UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, D.C. 20555-0001

May 11, 2004

MEMORANDUM TO: ACRS Members

FROM: Maggalean W. Weston
Senior Staff Engineer
ACRS

SUBJECT: CERTIFICATION OF THE MINUTES OF THE MEETING OF THE ACRS SUBCOMMITTEES ON RELIABILITY AND PROBABILISTIC RISK ASSESSMENT AND ON PLANT OPERATIONS, May 11, 2004, ROCKVILLE, MD

The minutes of the Reliability and Probabilistic Risk Assessment and the Plant Operations subcommittees meeting on the Reliability and Probabilistic Risk Assessment and Plant Operations subcommittees meeting on the Mitigating System Performance Index, held on April 14, 2004, have been certified as the official record of the proceedings of that meeting. A copy of the certified minutes is attached.

Attachment: As stated

cc via email: J. Larkins
H. Larson

UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, D.C. 20555-0001

May 11, 2004

MEMORANDUM TO: Maggalean W. Weston
Senior Staff Engineer
ACRS

FROM: John D. Sieber
Chairman
Plant Operations Subcommittee
ACRS

SUBJECT: CERTIFICATION OF THE MINUTES OF THE MEETING OF THE ACRS SUBCOMMITTEES ON RELIABILITY AND PROBABILISTIC RISK ASSESSMENT AND ON PLANT OPERATIONS, APRIL 14, 2004, ROCKVILLE, MD

I hereby certify that, to the best of my knowledge and belief, the minutes of the Reliability and Probabilistic Risk Assessment and Plant Operations subcommittees meeting on the Mitigating System Performance Index, held on April 14, 2004, are an accurate record of the proceedings for that meeting.

John D. Sieber 5-11-04
John D. Sieber, Chairman Date

UNITED STATES
NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON REACTOR SAFEGUARDS
WASHINGTON, D.C. 20555-0001

May 7, 2004

MEMORANDUM TO: John D. Sieber
Chairman
Plant Operations Subcommittee
ACRS

FROM: Maggalean W. Weston
Senior Staff Engineer
ACRS

SUBJECT: WORKING COPY OF THE MINUTES OF THE ACRS SUBCOMMITTEES ON RELIABILITY AND PROBABILISTIC RISK ASSESSMENT AND ON PLANT OPERATIONS, APRIL 14, 2004, ROCKVILLE, MD

A working copy of the minutes for the Reliability and Probabilistic Risk Assessment and the Plant Operations subcommittees meeting on the Reliability and Probabilistic Risk Assessment and Plant Operations subcommittees meeting on the Mitigating System Performance Index, held on April 14, 2004, is attached for your review. Please provide me with any comments you might have.

Attachment:
As Stated

**Certified: May 11, 2004 by John D. Sieber**

# ADVISORY COMMITTEE ON REACTOR SAFEGUARDS RELIABILITY AND PRA AND PLANT OPERATIONS SUBCOMMITTEES MITIGATING SYSTEMS PERFORMANCE INDEX ROOM T-2B3, 11545 ROCKVILLE PIKE, ROCKVILLE, MARYLAND

## APRIL 14, 2004

## MEETING MINUTES

### INTRODUCTION

The ACRS subcommittees on Reliability and Probabilistic Risk Assessment and on Plant Operations held a meeting on April 14, 2004, with representatives of the Industry and the NRC staff to discuss Risk Management Technical Specifications. The purpose of the meeting was to hear an the status of the mitigating system performance index (MSPI) pilot program. The meeting was open to the public. Maggalean W. Weston was the cognizant ACRS staff engineer and designated federal official (DFO) for this meeting. There were no written comments provided by the public. The meeting was convened by John D. Sieber, Chairman of the Plant Operations Subcommittee at 8:30 a.m. and adjourned at 11:15 a.m. that day.

### ATTENDEES

Attendees at the meeting included ACRS members and staff, the Industry and NRC staff.

ACRS Members/Staff

J. Sieber, Chairman
M. Bonaca, Member
F. Peter Ford, Member
T. Kress, Member
G. Leitch, Member
S. Rosen, Member
W. Shack, Member
M. W. Weston, Staff Engineer and DFO

NRC Staff

David Allsopp, NRR
James Anderson, NRR
Patrick Baranowsky, RES
Bruce Boger, NRR
Bennett Brady, RES
Donald Dube, RES
Anne-Marie Grady, RES
Naoto Ichii, NRR
Audrey Klett, NRR
Patrick O'Reilly, RES
Selin Sancaktar, RES
John Thompson, NRR

Industry

Corwin Atwood, Statwood Consulting
Steve Eide, INEEL
Tom Houoghton, NEI
Bruce Mrowca, ISL
Tony Pietrangelo, NEI
Bob Youngblood, ISL

A list of those attendees who registered is attached to the office copy of these minutes.

PRESENTATIONS AND DISCUSSION

The presentations to the subcommittees and the related discussions are summarized below. The presentation slides and handouts used during the meeting are attached to the office copy of the minutes.

