INSPECTABLE AREA: Maintenance Effectiveness

CORNERSTONE: Initiating Events (10%)
Mitigating Systems (80%)
Barrier Integrity (10%)

INSPECTION BASES: Baseline inspection of maintenance effectiveness supports NRC oversight of the initiating events, mitigating systems, and barrier integrity cornerstones. Reliability and availability of structures, systems and components (SSCs) as monitored or demonstrated under the Maintenance Rule (MR) directly affect those reactor safety cornerstones and are dependent upon maintenance effectiveness (including work practices and common cause problems). This baseline inspection supplements the Unplanned Scrams, Unplanned Power Changes, Safety System Unavailability, and Safety System Functional Failure performance indicators.

LEVEL OF EFFORT: Routine Maintenance Effectiveness Inspection. Review 8 to 10 maintenance effectiveness performance issues a year with emphasis on high-risk-significant issues. This is an annual goal, but available maintenance effectiveness issues should be inspected each quarter to facilitate a reasonable distribution throughout the year.

Biennial Periodic Evaluation Inspection. Every 2 years, review licensee §50.65(a)(3) periodic evaluations and resulting adjustments or corrective action performed since the last inspection. As part of this inspection, review 4-6 scoped SSCs and/or functions (preferably high-risk-significant) that have suffered degraded performance or condition to aid in determining the effectiveness of the licensee's (a)(3) activities. When deemed necessary or appropriate, regional risk experts (with support from other agency risk analysis staff as necessary and available) review licensee probabilistic safety assessment (PSA) activities related to maintenance effectiveness in conjunction with the (a)(3) inspection.

71111.12-01 INSPECTION OBJECTIVE

01.01 To supplement performance indicators by providing for independent oversight of licensee maintenance effectiveness including MR activities, work practices, and common cause issues.

71111.12-02 INSPECTION REQUIREMENTS

02.01 Routine Maintenance Effectiveness Inspection

a. Independently verify the licensee's appropriate handling of SSC performance or condition problems in terms of:

   1. Appropriate work practices.
   2. Identifying and addressing common cause failures.
   3. Scoping in accordance with 10 CFR 50.65(b).
   4. Characterizing reliability issues (performance).
   5. Charging unavailability (performance).
   6. Trending key parameters (condition monitoring).
   7. 10 CFR 50.65(a)(1) or (a)(2) classification and reclassification.
   8. Appropriateness of performance criteria for SSCs/functions classified (a)(2) and/or appropriateness and adequacy of goals and corrective actions for SSCs/functions classified (a)(1).

b. For the maintenance effectiveness attributes specified in Section 02.01.a above, verify the licensee's appropriate handling of degraded SSC/function performance or condition as follows:

   1. Identify and screen equipment problems for review using an issue/problem-oriented approach and/or an SSC/function performance history-oriented approach. Problems can relate to reliability, availability, condition monitoring, work practices, work control, or common cause failures. Concentrate on high-safety-significant issues/problems or SSCs/functions, especially those not covered by performance indicators, those with declining performance or condition trends, and those with known equipment problems.

   2. Based on the review of paragraph 02.01.b.1, select potentially risk-significant issues from either the issue/problem approach category or the SSC/function approach category or both such that 8 to 10 samples will be reviewed in a year and perform detailed reviews.

   3. In conjunction with the detailed review, assess the extent to which the problem(s) may affect other trains, systems, units, or similar components in other applications. For those problems recognized by the licensee, assess the accuracy with which the licensee has identified the extent of condition.

c. After the detailed review of the problem history and surrounding circumstances, evaluate the role of work practices and common cause problems as follows:

1. Determine if deficient work controls or work practices contributed to the degraded performance or condition of the affected SSC(s). Having learned the extent of condition, if work practices are implicated, observe affected and/or related work activities, as appropriate. As necessary, discuss the issue with licensee personnel at the appropriate level, and evaluate licensee corrective actions.

2. Determine the extent of condition for those issues with common cause or generic implications if the issues have the potential to result in, for example, failures of multiple or diverse trains of SSCs. Evaluate adequacy of licensee corrective actions.

d. Evaluate the licensee's handling of the SSCs/issues being reviewed under the requirements of the MR and, where applicable, 10 CFR Part 50, Appendix B, and the technical specifications (TS) as follows:

1. Determine whether the SSCs/functions of interest are within the licensee's MR scope. If they are, evaluate the licensee's handling of the issues under the MR. If not, determine whether they should be in scope and conduct regulatory review if they should. If they are not required to be in scope, there will be no MR issues.

2. Independently evaluate SSC/function performance in terms of reliability and availability. Compare documented functional failures with those being tracked by the licensee under the MR. Compare unavailable hours (when required) to those being charged by the licensee. For SSCs under condition monitoring, evaluate the effectiveness of the licensee's condition monitoring at tracking and trending SSC condition and recognizing declining trends.

3. Evaluate licensee corrective action that may be required by the MR for degraded SSC/function performance or condition, as well as any corrective action that may be required by 10 CFR Part 50, Appendix B; license technical specifications (TS); plant or site procedures. Also evaluate use of industry standards, guidance, and operating experience (important, but not regulatory requirements, except operating experience where its use is required by the MR).

4. Evaluate functional failures and unavailable hours against the licensee's goals or performance criteria as applicable. Determine, as applicable, if goals are being met or if SSC/function performance or condition is being effectively controlled through the performance of appropriate preventive maintenance.

5. Based on the performance and condition review above, determine if the affected SSC(s)/function(s) has/have been properly classified in terms of monitoring under 50.65(a)(1) or effectively controlling performance by appropriate preventive maintenance under (a)(2).

6. Determine if (a)(1) goals are commensurate with safety, are reasonable, and where practicable, take industry operating experience into account. Similarly evaluate (a)(2) performance criteria for SSCs in (a)(2). Determine if effective preventive maintenance can be reasonably demonstrated or degraded performance detected.

If the results of any of the above determinations are unsatisfactory, conduct licensee engagement and regulatory review. See Appendix A for guidance.

02.02 Biennial Periodic Evaluation (PE) Inspection. Once every 2 years, assess the effectiveness of the licensee's PE(s) and the resulting adjustments performed pursuant to 10 CFR 50.65(a)(3) since the last PE inspection. When deemed necessary and appropriate, regional risk experts (i.e., regional staff/inspectors with sufficient risk knowledge), with support as necessary and as available from other agency risk analysis staff, may review maintenance effectiveness activities related to the plant's probabilistic safety assessment (PSA) or probabilistic risk analysis (PRA), if any, in conjunction with the PE inspection.

