Enclosure 3
January 2009 Meeting Handouts
Meeting Summary of the 01/14/09 Reactor Oversight Process Working Group Public Meeting
Dated February 24, 2009

ANS Testing

Proposed change to NEI 99-02:

The following text would be inserted in the clarifying notes section between lines 21 and 22 on page 58 of NEI 99-02:

21 ....during NRC inspection.

In order to ensure that test results indicate the actual as-found condition of the ANS, licensees can only use ANS data that is reflective of actions contained in established FEMA approved testing procedures. Testing or actions performed prior to a scheduled test that is not contained in procedures could bias results and therefore the scheduled test should not be counted.

22 A licensee may change ANS test methodology at any time consistent with regulatory guidance. For the purposes of this performance indicator, only the testing methodology in effect on the first day of the quarter shall be used for that quarter. Neither successes nor failures beyond the testing methodology at the beginning of the quarter will be counted in the PI.....

Accounting for Post Maintenance Test Failures in the Mitigating Systems Performance Index

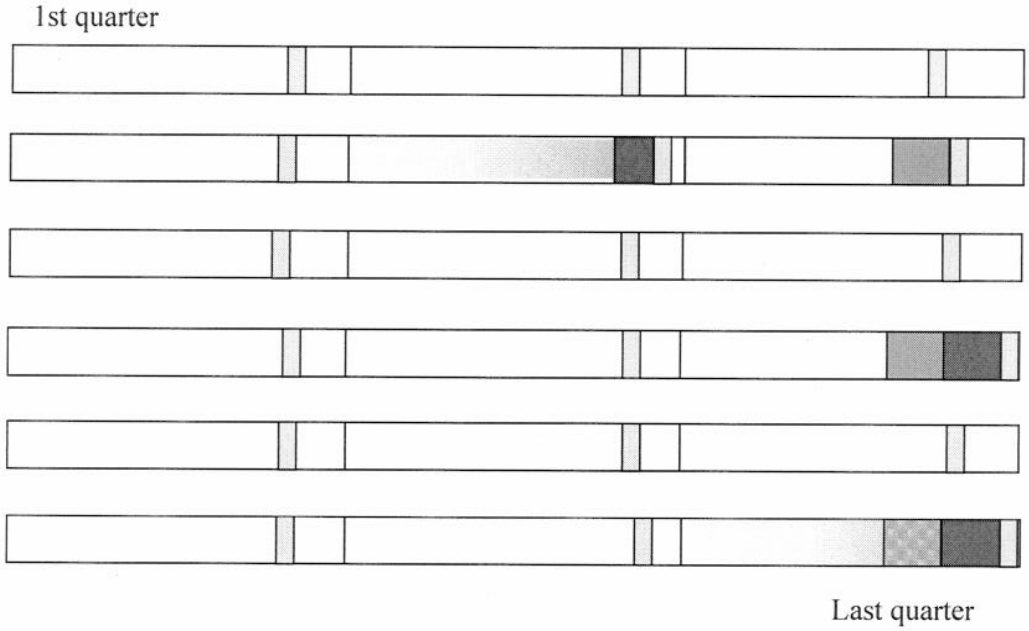
This simple illustration has been developed to help with the interpretation of the guidance in NEI 99-02 which says:

> *Exclude post maintenance tests, unless the cause of the failure was independent of the maintenance performed.*

This guidance is consistent with that contained in NUREG/CR-6823, Handbook of Parameter Estimation for Probabilistic Risk Assessment (page 5-7, item 10).

> *Successive failures of the same components over short time intervals should be counted as a single failure. Similarly, failures of a component during post-maintenance testing where the failure is related to the maintenance or to an earlier failure that the maintenance was trying to correct should be considered as a continuation of the original failure and should be disregarded. The successive failures are because proper maintenance was not performed to fix the initial problem, and the component is still in the failed state.*

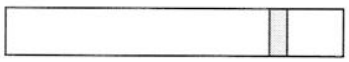
Consider 6 quarters of operating history for an EDG that are depicted in the following figure. Each rectangle represents one month of operating history. This constructed operating history can be used to test different interpretations of the guidance to see which one results in the correct answer because the correct answer is known explicitly from the constructed history.