Chairman's Comments

John Sieber, chairman of the Plant Operations Subcommittee opened the meeting and introduced Patrick Baranowski of the Office of Research.

NRC Staff and Industry Presentations

The NRC presentation on the MSPI was made by Patrick Baranowsky and Donald Dube, both of the Office of Research. The industry presentation was made by Tony Pietrangelo of NEI. The topics covered were:

1. MSPI Pilot Results
    - Status of Pilot Program
    - Scope of Independent Verification
    - Research Results
    - Key Issues
        - PRA Adequacy Analysis
        - SDP Safety System Unavailability
    - Overall Assessment

Pat Baranowsky indicated that the presentation was to discuss the technical evaluation that had been performed on the MSPI development over the past two years. He indicated that he thinks the MSPI is a highly capable performance indicator (PI) that can differentiate risk-significant changes in performance and address problems associated the current PIs. There was an extensive development testing program, looking at validity and verification capability. The performance Characteristics, strengths, and limitations a very well understood. It provides the best overall measure of system performance while minimizing false positive and false negative performance indications. especially true for identifying changes in performance. The formulation is flexible and adaptable.

The MSPI was undertaken because of a feasibility study of risk-based performance indicators. When problems were identified with the current set of PIs, NRR asked RES to adapt current

work that was ongoing to address these problems. The use of fault exposure time is a surrogate for reliability. The thresholds and the PIs themselves were generic and there was significant concern about plant specific differences.

Bruce Boger, NRR, indicated that the office is trying to find a replacement for the safety system unavailability PI (SSUPI). He said that he thought the MSPI had several advantages over the SSUPI and it solves many of the problem. However, they also think there are some disadvantages to the use of the MSPI relative to the reactor oversight process.. He stated that the Commission encouraged the staff to continue, in a timely manner, the pursuit of a risk-informed PI that resolves the issues associated with SSUPIs, to address the lessons learned from the MSPI pilot and to continue involve stakeholders.

Tony Pietrangelo, NEI, provided brief comments complimenting the NRC on the technical work done on the methodology for the MSPI. He indicated that there was more work done to develop and define the technical basis for MSPI than what was done for the entire ROP over four years ago. The potential impacts and limitations are well understood. He lauded the collaborative process between the staff and the industry. NEI's interest from a technical standpoint stems from the fact that there are multiple definitions of unavailability in the industry. There is one definition for the ROP SSUs, one for the maintenance rule, one for the WANO/INPO indicators, and some different PRA definitions. Therefore, if you ask a system engineer at the plant the unavailability for a system, he needs to know which one you want. Bookkeeping is a significant concern for the industry. Data collection is confusing and resource intensive.

Subcommittee Comments

- J. Sieber indicated that this type of indicator is very complex with many features needing to be adjusted. Therefore, explaining it to the public is going to prove extremely difficult. Staff indicated that they should make every effort to simplify the story.

- G. Leitch asked if, based on the 12 month pilot, actual operating experience had been factored into the PI to see how the indicator would react. The response was that yes, operating experience and simulation of certain failures were used.

- W. Shack asked about the variability of the results for components using Fussell-Vesely and if it were related to the lack of initiating event fault trees. The response was that you could have significant differences in the importance measures if, say, one PRA model has an explicit fault tree for specific initiating events linked with the rest of the model while another uses a single parameter frequency. One needs to be sophisticated with PRA to capture results that present consistent outcomes over time.

- S. Rosen asked if modeling of the support systems would be a difficult task. The response was that it is fairly straightforward.

- G. Leitch asked if these PIs that can be managed or manipulated because it can sometimes yield unintended consequences. The response was that the formula has been developed to prevent that by having a balance between unavailability and unreliability. The MSPI weights unavailability and unreliability based on the risk importance.

- P. Ford asked if aging effect on passive components are covered in the scheme of events. The response was that they are not covered.

- W. Shack commented that the frontstops and backstops address a lot of concerns because you catch performance problems even if they're not risk significant because they will bump into the backstops.

- T. Kress asked if the MSPI would actually become a part of the ROP. The response was that they did not know.

- J Sieber commented that if the basic framework, structures, and the meaning of the various indicators and processes are not understood, then the ROP will not gain its proper respect.

appropriate arrangements can be made to allow necessary time during the meeting for such statements. Use of still, motion picture, and television cameras during the meeting may be limited to selected portions of the meeting as determined by the Chairman. Information regarding the time to be set aside for this purpose may be obtained by contacting the Cognizant ACRS staff prior to the meeting. In view of the possibility that the schedule for ACRS meetings may be adjusted by the Chairman as necessary to facilitate the conduct of the meeting, persons planning to attend should check with the Cognizant ACRS staff if such rescheduling would result in major inconvenience.

Further information regarding topics to be discussed, whether the meeting has been canceled or rescheduled, as well as the Chairman's ruling on requests for the opportunity to present oral statements and the time allotted therefor can be obtained by contacting Mr. Sam Duraiswamy, Cognizant ACRS staff (301–415–7364), between 7:30 a.m. and 4:15 p.m., ET.