02.03 Identification and Resolution of Problems. Inspection activities under this procedure include independent verification that the licensee is identifying problems related to this inspection area and entering them in the corrective action program. For a sample of selected problems documented in the corrective action program, verify that the corrective actions and resolutions are appropriate and adequate. Problem identification and resolution (PI&R) activities inspected per this procedure can count toward satisfaction of the PI&R inspection requirements of Inspection Procedure 71152, "Identification and Resolution of Problems."

71111.12-03 INSPECTION GUIDANCE

03.01 Maintenance Effectiveness. See Appendix A to this procedure.

03.02 Periodic Evaluation (PE). See Appendix B to this procedure.

03.03 Identification and Resolution of Problems. PI&R are integral and essential elements of maintenance effectiveness; therefore the specific guidance in this inspection procedure covers review of licensee PI&R in the maintenance effectiveness area. Guidance on the conduct of PI&R inspections in general is contained in IP 711152.

71111.12-04 RESOURCE ESTIMATE

This inspection procedure is estimated to take 92 to 124 hours a year for the routine maintenance effectiveness inspection and 34 to 46 hours every 2 years for the biennial periodic evaluation inspection regardless of the number of reactor units at the site. The PSA review, if conducted, can be accommodated within the hours allotted to the biennial inspection.

71111.12-05 COMPLETION STATUS

Inspection of the minimum sample size will constitute completion of this procedure in the Reactor Programs System (RPS). The minimum sample for routine inspection will consist of eight maintenance effectiveness issues (of high risk significance to the extent available) in a year. The minimum sample for the biennial inspection will consist of four SSCs/functions (of high risk significance to extent available) that have suffered degraded performance or condition regardless of the number of reactor units at that site.

71111.12-06 REFERENCES

Section 50.65, "Requirements for monitoring the effectiveness of maintenance at nuclear power plants," of Title 10 of Part 50 of the *Code of Federal Regulations* (10 CFR 50.65)

Statement of Considerations for the Maintenance Rule (three sections)

Inspection Procedure (IP) 62706, "Maintenance Rule"

NRC Regulatory Guide (RG) 1.160, "Monitoring the Effectiveness of Maintenance at Nuclear Power Plants"

Nuclear Energy Institute (NEI) (formerly Nuclear Management and Resources Council (NUMARC)), NUMARC 93-01, "Industry Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants"

NRC Inspection Manual, Chapter 0609, "Reactor Safety Significance Determination Process"

NRC Inspection Manual, Chapter 0612, "Inspection Reports"

IP 97201, "Licensee disposition of NRC Generic Communications"

IP 71152, "Identification and Resolution of Problems"

NRC Generic Letter 90-03, June 15, 1990, "Relaxation of Staff Position on Generic Letter 83-28, Item 2.2, Part 2, Vendor Interface for Safety-Related Components"

NRC Enforcement Manual, Section 8.1.11, "Actions Involving the Maintenance Rule" (Go to http://www.nrc.gov/what-we-do/regulatory/enforcement/guidance.html#manual, click on Chapters 1-8)

IP 88025, "Maintenance and Surveillance Testing"

NRC Inspection Manual, Part 9900, Technical Guidance, "Preconditioning of Structures, Systems, and Components (SSCs) Before Determining Operability"

NUREG -1648, "Lessons Learned from Maintenance Rule Implementation"

END

Attachments:
Appendix A, “Routine Maintenance Effectiveness Inspection Detailed Guidance”
Appendix B, “Maintenance Effectiveness Periodic Evaluation Inspection Guidance”

APPENDIX A

Routine Maintenance Effectiveness Inspection Detailed Guidance

This appendix provides additional information and guidance for the performance of the maintenance effectiveness portion of the procedure. The steps referenced in this appendix provide guidance for completing the corresponding blocks in Flowchart 1. Comprehensive and detailed review of the licensee's maintenance rule program is not within the scope of this, performance-based baseline inspection, but inspection of maintenance effectiveness performance may reveal programmatic weaknesses requiring program improvements in addition to corrective action for the performance issues themselves.

Start - There are concerns involving degraded performance or condition of SSCs/functions or the handling thereof (concerns may be inspector or licensee identified).

Blocks 1 & 2 - Routine Inspection, Screening

Identify and screen equipment problems for review. Problems to be selected involve concerns with reliability, availability, work practices, or common cause failures. Note that these reviews are similar to and can be completed during performance of Inspection Manual Chapter 2515, Appendix D, "Plant Status." The intent of this section is to highlight inspection activities necessary to understand day-to-day equipment performance problems.

Block 1 - Issue/Problem-Oriented Approach. Routinely review logs, condition reports (or equivalents), etc., and monitor plant status to identify problems with the performance (reliability and/or availability) or condition of SSCs within the scope of the MR with emphasis on those of high risk or safety significance. Using the sources of information listed below (or others as available), review those instances that appear to have maintenance effectiveness implications, warrant further assessment of work practices, and/or may be related to common cause failures, independent of whether the licensee has identified them as such. The more significant issues should be considered for further review.

Block 2 - SSC/Function-Oriented Approach. As an alternative, complementary approach, review the performance or condition history of selected, preferably high-safety-significant, SSCs/functions to identify degraded or declining performance or condition independent of licensee recognition. Review instances that have maintenance effectiveness implications, warrant further assessment of work practices, and/or may be related to common cause failures, independent of whether the licensee has identified them as such. The SSCs/ functions may be selected and even scheduled for review such that the most safety-significant are covered periodically. The more significant maintenance effectiveness issues involving these SSCs should be considered for further review, particularly those that may not have been recognized or appropriately dispositioned by the licensee.

Sources of Information

The following list is not meant to be all-inclusive, but is intended to provide the inspector with potential sources of information regarding equipment problems for evaluation:

- Operating logs (manual and automated)
- Plant event reports/condition reports
- Technical specification action statement logs
- System or component work order history
- Safety system unavailability and unreliability performance indicator data
- Other reliability and availability data (MR, PRA, INPO/WANO)
- Corrective action program documents
- Operability evaluations or non-conformance reports
- Temporary system modification documents
- Maintenance (or component) history databases
- System "health" reports
- Predictive maintenance test or condition monitoring results (e.g. thermography, lubricating oil analysis, vibration analysis, other in-service test results)
- Maintenance Rule program documents
- Plant walkdown observations and plant status information
- Licensee personnel interviews
- Information discussed at licensee meetings
- Industry operating experience (IOE) information

The following are some sources of IOE information:

- NRC generic communications
- 10 CFR Part 21 notifications (and those posted on the NRC external website)
- Notifications from the Institute for Nuclear Power Operations (INPO)
- INPO's Equipment Performance Information Exchange (EPIX)
- Nuc Net
- Vendor technical bulletins or other correspondence (Vendor Equipment Technical Information Program (VETIP) - see also NRC Generic Letter 90-03)
- Owners and users group information
- IOE information published by the Electric Power Research Institute (EPRI)

From among the problems/issues (first approach category) or SSCs/functions (alternative approach category) screened above, select potentially risk-significant issues for detailed review from either or both categories. Consider the following when selecting samples: (1) the risk significance of the problems/issues or of the affected SSC(s)/function(s), (2) the duration and frequency of the problem, (3) the impact of the problem on the SSC performance (i.e., reliability and unavailability) or condition, (4) whether the problem results in frequent or repeated technical specification limiting condition for operations entries, (5) the impact of the problem on the licensee's organization (i.e., are operators and maintenance personnel challenged by frequent emergent work activities to resolve the issue?), (6) whether the apparent cause of the problem could result in a common cause failure, and (7) the extent to which the problem has been previously inspected.

