ROP LESSONS LEARNED
STATEMENT OF ISSUES
UNAVAILABILITY PI

NOTE: The Nuclear Energy Institute (NEI) formed a working group that established an industry proposal on the issues related to the Safety System Unavailability (SSU) PI. The NRC Focus Group met and developed its proposed position. A joint meeting of the two groups was convened, and the results are presented in the Proposed Resolution to each issue.

ISSUE NO. 1: What unavailable hours should be included in the SSU PI?

a. Should all unavailable hours of a train be counted whenever the function is required, or only when the train is required?

b. Should on-line maintenance be excluded from the SSU if the licensee has a risk analysis that shows the increase in risk is small?

c. Should support system unavailable hours be counted as monitored system unavailable hours?

d. Should unavailable hours due to design deficiencies be excluded from the SSU PI?

BACKGROUND:

a. The SSU PI was derived from the WANO Safety System Performance Indicator (SSPI). The WANO SSPI (and consequently the ROP SSU) does not include unavailable hours that occur when a train is not required to be operable by Tech Specs, even though the function may be required. For example, in cold shutdown, refueling or defueled, only one train of emergency ac power is required. Any maintenance, including overhaul, on another train is not included in the SSU calculation for that train. Should all unavailable hours of a train be counted whenever the function is required, or only when the train is required?

b. There was a perceived unfairness in counting unavailable hours for licensees that perform on-line maintenance in accordance with a risk-informed tech spec change that extended the AOT for that purpose, because off-line maintenance is not counted and the risk is comparable. Should on-line maintenance be excluded form the SSU if the licensee has a risk analysis that show the increase in risk is small?

c. The WANO SSPI includes unavailable hours for a monitored system when support system unavailability (except emergency ac power) renders the monitored system unavailable. Should such support system unavailable hours be counted as monitored system unavailable hours? If so, what requirements would be placed on the support system to assess unavailability of the monitored system, e.g., must the support system be single failure proof and/or meet all design basis requirements?

d. Design deficiencies can manifest themselves years later. The time of failure would normally be known and could result large fault exposure hours that could result in a non-green PI for up to three years. To avoid such a situation, the ROP excludes design deficiencies from the PI calculation. Should unavailable hours due to design deficiencies be excluded from the SSU PI?

PROPOSED RESOLUTION:

a. The NRC Focus Group and the NEI/Industry working group agree that the correct way to measure unavailability during power operation is to count unavailable hours when any train in a system is out of service and the system function is required. There is also agreement that, while shutdown, the licensee's shutdown risk-management plan would

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identify those safety functions and methods necessary to manage the increase in risk that may result from shutdown activities. The NRC Focus Group would count unavailable hours for any method for performing a safety function that is credited in that plan. The NEI/Industry working group proposes to only count unavailability of the primary and/or the first backup methods of performing a safety function. Both groups agree that unavailable hours during power operation and while shutdown should be tracked separately, and eventually there should be separate indicators for the two phases of operation. However, until shutdown indicators are developed, it is acceptable to combine both power operation and shutdown unavailability in one indicator.

b. Both NRC and NEI agree that unavailable hours should be counted for on-line maintenance (and off-line maintenance whenever two trains of any system whose function is required by T.S. are not available).

c. The NRC and NEI agree that, as long as support systems are not monitored in the SSU, support system unavailable hours should be cascaded to the monitored systems. We also agree that the support system is available if a single train of that system is available (i.e., support systems are not required to be single-failure proof).

d. Both NRC and NEI agree that long-standing design deficiencies should not be included in the SSU, and that consideration should be given to identifying long-standing design deficiencies as those that occur before the 12 month period of the current calculation.

CANDIDATE FOR EXTERNAL LESSONS LEARNED WORKSHOP:

[X] Yes, as is [ ] Yes, after completing additional work (briefly identify additional work needed) [ ] No

FINAL NRC RECOMMENDED APPROACH:

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ISSUE NO. 2: How should demand and run failures be handled in the SSU?

a. Is a reliability indicator necessary, or can the SSU alone provide meaningful indication of safety system performance?

b. Should estimates of fault exposure hours be used in lieu of an unreliability indicator? Are there acceptable alternatives?

c. Should the ROP include a provision to allow licensees to remove large increments of fault exposure hours after one year if the NRC has approved the licensee's corrective actions?

BACKGROUND:

The WANO SSPI does not use an unreliability indicator. Instead, WANO incorporates unreliability into the SSU through the use of fault exposure hours (FEHs) associated with a train failure (although not explicitly stated, the failure should include run failures as well as demand failures). If the time of discovery of the failure is known but the time of failure is not known, the fault exposure time is taken as one-half the time (t/2) since the last successful test or operation of the train. The problem is that the t/2 estimate will usually dominate the unavailable hours. Should estimates of fault exposure hours be used in lieu of an unreliability indicator? Are there acceptable alternatives to the use of estimated FEHs, such as using a baseline inspection to assess the risk of demand and run failures? Or should an unreliability indicator be developed for use prior to the completion of the RBPI effort? If an unreliability indicator is used, how are FEHs then used for discovered conditions, such as a closed manual valve in the injection path of a monitored system?