ACRS meeting agenda, meeting transcripts, and letter reports are available through the NRC Public Document Room at *pdr@nrc.gov,* or by calling the PDR at 1–800–397–4209, or from the Publicly Available Records System (PARS) component of NRC's document system (ADAMS) which is accessible from the NRC Web site at *http://www.nrc.gov/reading-rm/adams.html* or *http://www.nrc.gov/reading-rm/doc-collections/* (ACRS & ACNW Mtg schedules/agendas).

Videoteleconferencing service is available for observing open sessions of ACRS meetings. Those wishing to use this service for observing ACRS meetings should contact Mr. Theron Brown, ACRS Audio Visual Technician (301–415–8066), between 7:30 a.m. and 3:45 p.m., ET, at least 10 days before the meeting to ensure the availability of this service. Individuals or organizations requesting this service will be responsible for telephone line charges and for providing the equipment and facilities that they use to establish the videoteleconferencing link. The availability of videoteleconferencing services is not guaranteed.

Dated: March 18, 2004.

**Andrew L. Bates,**

*Advisory Committee Management Officer.*

[FR Doc. 04–6523 Filed 3–23–04; 8:45 am]

BILLING CODE 7590–01–P

## NUCLEAR REGULATORY COMMISSION

### Advisory Committee on Reactor Safeguards Joint Meeting of the ACRS Subcommittees on Reliability and Probabilistic Risk Assessment and on Plant Operations; Notice of Meeting

The ACRS Subcommittees on Reliability and Probabilistic Risk Assessment and on Plant Operations will hold a joint meeting on April 14, 2004, Room T–2B3, 11545 Rockville Pike, Rockville, Maryland.

The entire meeting will be open to public attendance.

The agenda for the subject meeting shall be as follows:

**Wednesday, April 14, 2004—8:30 a.m. Until 11:30 a.m.**

The Subcommittees will discuss the results of the pilot program on the Mitigating Systems Performance Indicator (MSPI). The Subcommittees will hear presentations by and hold discussions with representatives of the NRC staff and other interested persons regarding this matter. The Subcommittees will gather information, analyze relevant issues and facts, and formulate proposed positions and actions, as appropriate, for deliberation by the full Committee.

Members of the public desiring to provide oral statements and/or written comments should notify the Designated Federal Official, Ms. Maggalean Weston (telephone: 301–415–3151) five days prior to the meeting, if possible, so that appropriate arrangements can be made. Electronic recordings will be permitted.

Further information regarding this meeting can be obtained by contacting the Designated Federal Official between 8 a.m. and 5:30 p.m. (e.t.). Persons planning to attend this meeting are urged to contact the above named individual at least two working days prior to the meeting to be advised of any potential changes to the agenda.

Dated: March 17, 2004.

**Maggalean W. Weston,**

*Acting Associate Director for Technical Support, ACRS/ACNW.*

[FR Doc. E4–659 Filed 3–23–04; 8:45 am]

BILLING CODE 7590–01–P

## OFFICE OF PERSONNEL MANAGEMENT

### Submission for OMB Review; Comment Request for Reclearance of a Revised Information Collection: RI 92–19

**AGENCY:** Office of Personnel Management.

**ACTION:** Notice.

**SUMMARY:** In accordance with the Paperwork Reduction Act of 1995 (Pub. L. 104–13, May 22, 1995), this notice announces that the Office of Personnel Management (OPM) has submitted to the Office of Management and Budget (OMB) a request for reclearance of a revised information collection. RI 92–19, Application for Deferred or Postponed Retirement: Federal Employees' Retirement System (FERS), is used by separated employees to apply for either a deferred or a postponed FERS annuity benefit.

Approximately 1,539 forms are completed annually. The form takes approximately 60 minutes to complete. The annual estimated burden is 1,539 hours.

For copies of this proposal, contact Mary Beth Smith-Toomey on (202) 606–8358, FAX (202) 418–3251 or via e-mail to *mbtoomy@opm.gov.* Please include a mailing address with your request.

**DATES:** Comments on the proposal should be received on or before April 23, 2004.

**ADDRESSES:** Send or deliver comments to—Ronald W. Melton, Chief, Operations Support Group, Retirement Services Program, U.S. Office of Personnel Management, 1900 E Street, NW., Room 3349, Washington, DC 20415–3540, and Joseph Lackey, OPM Desk Officer, Office of Information & Regulatory Affairs, Office of Management & Budget, New Executive Office Building, NW., Room 10235, Washington, DC 20503.

For Information Regarding Administrative Coordination—Contact: Cyrus S. Benson, Team Leader, Publications Team, Support Group, (202) 606–0623.

Office of Personnel Management.