Block 3 - Detailed Review. Detailed review includes examining work orders and associated records for corrective and preventive maintenance and related corrective action documents. Obtaining an adequate understanding of the problem may require review of

those applicable work orders and/or corrective action documents generated in at least the past 2 years. Reviews of up to 5 years may be considered for SSCs that are rarely operated or tested.

Following the detailed, historical review, the inspector should understand the duration and extent of the problem(s) being evaluated and the effectiveness of the licensee's corrective actions to improve SSC performance or to correct the identified problem.

Block 4 - Extent of Condition. In conjunction with the detailed review, independent determination of the extent to which the problem(s) may affect other trains, systems, units or plants, or similar components in other applications will enable the inspector to judge the accuracy with which the licensee has assessed the extent of condition.

Block 5 - Work Practices Implicated. Deficient work practices can cause or contribute to an SSC performance or condition problem. The term "work practices" refers to the broad range of activities performed to maintain SSCs, including (but not limited to) preventive maintenance program requirements, maintenance procedures, field activities, system isolation and restoration procedures and practices, and post-maintenance testing. Note that the licensee's maintenance preventable functional failure (MPFF) evaluations and/or root cause analyses, if any, may contain insights in this area. If work practices are not implicated, continue inspecting for common cause implications.

Block 6 - Observation of Work Activities. If work practices are implicated, observation of affected and/or similar activities (as necessary) will enable the inspector to assess the extent and/or the impact of the maintenance problem. For instance, the inspector may determine that it is necessary to review a specific activity such as motor alignments, or perhaps it is necessary to look more broadly at electrical maintenance activities to ensure that the nature and extent of the maintenance problem is fully understood.

Block 7 - Work Practices OK? If work practices are found to be acceptable, continue inspecting for common cause implications. If not, go to Regulatory Review for this issue, but continue inspection in other paths as appropriate.

Block 8 - Common Cause. For those issues with common cause or generic implications, determination of the extent of condition will reveal the issues' potential to result in, for example, failures of multiple or diverse trains of SSCs. Note that common cause problems may be related to maintenance support activities, including plant design, application engineering, procurement and acceptance, material control, and commercial-grade dedication. However, problems may occur that are ultimately determined to be related to latent component design and manufacturing deficiencies that were not or would not reasonably expected to be identified by the licensee. This distinction may become important in determining if any resultant functional failures were maintenance preventable. If there are no apparent common cause implications, continue the inspection in the MR implementation area. If there are, proceed in this path.

Block 9 - Corrective Actions. Detailed review includes evaluation of the licensee's corrective actions for the common cause problem(s). The licensee should ensure that the entire extent of condition is identified and adequately addressed. In addition, overall maintenance effectiveness is in part dependent upon feeding the insights gained in dealing

with common cause issues back into other maintenance-related or support areas. If corrective actions are adequate, continue the inspection in the MR implementation area. If not, go to Regulatory Review for the issue(s) in question, but then continue inspecting MR implementation.

MR Implementation

Block 10 - MR Scope Determination. Is/are the SSC(s)/function(s) being reviewed classified by the licensee as being within the scope of the MR? If so, continue inspecting and evaluating SSC/function performance (i.e., reliability and availability) or degraded condition issues if any.

Block 11 - If not, determine if the SSCs/functions in question should be in scope. If they should, regulatory review and licensee engagement will facilitate development of a regulatory position. Continue evaluating SSC/function performance and/or condition. If the SSC(s)/function(s) in question are not required to be in scope, MR compliance is not a regulatory issue. Go to Block 25.

SSCs/functions that have one or more of the following attributes must be scoped into the maintenance rule program:

1. Safety-related SSCs/functions [50.65(b)(1)]
2. Non-safety-related SSCs that perform an accident or transient mitigation function [50.65(b)(2)(i)] (as defined in the Final Safety Analysis Report)*
3. Non-safety-related SSCs that are used in the emergency operating procedures (EOPs) [50.65(b)(2)(i)]*
4. Non-safety-related SSCs that could prevent the fulfillment of a safety-related function [50.65(b)(2)(ii)]
5. Non-safety-related SSCs that could cause an unwanted reactor trip or engineered safety feature (ESF) activation [50.65(b)(2)(iii)]

*Note: NUMARC 93-01 (Rev. 3) states that an SSC needs to be in scope under (b)(2)(i) only if it "provides a significant fraction of the mitigating function"; whereas, paragraph 1.1.2 of RG 1.160 (Rev. 2) states that SSCs that are "directly used to address the accident or transient or explicitly used in the EOPs are within the scope of the rule, as are SSCs whose use is implied and that provide a significant fraction of the mitigating function." NRR (MR group) should be consulted for scoping issues of this type.

Block 12 - Reliability. SSC/function reliability may be evaluated by reviewing failure history independent of the licensee's recognition of failures as MR functional failures (MRFFs) (i.e., failures of one or more functions for which the SSC was included in the MR scope). Compare documented failures with those being tracked by the licensee under the MR. Evaluate these failures against the licensee's reliability performance criteria for SSCs in (a)(2), or goals for SSCs in (a)(1), and evaluate licensee corrective actions.