A large increment of fault exposure hours, such as might occur due to a failed surveillance test of 30 days or longer interval, could result in a non-green PI for up to three years. This creates two concerns. First, any additional problems in that train could be masked, since the white band is from one to three times the width of the green band, so that another threshold might not be crossed to trigger additional NRC engagement. Second, after some period of time, the PI is no longer indicative of current performance. For these reasons, a provision has been added to the ROP SSU to allow licensees to remove large ($\geq$336 hours) increments of FEHs due to a single event or condition after one year if the problem has been corrected and the NRC Region has approved the resolution. Should the ROP include a provision to allow licensees to remove large increments of fault exposure hours after one year if the NRC has approved the licensee's corrective actions?

PROPOSED RESOLUTION:

a. The working groups agree that an unreliability indicator is the correct way to measure demand and load-run failures. However, in the absence of unreliability indicators, the groups agree that FEHs due to demand and load-run failures can introduce large blocks of unavailable hours into the SSU that can misrepresent the risk at the plant and can limit the NRC's ability to respond to performance issues.

b. The NRC and NEI groups agree that the best resolution to the question of FEHs due to demand and load-run failures is to remove them from the SSU and to use the Significance Determination Process to assess those events.

c. The NRC and NEI agree that removal of FEHs due to demand and load-run failures from the SSU will greatly reduce the problem, and that, for large increments of FEHs due to other causes, this provision is acceptable.

CANDIDATE FOR EXTERNAL LESSONS LEARNED WORKSHOP: [Task lead makes a recommendation; final decision will be made at the internal lessons learned workshop]

[X] Yes, as is [ ] Yes, after completing additional work (briefly identify additional work needed) [ ] No

FINAL NRC RECOMMENDED APPROACH:

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ISSUE NO. 3: What credit should be allowed for operator recovery actions?

BACKGROUND: The SSU allows credit for operator actions to restore a train when a demand is received during surveillance testing if the actions are virtually certain to be successful. The same criterion can be used to allow credit for recovery from an operator error or a malfunction. Licensees have requested credit for operator actions to recover from uncomplicated maintenance configurations, and from more complicated maintenance or test configurations when there is sufficient time until the train is required by the accident analysis. Probabilistic Safety Analyses include probabilities of operator recovery actions as important components in the progression of any accident scenario. In the ROP, credit has been limited because the SSU PI measures equipment performance, not operator performance. If the recovery actions are virtually certain to be successful, then the probability is near 1 and credit can be given. Anything short of 'virtually certain' requires estimation of a number less than 1, which is likely dependent upon the situation, the crew, and perhaps the specific operator involved. Therefore no credit is given. Maintenance activities conducted during chaotic conditions in the course of an analyzed accident are not considered to be virtually certain. Should the SSU allow credit for operator actions that are virtually certain to be successful? Should there be credit allowed for more complicated recovery actions? If so, what conditions should be applied to such actions?

PROPOSED RESOLUTION: Both NRC and NEI agree that the current allowances for operator recovery action should be retained with no changes or additions, but that plant-specific exceptions could be made for special circumstances.

CANDIDATE FOR EXTERNAL LESSONS LEARNED WORKSHOP: [Task lead makes a recommendation; final decision will be made at the internal lessons learned workshop]

[X] Yes, as is [ ] Yes, after completing additional work (briefly identify additional work needed) [ ] No

FINAL NRC RECOMMENDED APPROACH:

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ISSUE NO. 4: Should default values for hours train required be allowed?

BACKGROUND: The calculation of the SSU uses, as the denominator in the calculation of train unavailability, the hours the train was required during the most recent 12 quarters. The WANO guidance has allowed licensees to estimate this number through the use of default hours to reduce the data collection burden on licensees. In some cases, the default value is non-conservative in that the denominator would be larger than the actual required hours. This will cause the calculated value to be lower than the true value. In the case of the EDG SSU, the error could be as much as 60 percent. Should the ROP allow licensees to use the non-conservative default hours approved by WANO? If not, is there an acceptable alternative estimate?

PROPOSED RESOLUTION: NEI proposes to allow the use of default values for the hours a train is required because of the burden on licensees to collect the actual information. The NRC has data that show the calculated SSU value can be significantly underestimated, in certain circumstances, when the default hours are used. The NRC will look at the possibility of providing guidelines for licensees on when the use of default hours is acceptable and when it is not.

CANDIDATE FOR EXTERNAL LESSONS LEARNED WORKSHOP: [Task lead makes a recommendation; final decision will be made at the internal lessons learned workshop]

[X] Yes, as is [ ] Yes, after completing additional work (briefly identify additional work needed) [ ] No

FINAL NRC RECOMMENDED APPROACH: