Enclosure 5
NRC Whitepapers
Meeting Summary of the 12/10/08 Reactor Oversight Process Working Group Public Meeting
Dated December 30, 2008

Staff White Paper on NEI 99-02 Guidance Changes for MSPI for Clarification of Planned UA Expectations

Background:

The staff conducted a review of MSPI planned unavailability (UA) baselines and found that there are some plants that have made large UA changes or continuous frequent baseline changes. The staff has also found indications that for many plants there are disconnects between the UA baseline values and the associated values contained in the PRAs.

–MSPI does not penalize a licensee unless their UA exceeds the baseline UA value. The downside of constant baseline changes is that a licensee may never see any UAI contribution if the delta between actual and baseline UA is very small (or zero), as would be the case for frequent baseline revisions. NEI 99-02 Revision 5 provides guidance that allows licensees to revise their planned UA baseline with no periodicity restriction when changes in maintenance program philosophy occur. However, this should not be interpreted to mean it is desirable to change baseline planned unavailability to accommodate emergent work or frequent periodic maintenance activities.

NEI 99-02 also states that baseline UA values should reflect current maintenance practices. It is also an expectation of the ASME PRA Standard that the PRA reflects that as-built, as operated plant. As these objectives are similar, the expectation is that the MSPI baseline UA values should be consistent with the values used in the PRA.

Proposal:

To address the problem of having too frequent baseline revisions, the staff is proposing to clarify the definition of maintenance program philosophy and the addition of a requirement to ensure that changes in the UA baseline are consistent with the unavailability assumptions contained in the PRA.

Maintenance Program Philosophy

Section F.1.2.1 of NEU-99-02 Rev 5 states that "Planned unavailable hours: These hours include time a train or segment is removed from service for a reason other than equipment failure or human error. Examples of activities included in planned unavailable hours are preventive maintenance, testing, equipment modification, or any other time equipment is electively removed from service to correct a degraded condition that had not resulted in loss of function." Therefore, planned unavailability includes all unavailability not related to failures and, as defined, is beyond those activities associated with preventive maintenance and testing which could be considered the typical scope of a maintenance program.

Section F1.2.2 states that "The initial baseline planned unavailability is based on actual plant-specific values for the period 2002 through 2004. (Plant specific values of the most recent data are used so that the indicator accurately reflects deviation from expected planned maintenance. These values are expected to change if the plant maintenance philosophy is substantially ~~changes~~ changed with respect to on-line maintenance or preventive maintenance. In these cases, the planned unavailability baseline value should be adjusted to reflect the current maintenance practices, including low frequency maintenance evolutions." The focus of changing the planned unavailability values is philosophy changes to the on-line maintenance or preventive maintenance program.

Section F1.2.2 also includes a discussion of significant maintenance events and states that "Some significant maintenance evolutions such as EDG overhauls, are performed at an interval greater than the three year monitoring period (5 or 10 year intervals). The baseline planned unavailability should be revised as necessary during the quarter prior to the planned maintenance evolution and then removed after twelve quarters." This guidance recognizes that some program variations can occur and should result in revisions to the planned unavailability values.

As this UA baseline definition includes all non-failure activities, the concept of making changes to the UA baseline tied solely to the maintenance program philosophy appears to have created inconsistencies in the implementation of maintenance program philosophy changes. It is the staff's expectation that the performance or condition of the SSCs is effectively controlled by preventive maintenance and testing programs (a maintenance rule expectation). These programs and condition monitoring activities should be periodically evaluated to ensure that the objective of preventing failures of SSCs through maintenance is appropriately balanced against the objective of minimizing unavailability of SSCs. Changes to the maintenance program philosophy refer to changes to the preventive maintenance and testing programs. Other additions of unplanned unavailability such as equipment modifications or responses to degraded conditions are not considered to be a change in maintenance program philosophy.