In view of varying inspector experience and widely varying licensee practices, the following discussions address some of the more complex (and historically contentious) MR issues

based on the collective inspection and enforcement experience of resident and regional inspectors and headquarters staff:

MR reliability performance criteria may be defined in various ways by the licensee, most of which are acceptable under the endorsed guidance. However, the inspector should be aware of limitations. For example, a licensee who defines reliability (or unreliability) in terms of Maintenance Rule functional failures (MRFFs), i.e., loss of one or more of the functions for which the affected SSC was included within the scope of the MR program, may only consider a total loss of those functions to be an MRFF. The licensee's program may not recognize certain degraded performance as an MRFF (e.g., reduction in capacity below the nominal value). Nevertheless, it may be reasonable to consider, for example, that an affected SSC which still retained its minimum design-basis capability did not suffer an MRFF, particularly if there were no condition monitoring being done on the SSC in question. Further, it may also be reasonable to consider some degraded performance not to be a MRFF when the minimum capability assumed in the PRA (upon which performance criteria are based in part) was maintained (i.e., PRA functional success criteria met) even if design-basis capability was not. However, such rationalization to avoid declaring MRFFs (or to avoid charging unavailability) may be counterproductive to maintenance effectiveness because the practice may mask declining performance trends that otherwise might be more promptly addressed, preferably before complete failures occur. In addition, the inspector should consider not only the design basis and/or PRA success criteria for the function(s) in question, but also the success criteria for all the functions for which the SSC was scoped (e.g., use in the EOPs). If the affected SSC cannot meet the appropriate functional success criteria for one or more of the functions for which it was scoped, the reduced capability should ideally be considered a MRFF. If it is not, then the inspector would be justified in questioning the licensee's basis for this determination, whether or not counting the degraded performance as an MRFF would result in the need to consider putting the affected SSC in (a)(1). While this situation may not result in an MR violation per se, there may be PI&R and/or corrective action implications, not to mention some risk or safety significance that could possibly be assessed through the significance determination process (SDP).

Some licensees define their reliability performance criteria in terms of maintenance-preventable functional failures (MPFFs) in a given number of valid demands or within some time period, as opposed to merely MRFFs. This further distinction can become very subjective. In evaluating the licensee's characterization of MRFFs as MPFFs (or not), where circumstances warrant, the inspector should consider maintenance-related contributing factors in a broad sense, not limited to work practices or other activities of maintenance staff alone. For example, deficiencies in certain direct maintenance support activities may cause or substantially contribute to failures, allow failures to occur or fail to prevent them, or allow unsatisfactory conditions to persist. These activities can include (but are not limited to) procurement; acceptance (including receiving and commercial-grade dedication); material control and issue; engineering (including design control, specifications, procedures and drawings, and poorly designed post-maintenance tests), work controls (including clearances, equipment lineups, etc.); operators (reconfiguring systems and equipment in support of maintenance); and use of vendor information and industry operating experience to keep instructions and procedures up to date. See the definition of maintenance in Section 1.2 of RG 1.160 and Appendix B of NUMARC 93-01.

Even certain common cause problems related to design and/or manufacturing deficiencies in replacement parts, component, or materials (e.g., sealants, adhesives, lubricants, etc.) may be legitimately considered to render an MRFF maintenance-preventable (i.e., the MRFF would become an MPFF) if the deficiency(ies) could or should reasonably have been detected and screened out (or contained) by the licensee applying generally acceptable industry standard practices in procurement, acceptance, and comprehensive corrective action. These maintenance support activities can be viewed as part of a more comprehensive concept of maintenance, and preventive maintenance in particular.

However, the inspector should also recognize that while such factors may indicate the need for improvements in maintenance and/or its support activities (e.g., re-training, improved work practices, etc.), they may not necessarily reflect degraded health of the affected SSC that would warrant monitoring. Such contributing factors as certain operator errors, for example, committed in direct support of maintenance (e.g., clearances, valve or equipment lineups, etc.), may require a failure to be deemed an MPFF by the licensee's program. However, absent any indications of actual degraded performance or condition of the SSC(s) involved, the licensee (typically an expert panel) may be justified in not placing or retaining the affected SSC(s) in (a)(1), even if that operator error-related MPFF caused the applicable performance criterion to be exceeded. It would be reasonable in such a situation for the licensee to prescribe corrective action more appropriate to the circumstances, such as remedial operator training or requalification. The licensee should be expected to be able to defend such decisions. Although not required by the MR to be documented, this sort of rationale may often be found recorded in expert panel meeting minutes or similar documents.

Note that for MR purposes, reliability or unreliability is tracked under all plant conditions for which the scoped SSC(s) or function(s) are expected to start and run, or remain running while meeting the appropriate success criteria for their required mission time. Valid demands may include automatic or manual operation in-service or during testing. When in doubt with regard to licensee recognition or categorization of functional failures, inspectors are encouraged to consult with MR experts in the region and/or NRR. If reliability is not an issue, review availability/unavailability. If reliability is an issue, continue in this flowchart path.

<u>Block 13</u> - Comparison of the identified failures with the licensee's (a)(1) reliability goals and/or (a)(2) reliability performance criteria will enable the inspector to determine whether the given failures exceeded or did not meet them as applicable. If reliability goals are not met or unreliability goals exceeded for SSCs in (a)(1), the licensee must take corrective actions under the MR. Note that prompt corrective actions may also be required for SSCs in (a)(2) by other regulations (e.g., Criterion XVI of 10 CFR Part 50, Appendix B, or technical specifications). If there are MRFFs or MPFFs of SSCs in (a)(2) status, particularly if unreliability performance criteria are exceeded, the licensee must determine whether effective control of SSC performance is being demonstrated. If not, the licensee must at least consider placing (a)(2) SSCs into (a)(1). If reliability goals or performance criteria are appropriate and are being met as applicable, reliability is not normally an issue unless the performance criteria are inappropriate and cannot be relied upon to identify degraded performance. In this case, the validity of the (a)(2) demonstration may be in doubt even when performance criteria are met and regulatory review must include

consultation with NRR and OE. If reliability is not an issue, go to Block 25; otherwise continue.

Block 14 - Licensee Aware? When the licensee miscounts failures and is unaware of exceeding unreliability goals or performance criteria as applicable, or when the licensee counts correctly, but still fails to recognize that goals or performance criteria have been exceeded, go to Regulatory Review for this issue, but continue inspecting in this path.

Block 15 - Licensee Actions. If the SSC performance trend is poor and not improving, the licensee's corrective actions for this problem likely have not been timely and adequate. In cases where an SSC has experienced an apparently high number of failures, consult with a regional senior reactor analyst (SRA) to determine whether the SSC reliability problems are likely to result in a significant risk increase. If licensee actions are acceptable, proceed to assess availability. If not, go to Regulatory Review for this issue, but continue to review SSC availability.

Block 16 - Availability. Availability is often tracked by its numerical complement, unavailability, and typically only for high-safety-significance (HSS) SSCs as provided for in the endorsed industry guidance. Unavailability is the time an SSC is unavailable during periods when the SSC was required to be available. Unavailability may also be expressed as a fraction of the total time the SCC was required to be available. Refer to the definition and discussion of unavailability in Appendix B to NUMARC 93-01. Under the MR, unavailability is customarily charged from the time of a demand failure or discovery of a degraded or failed condition until restoration. For the period prior to a demand failure or discovery of a failed or degraded condition, additional unavailability may be charged from when the condition first existed (i.e., fault exposure time) if the fault exposure time can be determined. However, for MR purposes, if the fault exposure time cannot be determined, additional unavailability need not be charged. Nevertheless, as an alternative to charging unavailability for fault exposure time, the licensee may impute a demand failure and count it against the unreliability performance criterion. Treatment of very long fault exposure time resulting from long-standing latent deficiencies (e.g., design deficiencies) depends on the circumstances. While the condition should be promptly corrected (and extent of condition addressed), it may legitimately be judged not to reflect adversely on current maintenance effectiveness or on other aspects of the "health" of the affected SSC(s); hence, not be charged as unavailability. Consultation with cognizant NRC staff in such instances is encouraged.