**Kay Coles James,**

*Director.*

[FR Doc. 04–6520 Filed 3–23–04; 8:45 am]

BILLING CODE 6325–38–P

**ADVISORY COMMITTEE ON REACTOR SAFEGUARDS**
**RELIABILITY AND PRA AND PLANT OPERATIONS SUBCOMMITTEES**
**MITIGATING SYSTEMS PERFORMANCE INDEX**
**ROOM T-2B3, 11545 ROCKVILLE PIKE, ROCKVILLE, MARYLAND**

**APRIL 14, 2004**

**- PROPOSED AGENDA -**

| SUBJECT | PRESENTER | TIME |
|---|---|---|
| I. Introductory Remarks<br>Subcommittee Chair | John D Sieber, ACRS | 8:30-8:35 a.m. |
| II. MSPI Pilot Results<br>Background<br>Overview<br>Status of Pilot Program<br>Scope of Independent Verification<br>Research Results | Patrick Baranowsky, RES, and<br>Donald Dube, RES | 8:35-9:45 a.m. |
| | ****BREAK**** | 9:45-10:00 a.m. |
| III. MSPI Pilot Results (Cont'd)<br>Key Issues<br>PRA Adequacy Analyses<br>SDP* SSU** Comparison<br>Overall Assessment and Conclusions | Patrick Baranowsky. RES, and<br>Donald Dube, RES | 10:00-10:50 a.m. |
| IV. Status of the MSPI | Bruce Boger, NRR | 10:50-11:00 a.m. |
| V. Public Comments | Tony Pietrangelo, NEI | 11:00-11:15 a.m. |
| VI. General Discussion | | 11:15 -11:30 a.m. |

* Significance Determination Process
**Safety System Unavailability

Note: Presentation time should not exceed 50% of the total time allocated for a specific item.
Number of copies of presentation materials to be provided to the ACRS - 40.

ACRS CONTACT: Maggalean W. Weston, mww@nrc.gov or (301) 415-3151.

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

SUBCOMMITTEE MEETINGS ON RELIABILITY & PROBABILISTIC RISK ASSESSMENT

AND PLANT OPERATIONS

April 14, 2004
Date

**NRC STAFF SIGN IN FOR ACRS MEETING**

**PLEASE PRINT**

| NAME | NRC ORGANIZATION |
|---|---|
| DON DUBE | RES/DRAA/OERAB |
| Patrick Baranowsky | " " " |
| Bruce Boger | NRR/DIPM |
| Patrick O'Reilly | RES/DRAA/OERAB |
| James Anderson | NRR/DIPM |
| Audrey Klett | NRR/DIPM |
| Naoto Ichii | NRR/DSSA/SPSB |
| DAVID ALLSOPP | NRR/DIPM |
| John Thompson | NRR/DIPM |
| Selim Sancaktar | RES/DRAA/OERAB |
| Annie Marie Grady | RES/DRAA/OERAB |
| Bennett Brady | RES/DRAA/OERAB |

ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

SUBCOMMITTEE MEETINGS ON RELIABILITY AND PROBABILISTIC RISK ASSESSMENT AND PLANT OPERATIONS

APRIL 14, 2004
Date

**PLEASE PRINT**

| NAME | AFFILIATION |
|---|---|
| Steve Eide | INEEL |
| Corwin Atwood | Statwood Consulting |
| Bruce Mrowca | ISL |
| Bob Young Hurst | ISL |
| Tony Pietrangelo | NEI |
| Tom Houghton | NEI |
| Jenny Weil | McGraw-Hill |

# MITIGATING SYSTEMS PERFORMANCE INDEX PILOT RESULTS

**PRESENTATION TO ACRS SUBCOMMITTEES ON RELIABILITY AND PRA, AND PLANT OPERATIONS**

**PATRICK W. BARANOWSKY (301-415-7493) (pwb@nrc.gov)**
**DONALD A. DUBE (301-415-5472) (dad3@nrc.gov)**
**OPERATING EXPERIENCE RISK ANALYSIS BRANCH**
**OFFICE OF NUCLEAR REGULATORY RESEARCH**
**U.S. NUCLEAR REGULATORY COMMISSION**

**April 14, 2004**

# Purpose and Objective of Meeting

- RES to present results of MSPI evaluation
- NRR to provide current status of MSPI
- To hear public views
- To request ACRS Letter on MSPI methodology in 2004

# RES Overall Conclusions on MSPI

- The MSPI is a highly capable performance indicator that can differentiate risk significant changes in performance and addresses problems associated with the currently used performance indicators.

- The MSPI has undergone an extensive development, testing, and evaluation program. Its performance characteristics, strengths, and limitations are well understood.

- The MSPI appears to provide the best overall measure of system performance while minimizing false positive and false negative performance indications.

- The formulation is flexible and adaptable to address emerging issues and concerns regarding validity and appropriateness of outcomes.

