of valves would be reasonable.

17. Some licensees tended to report all pump start demands including, post maintenance test (PMT) starts, because it was easy to determine the number of starts for many pumps, based on charts of breaker position or discharge pressure/flow, but it took extra work to determine the reason for the start. The guidance should be clarified to state whether it is an acceptable option to report all start demands, or do PMTs have to be excluded.

Answer: Guidance will be provided for the January 21, 2003 workshop.

18. Some licensees tended to report all unavailable time, including times of less than 15 minutes, because it took extra effort to eliminate the times less than 15 minutes from the lists of unavailable times that were generally totaled on a computer spreadsheet. This seems to contradict the reason given by the industry in the recently approved FAQ and in the MSPI guidance for not counting the short unavailable times. I think we should re-evaluate the guidance on reporting unavailability and require all unavailability to be reported, even the short periods.

Answer: Agree. The original thought was that it would be a burden to count the times less than 15 minutes, but that it would *not* lead to inaccurate estimation of the

unavailability. If it is easier to count all unavailable time, then that should be an acceptable approach.

19. The guidance in Appendix F and other places tells the licensees to include information in the comments field of the spreadsheet for certain things like substantial changes to their maintenance philosophy and corrections to previously reported data. There doesn't appear to be a comments field in the spreadsheet.

Answer: Good point. This should be addressed by NEI.

20. At some plants support systems are modeled for their mitigation functions only. In others, the contribution to initiating event frequency (such as reactor trips) is also modeled for the support systems. This results in different F-V values for the same system in similar plants.

Answer: Agree. This remains an open item as far as RES is concerned. Some plant PRA models include detailed initiator fault trees, which would capture the contribution of the components in question to the FV. In other cases, a straight initiator frequency for the loss of the support system is used, and the contribution to FV from the component in question is missing. This topic will be discussed at the January 21, 2003 workshop, but closure of the issue will not occur until later in 2003.

21. The ROP web site does not have a link for submitting comments on the MSPI, nor does it have the specific MSPI comment forms.

Answer: Good point. This needs to be addressed.

ROP MONTHLY WORKING GROUP MEETING

AGENDA

OWFN 09B4

January 23, 2003

- | | |
|------------|---|
| 08:00 a.m. | Welcome and Introduction |
| 0815 a.m. | General discussion on ROP process improvements and initiatives |
| 08:45 a.m. | Discussion on EP/ORSafety/Public Rad Safety/ & Fire Protection proposed SDP changes |
| 10:00 a.m. | 15 Minute Break |
| 10:15 a.m. | Discussion on Self-assessment Initiative |
| 11:00 a.m. | Discussion on PI Improvements |
| 12:00 p.m. | Break for Lunch |
| 1:00 p.m. | Discussion of FAQs |
| 2:15 p.m. | 15 Minute Break |
| 2:30 p.m. | Continue FAQ Discussion |
| 4:00 p.m. | Adjourn |