An SSC may be considered unavailable, even if deemed operable under technical specifications, when it cannot meet the appropriate success criteria for one or more of its MR-scoped functions. On the other hand, if the performance of the scoped function is tracked at the system level, and not all trains of the system are unavailable (such that the system can still meet scoped functional success criteria), then the licensee may legitimately consider the system available. For MR purposes, support system unavailability is not normally cascaded onto supported system(s) because it is indicative only of the performance or condition ("health") of the support system, not that of the supported system.

NUMARC 93-01 contains guidance on the restrictions for crediting operator recovery actions. Note that required availability may vary widely under different plant conditions.

It may depend upon the licensee's relying on the SSC for alternate success paths to preserve key safety functions.

With the assistance of regional and headquarters staff cognizant of the MR, the inspector should be able to keep abreast of changes to industry guidance related to maintenance effectiveness and the NRC positions with respect to that guidance. For example, it is current industry practice to track unavailability of HSS SSCs or functions for MR purposes under all plant conditions in which they are required. However, this may not always be the case during shutdown. Also, there may be changes in the way fault exposure time and discovered conditions are treated for MR purposes in the interest of improved consistency with unavailability tracking for ROP performance indicators and other reporting programs.

If availability is affected, continue in this path. If not, proceed to assessment of MR (a)(1)/(a)(2) classification, i.e., MR monitoring category. If neither availability nor reliability is affected, go to Block 25.

Block 17 - Goals or Performance Criteria Exceeded? If unavailability goals are exceeded, the licensee must take corrective actions under the MR for SSCs in (a)(1). Note that prompt corrective actions may also be required for SSCs in (a)(2) by other regulations (e.g., Criterion XVI of 10 CFR Part 50, Appendix B, or technical specifications). If there is unavailability incurred by SSCs in (a)(2) status, particularly if performance criteria are exceeded, the licensee must determine whether effective control of SSC performance is being demonstrated. If not, the licensee must at least consider placing (a)(2) SSCs into (a)(1). If availability goals or performance criteria are appropriate and are being met as applicable and the inspector is satisfied that effective preventive maintenance is being demonstrated for SSCs in (a)(2), or if availability is not an issue, go to Block 25; otherwise continue.

Block 18 - Licensee Aware? Actual unavailable hours (or as determined by the inspector from records and applying applicable criteria) may not be consistent with those being tracked and counted by the licensee. When the licensee incorrectly tracks unavailability, but is unaware that goals or performance criteria have been exceeded or when the accounting is correct, but the licensee still fails to recognize that goals or performance criteria have been exceeded, go to Regulatory Review for this issue, but continue inspecting in this path.

Block 19 - Licensee Actions OK? Unavailability trend data should show whether system performance is improving. If performance is not improving, ideally, the licensee should take timely and reasonable corrective actions for this problem. Depending on the circumstances, this situation may or may not amount to an MR violation, but it reflects negatively upon maintenance effectiveness and should be pursued through regulatory review. In cases where an SSC has experienced an apparently large amount of unavailability, the licensee's PRA may provide some insight as to the risk significance of this condition. Also, use of the SDP or consultation with a regional SRA may be necessary to determine whether the SSC availability performance problems are likely to result in a significant risk increase. If licensee actions are not acceptable, go to Regulatory Review for this issue, but continue to review MR disposition of the issue(s) in question.

Block 20 - MR Monitoring Category. If the SSC is already classified as (a)(1), continue to evaluate; if not, the inspector must decide if it should have been in (a)(1). The inspector should determine independently whether the licensee has demonstrated effective control of SSC or function performance through appropriate preventive maintenance for SSCs/functions in (a)(2), independent of whether performance criteria were exceeded. For example, in general, repetitive MPFFs (i.e., multiple failures of the same SSC for the same maintenance-related reason) can demonstrate that preventive maintenance is not effective and may be sufficient cause for placing the affected SSC in (a)(1) even if the performance criterion was not exceeded. By the same token, as discussed above, failures that are technically MPFFs and that exceed the reliability performance criterion, but are not related to the health of the SSC itself, may be reasonably judged by an expert panel not to warrant the increased attention of (a)(1) status.

Note that (a)(2) performance criteria are not required or even recognized per se by the MR. However, they are the means, established by the industry MR guidance, NUMARC 93-01, by which licensees typically determine whether they are demonstrating effective control of the performance of SSCs within the MR scope through appropriate preventive maintenance, and they have been endorsed by the NRC for this purpose in RG 1.160. Meeting or not meeting (a)(2) performance criteria is not, by itself, the sole test for a valid (a)(2) demonstration for MR compliance with regard to those SSCs being carried in (a)(2) status, i.e., not being monitored against goals in (a)(1) status. Therefore, not placing an SSC into (a)(1) status for failing to meet (a)(2) performance criteria alone may not be sufficient grounds for an (a)(1)/(a)(2) violation; just as meeting (a)(2) performance criteria alone may not be sufficient demonstration of effective control of SSC performance in (a)(2).

If the inspector believes, on the basis of some objective standard (e.g., the plant's PRA, the EPRI PRA applications guide, or industry operating experience) that unavailability and/or unreliability is excessive, even if the existing performance criteria (which may no longer be valid) are not exceeded, there may be justification to conclude that the licensee is not effectively controlling the performance of the affected SSC(s)/function(s) through appropriate preventive maintenance. In such a case, the licensee should at least be considering the affected SSC(s)/function(s) for monitoring under (a)(1). However, not having recognized the unacceptable performance or condition, the licensee will not have considered monitoring under (a)(1). This may be grounds for identifying an (a)(2) violation, but this kind of issue may be highly subjective and would require considerable objective evidence to support a violation or a risk-significant finding. In such cases, regulatory review must include consultation with NRR and OE.

Block 21 - A Regulatory Review will take place if it is determined that the affected SSC should have been in (a)(1), but was instead was being carried in (a)(2) status even when effective control of SSC performance or condition was not being demonstrated.