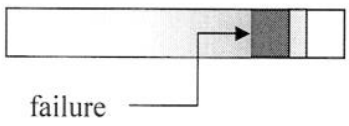
The key to the diagram is provided in the figure below, but in summary the history includes 18 months of history. In the 18 months there is one ST each month depicted by the yellow

block. The ST does not affect the availability of the DG and for illustration purposes should be considered a perfect ST in that it can identify all possible failure modes of the EDG.

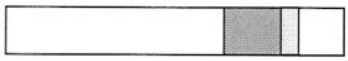
There are three planned maintenance events in the history (blue and purple blocks) each lasting 48 hours. There are three unplanned maintenance events (red blocks) following failures of the EDG, each one assumed to last 24 hours. In two of the failures, there was a period when the EDG was in an undetected failed stated (orange shaded block) prior to the failure. Because we use demand related failure rates in MSPI as opposed to a failure rate with a test interval exposure time, the time the EDG is assumed to be in an undetected failed state is the entire 30 day interval since the last successful ST In the case of the second of the three failures on the chart, it was determined that the failure event was caused by the maintenance activity prior to the failure and the EDG was not in an undetected failed state prior to the planned maintenance.



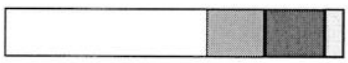
One month with a single successful ST (yellow)



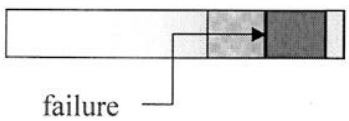
One month with a failure preceded by an unknown amount of UA (orange) followed by known UA time (red) followed by a successful ST (yellow)



One month with a maintenance outage with a known amount of UA (blue) followed by a successful ST (yellow)



One month with a maintenance outage with a known amount of UA (blue) followed by a failed ST related to the maintenance with Known UA (red), followed by a successful ST (yellow)



One month with a maintenance outage with a known amount of UA (purple) followed by a failed ST **unrelated** to the maintenance with Known UA (red), followed by a successful ST (yellow). The failure is preceded by an unknown amount of UA (orange)

Given these parameters, the probability the EDG will not perform its function is given by:

$$P = \frac{\text{Total hours the EDG is nonfunctional}}{\text{Total exposure hours}}$$

The total exposure hours is:

Exposure Hours = 18 months* 30 days/month*24 hours/day = 12960 hours

The hours the EDG was non-functional is:

Non-functional Hours = 3 planned maintenance events * 48 hours each

+ 3 unplanned maintenance events * 24 hours each

+ 2 periods of time in an undiscovered failed state * 30 days each

* 24 hours per day

- one 48 hour instance where the planned maintenance overlapped the same time the the EDG was already failed.

= 1608 hours

$$P = \frac{1680}{12960} = .124$$

Using an approach that parallels the MSPI rules, the probability the EDG will not perform its function is given by:

$$P = UR + UA = \frac{\#\,\text{failures}}{\#\,\text{demands}} + \frac{\text{UA Hours}}{\text{Exposure Hours}}$$

$$P = \frac{2}{18} + \frac{216}{12960} = .128$$

This answer is close to the previous answer, but not identical because this method does not adequately account for the overlap of planned unavailable hours and hours in an undiscovered failed state in the last month. We could account for this by subtracting the 48 planned hours from the numerator of the second term in the equation above and the results would be identical.

Counting the failure that occurred post maintenance in the 12th quarter as an MSPI failure would significantly overestimate the probability as given by:

$$P = \frac{3}{18} + \frac{216}{12960} = .183$$

We conclude that to get the correct answer from the MSPI method, only two failures should be counted, even though it is known that there were three failures in the 18 month period. To decide if the failure should be counted or not it is important to remember that the Un-Reliability term is included to estimate the number of hours that a component was thought to be functional, but was actually in an undiscovered failed state.