This is not to say that hours associated with equipment modification, or any other time equipment is electively removed from service (to correct a degraded condition that had not resulted in loss of function) are not allowed in the baseline. The initial baseline planned unavailability is based on actual plant-specific values for the period 2002 through 2004 likely includes these types of activities. However, it is expected that changes in these activities will reflect the appropriate balancing of preventing failures of SSCs against the objective of minimizing unavailability of SSCs and as such the unavailability should not be increasing with time unless a maintenance program philosophy change has been implemented.

UA Baseline Changes Consistent with PRA

The Birnbaum values used in the MSPI are derived from plant-specific PRAs and are dependent, in part, on the unavailability values assumed in the PRA. The ASME PRA Standard Section 5 states the PRA configuration control requirements including the expectation that the PRA is to be consistent with the as-built, as operated plant. Supporting requirement DA-D7 of the ASME PRA Standard includes requirements to limit the use of old data if modification to plant design or operating practice leads to a condition where past data are no longer representative of current performance.

Therefore, it is staff's expectation that the UA baseline is consistent with that used in the PRA and that changes to the UA baseline should only occur as a result of or consistent with changes to the PRA. ~~are tested to ensure they do not result in significant changes to the MSPI Birnbaum values (greater than 10%).~~

<u>Recommended Changes</u>

Change Section F1.2.2(lines 35 to 41) from:

The initial baseline planned unavailability is based on actual plant-specific values for the period 2002 through 2004. (Plant specific values of the most recent data are used so that the indicator accurately reflects deviation from expected planned maintenance. These values are expected to change if the plant maintenance philosophy is substantially changes with respect to on-line maintenance or preventive maintenance. In these cases, the planned unavailability baseline value should be adjusted to reflect the current maintenance practices, including low frequency maintenance evolutions.

To:

The initial baseline planned unavailability is based on actual plant-specific values for the period 2002 through 2004. (Plant specific values of the most recent data are used so that the indicator accurately reflects deviation from expected planned maintenance. These values are expected to change if the plant maintenance philosophy is substantially changes with respect to on-line maintenance or preventive maintenance. In these cases, the planned unavailability baseline value should be adjusted to reflect the current maintenance practices, including low frequency maintenance evolutions." Prior to implementation of an adjusted the planned unavailability baseline value, the impact of the adjusted values on all MSPI PRA inputs should be assessed. If the PRA inputs change by ~~10~~25% or greater, they are expected to be updated with the implementation of the updated UA baseline value.

The following changes are considered a "change in plant maintenance philosophy:"

- A change in frequency or scope of a current preventative maintenance activity or surveillance test.
- The addition of a new preventative maintenance activity or surveillance test.

- The occurrence of a periodic maintenance activity at a higher or lower frequency during a three year data window (e.g., a maintenance overhaul that occurs once every 24 months will occur twice 2/3 of the time and once 1/3 of the time)
- Planned maintenance activities that occur on a frequency of greater than 3 years (e.g., 5 or 10 year overhauls).

The following changes are not considered a "change in plant maintenance philosophy:"

- The performance of maintenance in response to a degraded condition (even when it is taken out of service to address the degraded condition) unless this action is in response to a condition-based preventive maintenance activity.
- Planned maintenance activity that exceeds its planned duration.
- The performance of an on-line modification.

Staff White Paper for Long-term MSPI Baseline Unavailability Options

Background:

The staff has found indications that for many plants there are disconnects between the UA baseline values and the associated values contained in the site-specific PRAs.

NEI 99-02 states that baseline UA values should reflect current maintenance practices. It is also an expectation of the ASME PRA Standard that the PRA reflects the as-built, as operated plant. As these objectives are similar, the expectation is that the MSPI baseline UA values should be consistent with the values used in the PRA.

Proposal:

Staff recommends that a long-term objective be pursued that conforms the MSPI baseline unavailability with that assumed in the PRA.

Two options were investigated: 1) Planned Unavailability Consistent with PRA, and 2) Planned and Unplanned Unavailability Consistent with PRA.