Block 22 - The (a)(1) monitoring goals must be appropriate and commensurate with safety. Corrective actions must be timely and must address the cause of the degraded performance or condition. For example, in setting goals, the licensee (expert panel) should have considered:

1. Both reliability and availability

2. Balancing of reliability and availability
3. Industry operating experience information
4. Actual performance history
5. Frequency of valid demands or expected operation within the monitoring period
6. PRA or some other reasonable risk/safety consideration(s)

If (a)(1) goals are not appropriate or are not commensurate with safety, go to Regulatory Review (RR). If (a)(1) goals are satisfactory, but have not been met, evaluate the licensee's corrective actions. Repeated failure to meet goals may be indicative of inadequate corrective action. However, note that failure to meet (a)(1) goals is not, by itself, an MR violation. However, failure to take timely and adequate corrective action when (a)(1) goals are not met (corrective action that addresses the cause(s) of the problem(s)) may constitute a 50.65(a)(1) violation (depending on the circumstances) in addition to any other safety-significant findings.

Block 23 - For SSCs that remain in (a)(2) following the current problem, the licensee's performance criteria should be appropriate, i.e., technically justifiable. They should be sensitive enough to identify unacceptably degraded performance while allowing a reasonable, technically defensible (in terms of both deterministic and risk factors) and balanced amount of unreliability and/or unavailability without invalidating the (a)(2) demonstration. In general, the licensee (expert panel) should consider factors similar to those used to establish (a)(1) goals.

Block 24 - Determine whether the licensee's goals and/or performance criteria are reasonable and achievable, consistent with the PRA or commensurate with safety, and appropriate. Consult the regional MR contact if you conclude that the licensee's performance criteria or goals are not reasonable and also if you conclude that the actual number of failures or amount of unavailability would have exceeded a more a reasonable goal or performance criterion.

For example, it would be unreasonable if the number of MPFFs required to exceed the reliability performance criterion or goal for a given SSC exceeds the number of expected (or possible) valid demands during the monitoring period. In this case, the goal or performance criterion could never be reached, let alone exceeded, despite clearly degraded performance or condition of the affected SSC. After consultation with appropriate regional and possibly headquarters staff, such issues can be addressed with the licensee, who should have a sound technical basis for its goals and performance criteria. This area, if suspect, may also be a candidate for further and more in-depth examination during the biennial inspection of the licensee's (a)(3) periodic evaluation activities.

Block 25 - END - Develop Regulatory Position and Documentation

REGULATORY REVIEW (RR): In general, RR is entered whenever the resident has occasion to question licensee actions or inaction and has not a received satisfactory response or justification from the licensee, or whenever the resident desires further evaluation of the validity of a licensee response. On the basis of the results of the reviews prescribed above, and concurrent with a continuing dialog with the licensee (licensee engagement), in addition to normal discussion of issues with the other resident inspectors

on site and the senior resident inspector, also consult (1) regional supervision, (2) regional DRS maintenance rule contact(s), and (3) regional enforcement specialist(s). After consultation with appropriate regional staff, and at least preliminary significance determination and documentation as described below, consult with Office of Nuclear Reactor Regulation (NRR) maintenance rule staff and Office of Enforcement (OE) staff as necessary.

The following guidance is intended to supplement the general guidance of IMCs 0612, 0609, and 0305 by providing specific guidance on the disposition of ME issues. That is, where there are choices or interpretations indicated in the applicable manual chapters, this procedure is intended to provide the resident with the staff-pre-selected choices and preferred interpretations unique to ME issues and applicable under the vast majority of foreseeable circumstances.

First, the licensee performance deficiency(ies) involved in or associated with the ME issue(s) should be clearly identified. They should be able to be characterized by a simple written statement as a preliminary determination. A maintenance effectiveness (ME) performance issue can involve various types of licensee performance problems, including, but not limited to: deficient procedures, instruments/measuring and test equipment, tools or other equipment, deficient work practices, deficient maintenance support activities (e.g., replacement parts procurement and dedication, storage and material issue), inadequate recognition and handling of common cause problems, or inadequate root-cause analysis and/or corrective actions for degraded performance or condition of SSC(s)/function(s).

In addition, one or more of the identified performance deficiencies may constitute a violation of one or more NRC regulations. Though not limited to violations of 10 CFR 50.65, the Maintenance Rule (MR), this section will focus on the disposition of ME issues involving MR violations because treatment of violations of other regulations that may be involved as well are covered adequately elsewhere. For ME issues involving potential MR violations, refer to Enforcement Manual Section 8.1.11. Note that the provisions of NUMARC 93-01 and RG 1.160 are not regulatory requirements, but may provide insights for characterization of failures to meet one or more explicit requirements of the MR or expectations of the Commission with regard to MR implementation as described in the statements of considerations.

Next, the identified performance deficiency(ies) is/are screened against the criteria in Appendix B to IMC 0612 to determine whether they are minor or more than minor. Those issues that are determined to be minor, although not normally to be documented in the inspection report, should be brought to the licensee's attention at a level and in a forum deemed appropriate by the inspector and must be corrected. Effective corrective action normally requires entry into the licensee's corrective action program. Appendix B to IMC 0612 will refer to the examples of minor issues in Appendix E to IMC 0612. Note that specific examples of MR violations are included in Appendix E to IMC 0612. These examples also explain the conditions that make the violations more than minor. In general, ME performance deficiencies will be more than minor when there is or has been identifiable degraded performance or condition of associated SSCs/functions, sometimes regardless of the extent to which such degraded performance or condition has been recognized and/or appropriately categorized or characterized by the licensee.

In processing more-than-minor ME performance deficiencies (i.e., findings), consider that MR violations do not always cause degraded SSC/function performance or condition, but rather are often a separate consequence of them. In some instances, equipment failures are found not to be attributable to any licensee performance deficiencies and are therefore not findings. Yet, in many instances, licensee ME performance deficiencies contribute to the equipment problems, or allow them to occur, persist, or get worse. In order to disposition ME issues involving performance deficiency(ies) systematically and consistently, all such issues will be categorized as follows:

Category I - ME issues involving performance deficiencies (including any MR or other violations) that are minor, determined as described above.

Category II - ME issues involving more-than-minor performance deficiencies (which are thus considered findings) where any identified MR violation has occurred as a separate consequence of degraded performance or condition of associated SSCs/functions within the scope of the MR, but where the degraded SSC/function performance or condition is not attributable to the MR violation.

In this category, the degraded SSC/function performance or condition will have its own proximate, ultimate and/or contributing causes that involve licensee ME performance deficiencies (findings) other than MR violations. Those causal findings will be processed in accordance with Appendix B to IMC 0612 and their significance will be determined, independent of any associated MR violations, using the reactor safety significance determination process (SDP) commensurate with the severity and risk/safety significance of the degraded performance or condition of the affected SSCs/function(s). Alternatively, the impact of the equipment problems may be otherwise captured under the ROP by the performance indicators.