When decisions are to be made concerning failures discovered during post maintenance testing the following considerations should be made to interpret the guidance correctly.

- Did the failed condition discovered during post maintenance testing pre-date the conduct of the planned maintenance?

Or

- Did the maintenance activity cause the failed condition and the failed condition would not have existed absent the maintenance activity.

If the failed condition pre-dated the maintenance activity then it is clearly independent of the activity, it is impossible for an event that happens earlier in time to depend on an event that occurs later. The failure is independent (in the Boolean logic sense of the word) and it would count.

Conversely, if the maintenance activity caused the failed condition then the failure depended on the maintenance activity. The dependence is easily recognized by noting that if the maintenance activity had not occurred, then the failure would not have occurred. This is dependence, again in the Boolean logic sense of the word. And the failure would not be counted.

Thus, the term *independence* used in NEI 99-02 has to be interpreted in a Boolean logic context to arrive at the correct interpretation and should not be interpreted in terms of work scope of the maintenance which can lead to an incorrect interpretation.

Rev 2
December 20 2008

Staff White Paper on NEI 99-02 Guidance Changes for MSPI for Clarification of Planned UA Expectations (Industry proposed revision)

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. Though it is not intended that the baseline UA value match the assumptions made in the PRA, it is expected that the risk impacts of maintenance activities reflect the as-built, as-operated plant. As a change in maintenance philosophy has the potential to impact the results of the PRA, consideration of this potential impact is required.~~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 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. Changes to baseline unavailability values to allow for equipment modifications are allowed as they were included in the originally baseline values. However, these changes should be removed at the conclusion of the 3-year monitoring period that encompasses the modification. Similarly, baseline unavailability values that included unavailability for modifications should also be removed.

~~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 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~~after an evaluation is performed to determine the impact of the change on the PRA.

Recommended Changes

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 substantially changes with respect to on-line maintenance, ~~or~~ preventive maintenance or implementation of an on-line modification. 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 adjustment to the~~ed~~ planned unavailability baseline value, the impact of the adjusted values on all MSPI PRA inputs should be assessed. A change to the PRA model and associated changes to the PRA input values is required prior to changing the baseline unavailability if:

~~If the~~$\Delta CDF_{basline}$ > 1E-7/yr ~~PRA inputs change by 25% or greater, they are expected to be updated with the implementation of the updated UA baseline value.~~

Where:

$\Delta CDF_{basline} = \Sigma(\Delta UA_i * Birnbaum_i)$

$\Delta UA_i = UA_{current} - UA_{baseline}$ for segment i

$UA_{current}$ = proposed unavailability (expressed as a probability) to be used as the new baseline

$UA_{baseline}$ = the base unavailability (expresses as a probability) for 2002 – 2004.

$Birnbaum_i$ = Birnbaum value of segment i

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 performance of maintenance in response to a condition-based preventive maintenance activity.
- The performance of an on-line modification.

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 or is the result of emergent work.~~

~~The performance of an on-line modification.~~

FAQ – Dedicated Operators Draft Rev. 10 01/06/09

Plant: Kewaunee Power Station, Dominion Energy Kewaunee
Date of Event: July 2, 2008 and other various dates
Submittal Date: _____
Licensee Contact: Paul Miller Tel/email: 920-388-8350 / paul.c.miller@dom.com
NRC Contact: Steve Burton Tel/email: 920-388-3156 / sxb3@nrc.gov

Performance Indicator: Mitigating System Performance Index

Site-Specific FAQ (Appendix D)? **No**

FAQ requested to become effective **when approved**

Question Section

NEI 99-02 Guidance needing interpretation:
NEI 99-02, Rev. 5, page F-6, lines 31-40 and page F-7, lines 1-21 states:

31 Credit for Operator Recovery Actions to Restore the Monitored Functions
32
33 1. *During testing or operational alignment*:
34
35 Unavailability of a monitored function during testing or operational alignment need not be
36 included if the test or operational alignment configuration is automatically overridden by a
37 valid starting signal, or the function can be promptly restored either by an operator in the
38 control room or by a designated operator[11] stationed locally for that purpose. Restoration
39 actions must be contained in a written procedure[12], must be uncomplicated (*a single action or*
40 *a few simple actions*), must be capable of being restored in time to satisfy PRA success

[11] Operator in this circumstance refers to any plant personnel qualified and designated to perform the restoration function.
[12] Including restoration steps in an approved test procedure.

1 criteria and must not require diagnosis or repair. Credit for a designated local operator can be
2 taken only if (s)he is positioned at the proper location throughout the duration of the test or
3 operational alignment for the purpose of restoration of the train should a valid demand occur.
4 The intent of this paragraph is to allow licensees to take credit for restoration actions that are
5 virtually certain to be successful (i.e., probability nearly equal to 1) during accident
6 conditions.
7
8 The individual performing the restoration function can be the person conducting the test or
9 operational alignment and must be in communication with the control room. Credit can also
10 be taken for an operator in the main control room provided (s)he is in close proximity to
11 restore the equipment when needed. Normal staffing for the test or operational alignment may
12 satisfy the requirement for a dedicated operator, depending on work assignments. In all cases,

13 the staffing must be considered in advance and an operator identified to perform the
14 restoration actions independent of other control room actions that may be required.
15
16 Under stressful, chaotic conditions, otherwise simple multiple actions may not be
17 accomplished with the virtual certainty called for by the guidance (e.g., lifting test leads and
18 landing wires; or clearing tags). In addition, some manual operations of systems designed to
19 operate automatically, such as manually controlling HPCI turbine to establish and control
20 injection flow, are not virtually certain to be successful. These situations should be resolved
21 on a case-by-case basis through the FAQ process.

Event or circumstances requiring guidance interpretation:

A procedure is used to periodically drain water from between two normally closed containment isolation valves and the containment sump. The containment isolation valves provide a suction path to the Residual Heat Removal Pumps (RHR) from the containment sump. The isolation valve closest to the sump is opened and then a drain valve between the two containment isolation valves is opened to perform the draining. Two dedicated operators are used during this procedure. One is stationed in the control room, dedicated to closing the containment isolation valve if notified by the control room operator that a safety injection has occurred. The other operator is stationed in the field at the drain valve and will close it upon being notified by the control room operator that a safety injection has occurred. Restoration actions are contained in a written procedure, are uncomplicated (*a single action for each operator*), are capable of being restored in time to satisfy PRA success criteria and do not require diagnosis or repair. The operator in the control room performing the procedure (not one of the two dedicated operators) is responsible for identifying the condition and notifying the two dedicated operators to perform their dedicated functions.

The operator stationed in the field to close the drain valve is the operator dedicated to restoring the MSPI monitored function. The MSPI monitored function for RHR includes the flow path from the containment sump to the RHR pumps that is normally isolated and only used post-LOCA to cool and recirculate water from the containment sump following depletion of RWST inventory, to provide decay heat removal. The containment isolation valves are motor operated and do not have automatic open or close features. The containment isolation valve closest to the RHR pump suction remains closed during performance of the procedure. The dedicated operator used to close the inboard containment isolation valve is in place to restore the containment isolation function. Containment isolation is not a monitored function for MSPI. Therefore, only one dedicated operator is used to restore the MSPI monitored function.

The restoration actions taken by the station for this procedure fulfill the dedicated operator qualifying conditions:

- Are contained in a written procedure
- Are uncomplicated (*a single action or a few simple actions*),
- Are capable of restoring the system in time to satisfy PRA success criteria
- Actions for restoration do not require diagnosis or repair
- Operators are positioned at the proper location throughout the duration of the test
- Operators are in communication with the control room
- Operators are in close proximity to restore the equipment when needed
- Staffing is considered in advance
- Operators are identified to perform the restoration actions independent of other control room actions

The licensee credits operator recovery actions and unavailability of the RHR system is not counted for MSPI during this procedure.