These options recognized that the Birnbaum values used in the MSPI are derived from plant-specific PRAs and are dependent, in part, on the unavailability values assumed in the PRA. The ASME PRA Standard Section 5 states the PRA configuration control requirements including the expectation that the PRA is to be consistent with the as-built, as operated plant. Supporting requirement DA-D7 of the ASME PRA Standard includes requirements to limit the use of old data if modification to plant design or operating practice leads to a condition where past data are no longer representative of current performance.

Therefore, it is staff's expectation that the UA baseline is consistent with that used in the PRA and that changes to the UA baseline should only occur as a result of changes to the PRA.

Option 1: Planned Unavailability Consistent with PRA

This approach would replace the 2002 through 2004 basis for the current planned baseline unavailability with a value derived from the site's PRA. The word "derived" is used as it is likely that the unavailability values contained in the PRA for a given system or train are a composite of planned and unplanned unavailability. Therefore, the derivation of the MSPI baseline value would be that portion of the PRA unavailability that reflects the current preventative maintenance program and surveillance test activities. This derivation will likely need to be documented in the MSPI bases document.

This option has several advantages:

1) It ensures limited consistency between the assumed PRA unavailability and the MSPI baseline unavailability. In theory, the current values should be consistent as the 2002 through 2004 timeframe is fairly recent and is likely to reflect the current maintenance philosophy. Where maintenance philosophy changes have been made, updates to MSPI are expected as stated in NEI 99-02 and updates to the PRA are expected as required by the ASME PRA Standard. The word limited is used as the conformance of MSPI with the PRA does not include unplanned availability.

2) It maintains the generic unplanned unavailability values currently used in MSPI. These values are indicative of acceptable performance.

3) It changes the concern for monitoring changes in maintenance philosophy from the MSPI program to the PRA maintenance and update process. As plants have established PRA maintenance and update programs, this should result in less burden for the MSPI program.

Option 1 has one key disadvantage. It maintains the generic unplanned unavailability values as opposed to using plant specific values and therefore still requires unavailability to be divided into planned and unplanned (See Option 2 for the used of plant specific unplanned unavailability values). It also results in the potential for the total unavailability assume in the PRA for a given system or train (and used to derive the Birnbaum values) to be inconsistent with that used in MSPI.

Option 2: Planned and Unplanned Consistent with PRA

This approach would replace the current baseline unavailability (planned and unplanned) with a value derived from the site's PRA. As the baseline unavailability is the sum of planned unavailability determined by data from 2002 through 2004 and unplanned unavailability determined by generic data based on ROP PI data from 1999 through 2001, the use of terms planned and unplanned were necessary in order to enable the two types of data (plant-specific planned unavailability and generic unplanned unavailability) to be captured. The split of unavailability into these elements also allowed the baseline values to reflect current maintenance practices (site-specific) and to be consistent with acceptable (generic) unplanned unavailability values. The proposed approach is to directly use the composite unavailability value assumed in the PRA for the associated MSPI system or train.

Option 2 advantages:

1) It ensures full consistency between the assumed PRA unavailability (which is used as the basis for the MSPI Birnbaum values) and the MSPI baseline unavailability.

Planned Unavailability: In theory, the current PRA values should be consistent with the associated MSPI values as the 2002 through 2004 timeframe is fairly recent and is likely to reflect the current maintenance philosophy. Where maintenance philosophy changes have been made, updates to MSPI are expected as stated in NEI 99-02 and updates to the PRA are expected as required by the ASME PRA Standard. However, apparent differences between the MSPI and PRA values have been noted.

Unplanned Unavailability: The unplanned unavailability included in the PRA should reflect the historic performance of the MSPI systems. Therefore, the calculated PRA Birnbaum values used in the MSPI will be consistent with historical performance and with the assumed MSPI baseline unavailability.

2) It changes the concern for monitoring changes in maintenance philosophy from the MSPI program to the PRA maintenance and update process. As plants have established PRA maintenance and update programs, this should result in less burden for the MSPI program.