However, also in this category, the MR violation(s) itself/themselves is/are also considered to be more than minor because actual problems with the associated equipment have occurred. However, since the equipment problems are not attributable to the MR violation, rather, the MR violation has occurred as a consequence of those problems, they cannot be processed through the SDP. Therefore, in accordance with Appendix B to IMC 0612, such MR violations are considered to be GREEN by definition.

Category III - ME issues involving more-than-minor performance deficiencies where the identified MR violation(s) is/are among the contributing causes of degraded SSC/function performance or condition. Such instances will typically involve circumstances in which, in addition to non-MR proximate causes, the lack of adequate preventive maintenance or proper attention to degraded performance or condition of affected SSCs/functions, which has allowed such degraded performance to continue or the condition to deteriorate, can be shown to be the result of one or more MR performance deficiencies, including MR violations. MR findings in this category are bundled together with the other, contributory, non-MR findings, and treated collectively as one finding, involving multiple violations and/or other performance deficiencies, which is then processed through the SDP. Note that only Category III MR findings can be greater than green.

Note also that in all three categories, cross-cutting issues may be involved. However, where identified in conjunction with Category II or III ME findings as described above,

cross-cutting issue aspects should be documented within the finding and dispositioned in accordance with IMCs 0612 and 0305.

Example of a MR Finding: Consider the very common case in which a high-safety-significant (HSS) SSC in (a)(2) status has suffered one or more MR functional failures (MRFFs), i.e., failures of one or more of the functions for which it was included in the scope of the licensee's MR program. Typically one or more of the following circumstances exist: (1) The resident inspector has determined that the MRFFs were maintenance preventable (i.e., were MPFFs), but the licensee has not recognized this. If counted appropriately as an MPFF, the latest MRFF would exceed the licensee-established (a)(2) unreliability performance criterion (PC); and/or (2) the latest MPFF constituted a repetitive MPFF (i.e., same type of failure and same cause or type of cause); and/or (3) regardless of the PC, the number of failures (and/or associated unavailability) is excessive by one or more objective standards, e.g., the EPRI PRA Applications Guide, NRC, vendor or industry guidance (including NEI, INPO, EPRI, and users or owners groups) or prevailing industry practice or operating experience. In any of these three cases, the circumstances may support an inspector determination that the licensee has failed to demonstrate for the affected (a)(2) SSC that its performance or condition has or is being effectively controlled through appropriate preventive maintenance; although in the third case, consultation with NRR and OE staff is required. This demonstration must be made in order for the affected SSC/function to remain in (a)(2) status under the MR. But having failed to make this demonstration, the licensee must set goals and monitor the performance or condition of the affected SSC under (a)(1) to be in compliance with the MR.

In practice, when licensees consider putting the affected SSC/function in (a)(1), but can justify not doing so by reason, for example, of the root cause being either corrected or unrelated to the equipment itself (e.g., personnel issues only), then they may be deemed to be in compliance with the MR while allowing the affected SSC/function to remain in (a)(2) status. However, if the circumstances warrant monitoring the affected SSC/function under (a)(1), and the licensee commences monitoring under (a)(1) within a reasonable amount of time, and takes prompt and adequate corrective action in case goals are not met, there has, thus far, been no violation of the MR in this scenario. Therefore, when the inspector reviews the circumstances described above, and determines that the licensee has not yet complied with the MR, the inspector must then determine whether the time that has passed since the licensee's first opportunity to comply is excessive, in which case, a violation may be identified. In making this determination consider the following:

When the inspector's concerns are brought to the attention of the licensee, the licensee may immediately recognize the situation, convene its expert panel and at least consider putting the affected SSC into (a)(1). In this case, the licensee may have avoided an MR violation unless an excessive amount of time has already passed and/or the licensee has missed one or more reasonable opportunities to comply. However, the resident should also expect the licensee to take prompt corrective action for the degraded performance or condition of the SSC regardless of the MR disposition. There may still be grounds for a violation of Criterion XVI of 10 CFR Part 50, Appendix B, for inadequate corrective action for previous failures, assuming the affected SSC is safety-related.

The second common situation is that the series of MPFFs that invalidated the (a)(2) demonstration occurred some time ago, for example, before the licensee's last (a)(3)

periodic evaluation, one or more expert panels have been convened without addressing the issue, or more than one rolling MR monitoring period has gone by, and the licensee has never recognized that the SSC in question should have been in (a)(1). In this case, there has clearly been a violation of (a)(2) and/or (a)(1) in that effective preventive maintenance was not demonstrated under (a)(2), yet the SSC was never put in (a)(1) despite several opportunities for the licensee to comply with the MR. In either of the foregoing situations, to determine the appropriate MR finding category, the history of the performance or condition of the affected SSC(s)/function(s) must be considered.

Category II Scenario: If during the period following the MPFF that first invalidated the (a)(2) demonstration, there were no further MPFFs, no additional related unavailability, or no further degradation of the condition of the affected SSC(s)/function(s), then the equipment problems are not considered attributable to the associated (a)(2) violation. Therefore this situation would be consistent with Category II. Accordingly, the non-MR performance deficiencies/findings contributing to the equipment problems would be dispositioned as otherwise provided for under the ROP. However, the associated, more-than-minor, but non-contributory MR violation, identified as a separate consequence of the equipment problems, would be colored green by default and documented separately, but as an additional finding related to the other non-MR ME findings.

Category III Scenario: However, if when the MR finding is identified by the inspector, the historical review reveals a continued declining trend in performance, i.e., more MPFFs and/or more unavailable hours after the MPFF or amount of unavailability that first invalidated the (a)(2) demonstration, such that failure to place the affected SSC/function in (a)(1) has resulted in continued inadequate attention or corrective action, then this is a Category III MR finding in that the MR (a)(2) violation has contributed to the continued degraded performance of the affected equipment. In this case, the MR violation and all other contributing causes would be considered together. To determine the significance of the composite finding, the resultant equipment problems would not be aggregated, but the safety/risk significance of the most severe of them would be processed through the SDP to color the finding. Note that this single colored finding could comprise multiple contributory performance deficiencies and violations, including MR violations.

Other types of Category III MR findings would include, for example, an (a)(3) violation in which there are MPFFs as a direct consequence of failing to take industry operating experience into account, or a scoping violation of (b)(1) or (b)(2) in which failure to include an SSC or function in the scope of the MR program when required resulted in the failure to recognize that no preventive maintenance or inadequate preventive maintenance was being performed; which then resulted in excessive MPFFs, excessive unavailability, or degraded condition of the affected SSC, or failure even to recognize that the performance or condition of the affected SSC/function was excessively degraded.