# Contents of Presentation

- Background
- Brief Overview of MSPI
- Status of Pilot Program
- Scope of Independent Verification
- Research Results on the Pilot
- Discussion of Key Issues
  - PRA Adequacy Analyses for MSPI
  - MSPI/Significance Determination Process (SDP)/Safety System Unavailability (SSU) Comparison
- Overall Assessment and Conclusions

# Background

- MSPI evolved from feasibility study of Risk-Based Performance Indicators (NUREG-1753)
- NRR issued User Need Request to RES to support development of risk-informed indicator that includes unreliability and safety system unavailability
- MSPI formulated to address known issues with current indicator
  - Use of fault exposure time as surrogate for unreliability
  - Definition of unavailability inconsistent with Maintenance Rule
  - Cascading of cooling water support systems failures
  - Thresholds that do not recognize plant-specific features
- Twelve-month Pilot Program initiated September 2002
- ACRS subcommittees briefed on July 8, 2003 regarding status of pilot and RES-recommended improvements to method
  - No open items

## Overview of MSPI Features

- **Eliminates known problems with existing SSU Indicator.**
- **Accounts for both unavailability and unreliability of a system, weighted relative to their Risk-Importance.**
- **Uses plant PRA model to derive Risk-Importance weightings. Hence, captures plant-specific configuration and performance.**
- **Identifies changes in performance while limiting *false positive* and *false negative* indications.**
- **MSPI data are consistent with PRA methods and Maintenance Rule data. Data to be integrated with Consolidated Data Entry (CDE) Program under INPO.**

## MSPI Technical Approach

- MSPI monitors risk impact (i.e., change in CDF) of changes in performance of selected mitigating systems, which accounts for plant-specific design and performance data.

- MSPI consists of two elements, system unavailability and system unreliability. MSPI is the sum of changes in a simplified CDF evaluation resulting from changes in system unavailability and system unreliability relative to baseline values.

- MSPI = UAI + URI where

  UAI: system unavailability index due to changes in train unavailability

  URI: system unreliability index due to changes in component unreliability

- The risk impact of changes in mitigating system performance on plant-specific CDF is estimated using plant-specific performance data and Fussell-Vesely importance measures.

# List of MSPI Monitored Systems

| BWRs | PWRs |
| --- | --- |
| HPCI/HPCS (high pressure coolant injection/core spray) | HPSI (high pressure safety injection) |
| RCIC (reactor core isolation cooling) | AFW (auxiliary feedwater or equivalent) |
| RHR (residual heat removal) | RHR |
| EAC (emergency AC power) | EAC |
| Support System Cooling (ESW + CCW) | Support System Cooling |

## Outside of Scope of MSPI

- Multiple concurrent failures of components including common cause failures
- Conditions not capable of being discovered during normal surveillance tests
- Failures of non-active components.

(If any one of these conditions is present the current SDP would be used.)

# Status of Pilot Program

- Twelve-month pilot completed September 2003. Preliminary draft report forwarded to NRR.
- RES performed additional analyses on PRA Adequacy (beyond original scope).
- Continued to hold numerous public meetings through the present.
- Internal NRC meetings held and position papers formulated throughout fall and winter of 2003-2004.
- RES completed draft "Report on the Mitigating Systems Performance Index (MSPI) Results for the Pilot Plants" in February 2004.
- Inspection Program Branch, Division of Inspection Program Management of NRR decides to terminate development and implementation of MSPI in March 2004.

# Scope of Independent Verification

- Baseline data verified
  - Reviewed all unavailabilities, inconsistencies noted
  - Revised industry failure rates to represent 1999-2001 performance
- Current performance data verified
  - All unavailabilities compared for reasonableness
  - Reliability data compared to Equipment Performance and Information Exchange (EPIX) and Reliability and Availability Database Systems (RADS)
  - Errors noted and corrected
- All licensee Fussell-Vesely importances compared to SPAR models
- SPAR Enhancement effort completed
  - Improved eleven SPAR models to the level of component risk-importance
  - Analyzed differences between licensee PRA model and SPAR
- MSPI spreadsheet verified
- MSPI results compared using SPAR and licensee PRA
- Analyzed sensitivity of MSPI results to differences between SPAR and licensee PRA
- Analyzed MSPI, SDP, and SSU results for all component failures in pilot.

## Research Results on the Pilot

- MSPI results from pilot plant models and SPAR resolution models found to be in very good agreement
  - Color indication comparable if not identical depending on treatment of "frontstop" and common cause.
  - Numerical results within factor of three.
- Evaluated differences in pilot plant PRA models and SPAR
  - For eleven models, found three plant-specific model differences that could potentially have <u>large</u> impact on MSPI results.
  - Significant differences in major model inputs such as system success criteria or initiating event frequencies are primary source of significant quantitative differences.
  - Factors of two to three differences in basic event probability have low impact on MSPI results.
- Compared MSPI, SDP and SSU results for all seventy-seven component failures in the pilot
  - Some agreement and some disagreement, all explainable.