Option 2 disadvantages:

1) The primary purpose of the MSPI is to aid in the identification of degraded performance. Conforming the baseline unavailability value used in the MSPI to the PRA could obfuscate poor performance. To illustrate this point, consider a plant with two EDGs. EDG A has performance problems and a history of high unavailability. EDG B has performed well and has low unavailability. Assume that this asymmetrical performance is reflected in the PRA. The resulting cutsets (accident scenarios) will rely more on the better performing EDG B as EDG A is often unavailability. In other words, the frequency of the accidents with EDG A unavailable and where EDG B is required is higher than it would be if both EDGs are performing well. As a result, the Birnbaum importance of EDG B will be higher than EDG A. Although EDG A is the diesel with the performance problem, EDG B will be more likely to exceed a performance indicator threshold as a result of a failure because of its higher Birnbaum value. As a result EDG B may appear to be the problem diesel, not EDG A. If should be noted that other MSPI systems will also likely have higher Birnbaum values as a result of the poor performance of the example EDG for similar reasons as that stated above.

2) Option 2 requires CDE algorithm changes.

Due to the importance of identifying degraded performance, staff recommends Option 1.

Possible Steps for implementation

1) Formalize the recommended approach

2) Develop guidance for the derivation of baseline unavailability from the values assumed in the PRA.

3) Perform a limited pilot program to ensure clarity of guidance.

4) Develop a white paper/FAQ that documents the new guidance and the proposed changes to NEI 99-02.

5) Develop a change management plan.

6) Select a program wide implementation date and implement.

Staff White Paper

EDG Component Boundary

Issue

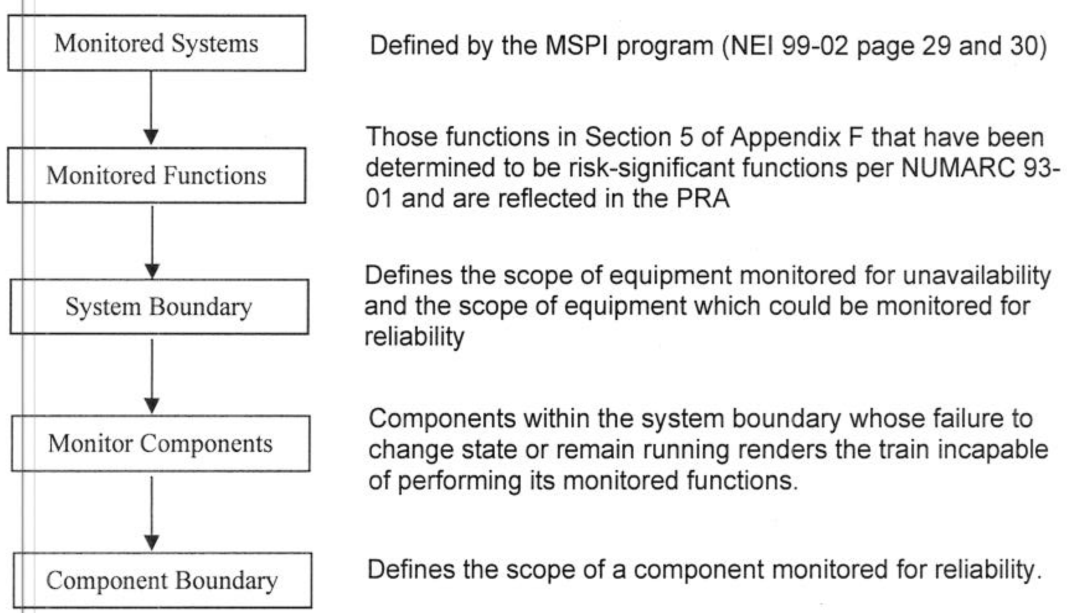
The treatment of the failures associated with the EDG fuel oil system is unclear as the fuel oil system is stated as being within the boundary of the EDG super component but the fuel oil transfer pumps (which are part of the fuel oil system) are stated as not being monitored.