If licensee and NRC resident/region do not agree on the facts and circumstances explain:

The NRC contends that NEI 99-02 only discusses the use of a dedicated operator in a singular manner (NEI 99-02, page F-6, lines 37-38, "the function can be promptly restored either by an operator in the control room or by a designated operator stationed locally for that purpose."). The procedure in question uses two dedicated operators and an operator in the control room as described above. The operator in the control room performing the evolution is procedurally instructed to notify the two dedicated operators to perform their dedicated functions if conditions warrant. Therefore, the NRC believes that unavailability should be counted for the stated condition.

Potentially relevant existing FAQ numbers

N/A

Response Section

Unavailability need not be counted during the described evolution since all the criteria are met for a dedicated operator in accordance with NEI 99-02, Rev. 5, page F-6, lines 31-40 and page F-7, lines 1-21. The MSPI function in question is for RHR, which NEI 99-02 defines as:

> The function monitored for the PWR residual heat removal (RHR) system is the long term decay heat removal function to mitigate those transients that cannot rely on the steam generators alone for decay heat removal. These typically include the low-pressure injection function and the recirculation mode used to cool and recirculate water from the containment sump following depletion of RWST inventory to provide decay heat removal. The pumps, heat exchangers, and associated piping and valves for those functions are included in the scope of the RHR system.

For the event in question, one dedicated operator is used to restore the MSPI monitored function. The operator stationed in the field to close the drain valve is the operator dedicated to restoring the MSPI monitored function. If the drain valve is open when placing containment sump recirculation into service, the potential exists to affect the RHR monitored MSPI function.

The operator located in the control room that is responsible for closing the containment inboard isolation valve is supporting restoration of the containment isolation function, which is not an MSPI monitored function. With the inboard containment isolation valve open, it is in the proper position for performing the MSPI monitored function. Therefore, repositioning is not required to restore the MSPI monitored function.
Unavailability need not be counted in the scenario provided. The NEI 99-02 requirements for a dedicated operator are met.

Additional Information

The dedicated operator located in the control room responsible for closing the containment inboard isolation valve is a licensed reactor operator. This is his sole responsibility. The reactor operator responsible for the primary side of the plant controls the evolution and is responsible for recognizing if the condition exists (e.g. a safety injection signal) that requires dedicated operator actions, and if so, directs the dedicated operator(s) to perform the required actions. The dedicated operator in the control room is also capable of recognizing a safety injection signal. The pre-job brief includes discussion of who is in charge, identification of each participant, identification of their tasks/responsibilities and the termination criteria. Termination on a safety injection signal is included in the discussion with assurance that the dedicated operator tasks are a priority.

Proposed Resolution of FAQ

The purpose of the guidance for dedicated operator in NEI 99-02 is to allow licensees to take credit for restoration actions that are virtually certain to be successful during accident conditions. Initially this scenario was described as using multiple dedicated operators during the event to be responsible for restoring the MSPI monitored function. It has been clarified that only one dedicated operator is used to restore the MSPI monitored function, and one is used to restore a non-monitored function. The issue of using more than one dedicated operator should still be clarified in NEI 99-02, even if it does not apply in this event. Using more than one operator fulfills the intent and safety function of the process. Licensees should not be required to incur unavailability for using multiple dedicated operators for actions that are virtually certain to be successful.

If appropriate, proposed rewording of guidance for inclusion in next revision.

In NEI 99-02, pages F-6 and F-7, section F.1.2.1.1, under Credit for Operator Recovery Actions to Restore the Monitored Functions, replace the term "or" with "and/or." As example, page F-6, lines 37-38, "...the function can be promptly restored either by an operator in the control room **and/or** by a designated operator stationed locally for that purpose."