# Sensitivity Studies to Address PRA Adequacy

- Using SPAR Enhancement results, identified major differences between SPAR and licensee PRA model (e.g. basic event probability, initiating event frequency, system success criterion).
- Differences grouped into 3 to 7 categories of issues (e.g. AC power, AFW system, PORV success criterion, etc.).
- "Change set" generated and SPAR model re-run one issue at a time for each plant.
- Generated new PRA results including revised Birnbaum importance measures.
- New Birnbaums fed back into MSPI algorithm to generate new MSPI results.
- Quantitative and qualitative (color indication) changes in MSPI provide a measure of sensitivity of results to model differences.

# Sensitivity Study Results

- **Impact of Model Differences:**
  - **Large: difference greater than 5E-7, likely to affect color performance indication given failures in the system**
  - **Medium: difference between 1E-7 and 5E-7, has the potential to affect color given sufficient failures in the system**
  - **Low: difference less than 1E-7, unlikely to affect MSPI results.**

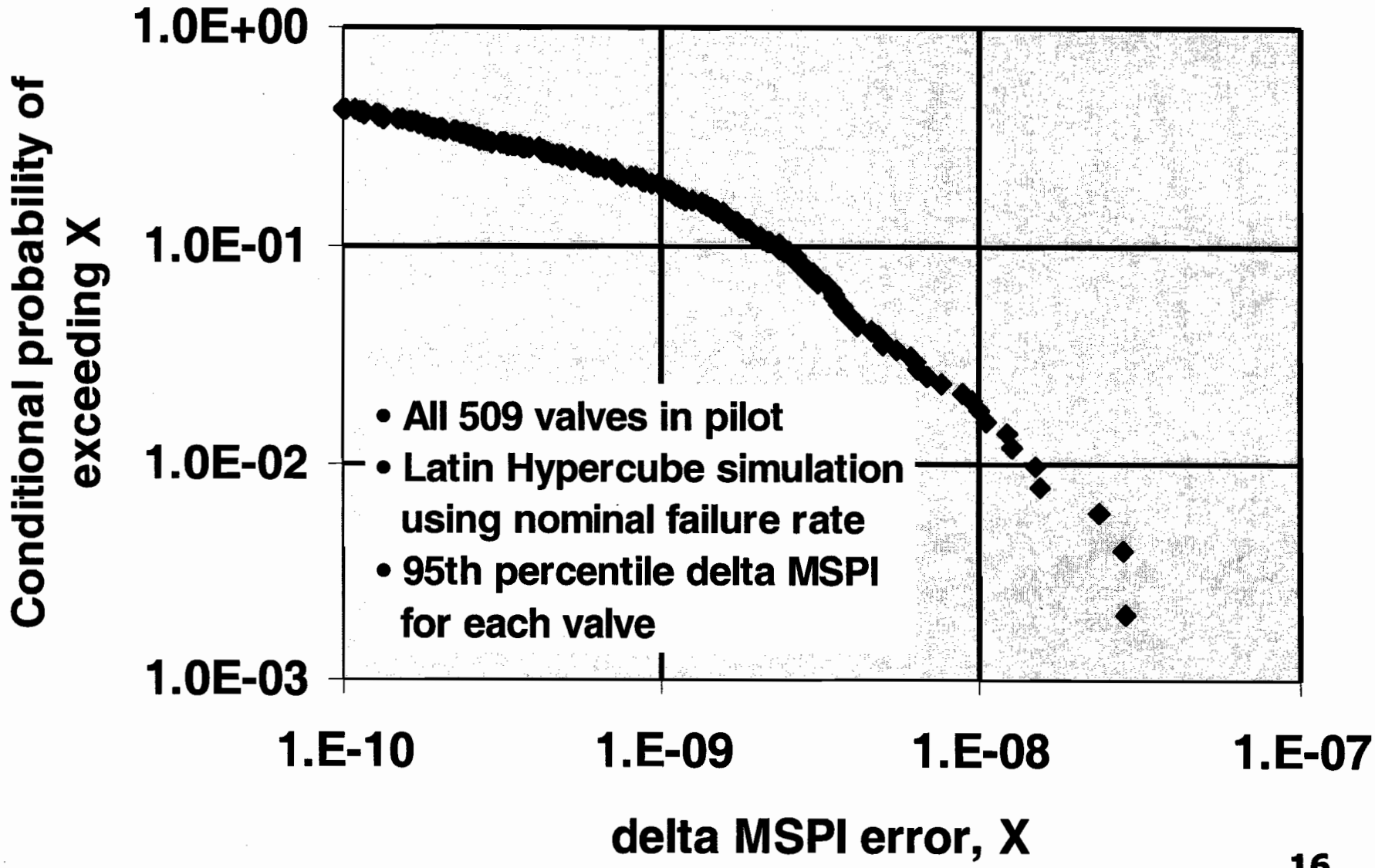
| Potential Impact on MSPI | PRA Model Difference Issue | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | PORV Success Criterion | AC Power | DC Power | LOCA Issues | HPI Issues | HRS Issues | RHR Issues | SWS/CCW Issues | Power Conversion System | Misc. Issues |
| Large | Braidwood | | | Millstone 2 | | | | Salem | | |
| Medium | | Hope Creek<br>Millstone 3<br>Salem | Braidwood | | Hope Creek<br>Millstone 3 | Millstone 3<br>Palo Verde | | Hope Creek<br>Millstone 2 | Braidwood<br>Hope Creek<br>Limerick<br>Millstone 3 | Hope Creek |
| Small | All others | All others | All others | All others | All others | All others | All | All others | All others | All others |