Background

Based on the guidance provided in NEI 99-02, the following scoping structure can be deduced as shown in Figure 1 below.

Figure 1

MSPI Scoping



Definitions (derived from NEI 9-02)

Monitor Systems –defined by the MSPI program (NEI 99-02 page 29 and 30)

Monitor Functions – are those functions in Section 5 of Appendix F that have been determined to be risk-significant functions per NUMARC 93-01 and are reflected in the PRA. (F1.1.1)

System Boundary – used to define the scope of equipment monitored for unavailability and the scope of equipment which could be monitored for reliability. All components within the system boundary are considered to be required to satisfy the monitored functions of the monitor systems.

Monitoring Components – components within the system boundary whose failure to change state or remain running renders the train incapable of performing its monitored functions. All pumps and diesels in the monitored systems are included as monitored components.

Component Boundary – defines the scope of a component monitored for reliability (note that no definition of component boundary was found in NEI 99-02)

Failure – in general, a failure of a component for the MSPI is any circumstance when the component is not in a condition to meet the performance requirements defined by the PRA success criteria or mission time for the functions monitored under the MSPI. This is true whether the condition is revealed through a demand or discovered through other means. (NEI 99-02 Section F2.2.2)

<u>Discussion</u>

The fuel oil system (including local or day tank) is identified as being part of the EDG super component (within the component boundary) while the fuel oil transfer pump is within the system boundary, but is not considered to be a monitored component. Its exclusion is stated as being due to the difficulty in obtaining accurate estimations of demands and run hours (due to the auto start and stop feature of the pump) and due to the expected small contribution to the index (NEI 99-02, Section F.5). Although Section F.5 states that the EDG Fuel Oil Transfer Pumps are exempt from unreliability monitoring, it implies that these pumps would normally have been monitored except for difficulties in data tabulation and in some cases for plants with multiple redundant pumps, their low risk significance. Additionally they are monitored for contribution to train unavailability only if an EDG train can only be supplied from a single transfer pump. Section F.5 notes that there are configuration differences where the capability may exist to supply an EDG from redundant transfer pumps which would result in the contribution to the EDG MSPI from these components to be small compared to the contribution from the EDG itself.

NEI 99-02 Section F 2.1.3 provides the basic philosophy stating that a support component that solely supports the operation of the monitored component should be considered part of the component boundary. If a support component supports multiple components, it should not be considered as part of the monitored component. Although this section refers to relays, breakers or contactors, it could be applied to the relationship between the fuel transfer pumps and the diesels.

Proposal

The staff proposes to align the fuel oil system issue with the philosophy of Section F 2.1.3 which states that a support component that solely support the operation of the monitored component should be considered part of the component boundary. Therefore, if a portion of the fuel system (including the fuel oil transfer pumps) that uniquely supports a single EDG results in the failure of the EDG, then that failure will be considered to be within the EDG component boundary and will be recorded as a failure against the EDG. This approach allows flexibility in the definition of the fuel oil system boundary such that the various plant configurations can be accommodated. If the failure of the failure of the fuel oil transfer pump results in a depleted day tank and the inability of the EDG to perform its mission (assume tank depletion occurs during an actual demand), then this event would be an EDG failure. If the failure of the fuel oil transfer pump does not result in an EDG failure, then no EDG failure would be recorded.

Applicable NEI 99-02 Guidance

1. NEI 99-02, Appendix F, Section F1.1.1 defines system boundary as the scope of components that are required to satisfy the monitored functions of the system.

2. NEI 99-02, Appendix F2, Section F2.1 states: "The identification of monitored components involves the use of the system boundaries and success criteria, identification of the components to be monitored within the system boundary and the scope definition for each component. Note that the system boundary defined in section 1.1.1 defines the scope of equipment monitored for unavailability. Only selected components within this boundary are chosen for unreliability monitoring."

3. NEI 99-02, Appendix F, Section 2.1.3, Table 2, Component Boundary Definition, states for the diesel generator:

"The diesel generator boundary includes the generator body, generator actuator, lubrication system (local), fuel system (local), cooling component (local), startup air system receiver, exhaust and combustion air system, dedicated diesel battery (which is not part of the normal DC distribution system), individual diesel generator control system, cooling water isolation valves, circuit breaker for supply to safeguard buses and their associated control circuit (relay contacts for normally auto actuated components, control board switches for normally operator actuated components)."

In Section F5 "Additional Guidance for Specific Systems," the same boundary conditions are listed with a few differences: fuel system is stated as including "local or day tank," the parenthetical for associated control circuits is excluded and air compressors are stated as not part of the EDG component boundary.

4. NEI 99-02, Appendix F, Section 2.1.3, page F-19 states: "in other words, if the relay, breaker or contactor exists solely to support the operation of the monitored component, it should be considered part of the component boundary. If a relay, breaker or contactor support multiple components, it should not be considered as part of the monitored component, failure of relay/switch would not be considered an MSPI failure. However,

failure of individual contacts on the relay/switch, which each support a single monitored component would be considered a failure of the monitored component."

5. NEI 99-02, Appendix F Section F.2.3.4, page F-35 states with regard to the common cause correction factor: "The EDG is a "super-component" that includes valves, pumps and breakers within the super-component boundary. The EDG generic adjustment value should be applied to the EDG "super-component" even if the specific event used for the [FV/UR] ratio for the EDG is a valve or breaker failure.

6. NEI 99-02, Appendix F, Section F.5, Additional Guidance, EAC Power Systems, pages F-44 and 45. Although this section states that the EDG Fuel Oil Transfer Pumps are exempt from unreliability monitoring, it implies that these pumps would normally have been monitored except for difficulties in data tabulation and in some cases for plants with multiple redundant pumps, their low risk significance. This would mean that the Transfer System should qualify as a system that should be treated as within scope and within the component boundary, but with no monitored components.

It further states: "The fuel transfer pumps required to meet the PRA mission time are within the system boundary, but are not considered to be a monitored component for reliability monitoring in the EDG system. Additionally they are monitored for contribution to train unavailability only if an EDG train can only be supplied from a single transfer pump. Where the capability exists to supply an EDG from redundant transfer pumps, the contribution to the EDG MSPI from these components is expected to be small compared to the contribution form the EDG itself. Monitoring the transfer pumps for reliability is not practical because accurate estimations of demands and run hours are not feasible (due to the auto start and stop feature of the pump) considering the expected small contribution to the index."

7. NEI 99-02, Appendix F, Section F.2.2.2, page F-28, states that "Failures of SSC's that would have caused an SSC within the scope of the performance index to fail will not be counted as a failure or demand. An example could be a manual suction isolation valve left closed which would have caused a pump to fail. Any mis-positioning of the valve that caused the train to be unavailable would be counted as unavailability from the time of discovery. The significance of the mis-positioned valve prior to discovery would be addressed through the inspection process. (Note, however, in the above example, if the shut manual suction isolation valve resulted in an actual pump failure, the pump failure would be counted as a demand and failure of the pump.)

The subsection titled "Failures and Discovered Conditions of Non-Monitored Structures, Systems, and Components," states that failures of non-monitored structures, systems, and components (SCCs) (such as a fuel transfer pump) that cause failure of the monitored component do not count as a failure against the monitored component, **unless** the SCC's failure results in an actual failure of the monitored component.

8. NEI 99-02, Figure F-1 provides a block diagram of the EDG component boundary. It includes a note that states "The Fuel Transfer Pump is included in the EDG System Boundary. See Section 5 for monitoring requirements.

9. NEI 99-02, Appendix F, Section F2.1 states that "Monitored Component: A component whose failure to change state or remain running renders the train incapable of performing its monitored functions, In addition, all pumps and diesels in the monitored systems are included as monitored components.

Recommended NEI 99-02 Changes

To be developed.