**(assumes all components have one failure beyond baseline)**

## Analysis of System Boundary Definition Error

- Guidelines require all EDGs and pumps to be included in system boundary
- Primarily an issue of omission of valves
- Probability of significant effect on MSPI:
  - A valve is inappropriately omitted, AND
  - The valve is a high risk-importance valve, AND
  - The valve has a failure rate much higher than the industry norm.
- The consequence of omission would be the underestimation of the MSPI. The valve would be subject to inspection process and an SDP evaluation of the performance deficiencies.

# Analysis of Impact of Missed Valve from System Boundary on MSPI Results



# MSPI/SDP/SSU Comparison

- They are fundamentally different approaches:
  - MSPI measures statistically valid risk-informed change in performance of systems over 3-year rolling intervals.
  - SSU directly accounts for unavailability, and indirectly attempts to address unreliability through use of fault exposure time, also over a 3-year rolling interval.
  - SDP measures short-term risk significance of a failure or condition associated with performance deficiency.
- Compared results for all 77 component failures in pilot.
- All non-Green SSU driven by fault exposure hours, one because of T/2 assumption prior to change in ROP Guideline.
- SDP non-Green findings for single failure often driven by short assessment period (less than a year) with insufficient data to measure statistically valid change in performance.
- MSPI White or near-White indicators usually involved multiple failures and unavailability providing high degree of confidence of adverse change in system performance.

# MSPI/SDP/SSU Comparison (cont.)

- MSPI captures as many if not more reliability/availability performance degradations than SSU/SDP
  - Historical review of 1,659 SDP findings and 5,157 SSU quarterly indicators.
  - Only 0.5% of SSU indicators have been non-Green in 3.25 years reviewed.
  - Average of 4 non-Green SDP findings per year for mitigating systems related to actual single failure (not degraded or non-conforming condition) for all 100+ nuclear units.
  - MSPI pilot resulted in 2 White indicators, and 3 near-White (data collection stopped 1st Qtr 2003)
  - SDP had 2 White findings, where MSPI was Green or near-White.
  - Analysis and numerical simulation (Latin hypercube) shows equal to or greater non-Green indicators with MSPI.

# Most Important Comparisons of MSPI, SDP, and SSU

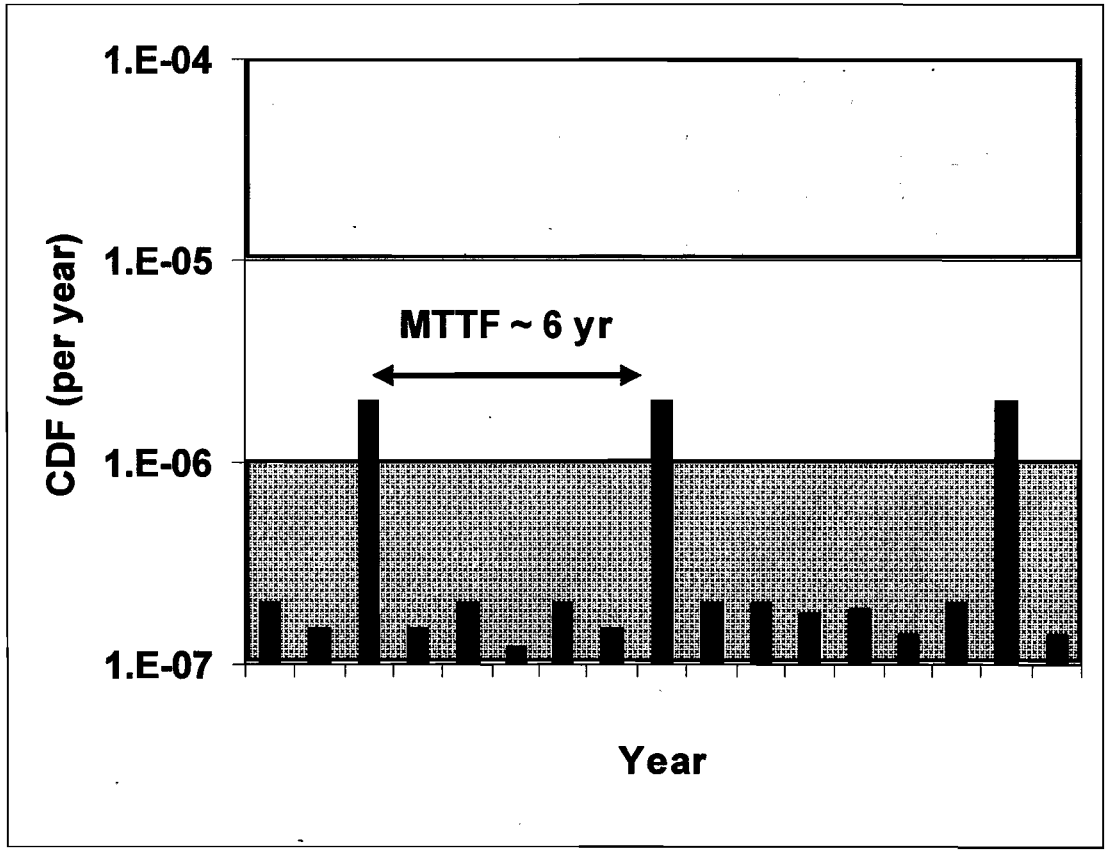
| Plant | Component | MSPI | SDP | SSU Value/Threshold | Comments |
|---|---|---|---|---|---|
| Braidwood-1 | 3 failures of AFW diesel pump | 2E-06 | One Green finding | 2.5% / 2.0% | MSPI White comes from combination of unreliability and unavailability. |
| Hope Creek | 3 failures of HPCI MOVs | 1E-06 | None | 1.7% / 4.0% | MSPI White comes from combination of unreliability and unavailability. |
| Palo Verde-2 | 1 failure of motor-driven AFW pump | 4E-07 | None | 0.6% / 2.0% | *Frontstop* applied. One more failure results in White MSPI. |
| San Onofre-2 | 6 failures of salt water pumps | *backstop* of 7 makes this a near-White | None | N/A (support system) | Calculated MSPI near zero owing to balancing of unreliability and unavailability. |
| Salem-1 | 4 failures of EDGs in 3rd quarter 2002 | 8E-07 | 9E-06 | 1.6% / 2.6% | One additional failure through 2nd quarter 2005 or net addition of 40 hours of EDG unavailability results in White MSPI. RES is assessing adding short-term *backstop*. |
| Millstone-2 | 1 failure of turbine-driven AFW pump | 4E-07 | 3E-06 | 2.7% / 2.0% | Motor-driven pumps much better than baseline for UA and UR. Turbine-driven pump at baseline for unavailability. SDP & SSU results driven by fault exposure time. |

# Application of Fault Exposure Time to Single Component Failure Can Lead to Volatile Indication of Performance Otherwise at Industry Norm (i.e. *False Positive)*

**Example: Typical turbine-driven AFW pump tested monthly with assumed 14-day fault exposure time**

**Prob(FTS) = 1E-2**

**MTTF ~ 6 years (includes demands from additional operations)**



# MSPI Qualities

- MSPI addresses both false positive and false negative concerns
  - Constrained non-informative prior (CNIP) for component reliability, *frontstop,* and *backstop* appropriately constrain minimum and maximum failures to White.
    - CNIP demonstrated to provide best false positive/false negative characteristics of priors considered in NUREG-1753.
    - Frontstop minimizes likelihood that one failure beyond baseline in 3-year period results in White. However, index could still become White with one or even zero failures if there is significant system unavailability.
    - Backstop results in White indication if component type exhibits statistically significant departure from nominal industry failure rate, regardless of risk-significance.
  - Latent faults and multiple concurrent failures with high risk would continue to be evaluated by SDP.

# MSPI Qualities (cont.)

- MSPI is consistent with Maintenance Rule (MR), Tech Specs, and principles from SECY 99-007, "Recommendations for ROP Improvements"
  - Consistent with MR definition of failure, demand, and unavailable hours.
  - Consistent with the basis of Technical Specifications and the Maintenance Rule in that single failures that are detectable by normal surveillance are neither risk-significant nor indicative of performance degradation.
  - "Sufficient margin...to allow opportunity [for licensee] to take appropriate action."
  - PIs should be used where practical, and inspections cover all other areas.

# In Conclusion

- MSPI has been thoroughly tested, evaluated, and discussed in numerous public meetings.
  - It addresses problems with currently used PIs.
  - Its capabilities, strengths, and limitations are well understood and accounted for.
- With a few peripheral adjustments, MSPI development and evaluation will be complete.
- Even in current configuration, MSPI is a highly capable performance indicator.
- MSPI has highly desirable qualities with respect to:
  - Plant-specific risk implications
  - Proper treatment of reliability and availability
  - Ability to capture performance degradation and address false positive/false negative concerns. Provides robust results.
  - Computation is structured and programmable.
  - MSPI is consistent with Maintenance Rule, Technical Specifications, and ROP SECY 99-007.
- PRA adequacy issues are identifiable and manageable; few contribute to significant discrepancies in outcome.

# Current Plans to Complete MSPI

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|---|---|
| ▪ Internal comments due | May 2004 |
| ▪ Public comments due | June 2004 |
| ▪ Prepare draft final MSPI report | August 2004 |
| ▪ ACRS full committee | September 2004 |
| ▪ ACRS letter | TBD |
| ▪ Issue Final MSPI Report | October 2004 |