Finally, for regulatory assessment under the ROP, it is appropriate to view the licensee's MR program as one part of their overall problem identification and resolution program. When an ME finding has problem identification and resolution or human performance aspects, these cross-cutting issues should be identified within the finding. The cross-cutting aspects should be documented as a contributing cause of the finding. Guidance related to evaluating and documenting issues in cross-cutting area is provided in IMC 0305 and IMC 0612.

Documenting Maintenance Effectiveness (ME) Findings

ME findings should be documented according to the format prescribed by IMC 0612 for the findings section of an item under "Report Details," i.e., an introduction section, description of the findings, an analysis section, and an enforcement section. In order to supplement that guidance, in view of varying inspector experience and the need for standardization, the following specific guidelines for documenting ME findings (particularly those involving MR violations) in inspection reports are provided. Although it is recognized that many instances are complex and do not fit preconceived patterns, use of the standard language and structure suggested herein to the extent practicable is expected to greatly facilitate expeditious processing of findings.

In the introduction section, briefly state the finding ("bottom-line result"), the safety/risk characterization and/or any enforcement or severity level. Use a short phrase to describe the regulatory requirement violated and how it was violated, as applicable. Note that the standard language for this section (within quotation marks in the examples) was crafted in view of its frequent publication in plant issues matrices (PIMs) which need to be understandable by the public. Examples:

[(a)(1) violation]:

> "(Green) The licensee failed to take timely and adequate corrective action for the failures of the "A" service water pump to run for its required mission time due to high bearing temperatures. These failures caused the pump not to meet its monitoring goals established pursuant to Paragraph (a)(1) of 10 CFR 50.65, the Maintenance Rule. The regulation requires corrective action for components being monitored under Paragraph (a)(1) that do not meet their monitoring goals. A non-cited violation of 10 CFR 50.65(a)(1) was identified."

This scenario may represent a Category II finding (automatic green) if identified when the SSC first fails to meet its goals. However, it is consistent with a Category III finding when unsatisfactory equipment performance or condition is aggravated or persists as a result of the (a)(1) violation, i.e., in this case, inadequate corrective action. Absent actual SSC degraded performance or condition, most other types of (a)(1) violations will be Category I (minor). The category of the finding need not be documented in the report but is used only to determine the appropriate disposition of the finding in regulatory review.

[(a)(2) violation]:

> "(Green) The licensee failed to set goals and monitor the performance [and/or condition] of the 22 CVC pump as required by 10CFR50.65(a)(1), and had no justification for not doing so, after it had failed to demonstrate effective control of the performance or condition of the pump through appropriate preventive maintenance. Per 10 CFR 50.65(a)(2), effective control of SSC performance or condition through appropriate preventive maintenance must be demonstrated in order for the monitoring under Paragraph (a)(1) not to be required. Therefore, a non-cited violation of 10 CFR 50.65(a)(2) was identified."

This scenario would be a Category II finding if no further degradation of performance or condition has occurred after that which first invalidated the (a)(2) demonstration and after the licensee had a reasonable amount of time and/or number of opportunities to comply. It would be Category III if lack of adequate attention due to remaining in (a)(2) contributed to further or prolonged degraded performance or condition.

[(a)(3) violation]:

> "([Greater than Green]) During its most recent periodic evaluation of its maintenance rule program performed pursuant to 10 CFR 50.65(a)(3), the licensee failed to take industry operating experience into account (when practicable) as required by Paragraph (a)(3). Specifically, the licensee failed to incorporate recommended maintenance actions specified in a vendor technical service bulletin on the emergency diesel generator (EDG) in its preventive maintenance. This resulted in a subsequent failure of the diesel engine while the other EDG was unavailable. A violation of 10 CFR 50.65(a)(3) was cited."

This kind of finding would be characterized per the SDP. This example is greater than green because of its safety significance. It must also be Category III for that reason, but more fundamentally because the (a)(3) violation directly contributed to the EDG failure. However, absent actual consequences in terms of degraded performance or condition of SSCs, most (a)(3) violations will be minor.

[(b)(1) violation]:

> "(Green) The licensee failed to include the vital station battery circuit breakers within the scope of its maintenance rule program as required by 10 CFR 50.65(b)(1) and therefore did not recognize that appropriate preventive maintenance was not being performed. Failure to perform preventive maintenance on the breakers resulted in a failure of the "B" breaker during a test which indicated that the breaker would have failed upon demand in service. A non-cited violation of 10 CFR 50.65(b)(1) was identified."

This is another Category III MR finding because the functional failure (in this case, failure of the breaker's overload/fault trip function) was a consequence of the MR violation. The safety significance of this Category III finding would be determined using the SDP.

<u>Description of findings section</u>: The description of findings should summarize the facts and circumstances surrounding the issue in the form of a brief chronology of events. The MR-related performance deficiency should be clearly described, citing applicable requirements. Category II findings should be described as separate consequences of the equipment performance deficiencies. Category III findings, as in the (a)(1) violation example below, are described as being a contributing cause of the equipment performance deficiencies. Cite, if relevant, any missed opportunities for licensee compliance with the MR such as expert panel meetings, (a)(3) periodic evaluations, or even the passing of multiple monitoring periods or cycles after action should have been taken. Example [(a)(1) violation]:

"Discussion: The "A" service water pump was included within the scope of the MR under 10 CFR 50.65(b)(2)(i). It is non-safety-related, but is relied upon in mitigating accidents and transients. The pump had been placed in (a)(1) status under the MR in December 2001 after having suffered its second maintenance-preventable functional failure (MPFF) within one year. The failures had been increasingly high bearing temperatures, eventually rising above alarm setpoints requiring immediate pump shutdown on the occasions when it was run. The (a)(1) reliability goal (and condition for returning the pump to (a)(2) status) that the licensee had established for the pump was zero Maintenance Rule functional failures (MRFFs) for the next 6-month period in which the pump would see at least two valid demands. However, the licensee had only performed routine preventive maintenance and had made the "A" pump the one normally in standby. On January 12, 2002, after being placed on service after preventive maintenance (shaft packing renewal), the "A" pump failed to run longer than 15 minutes before another high bearing temperature alarm was received. At that moment, a nearby auxiliary mechanical operator observed smoke coming from the area of the pump shaft packing gland. The "A" pump was immediately stopped from the control room and the now standby "B" pump picked up and ran normally. Upon a cursory examination of the pump, technicians found that the shaft packing gland was too tight. The gland was loosened to obtain proper leak off and the "A" pump was released to Operations for unlimited service. It was declared available and operable, but placed back in standby. However, the inspector learned later that the licensee had made no attempt to determine the cause of the high bearing temperature alarm. Approximately one month later, on February 10, 2002, the inspector inquired about the status of the pump. The licensee stated that the pump was still in (a)(1) status, awaiting completion of the so-called "get-well" period so that it could be returned to (a)(2). The inspector asked about the failure on January 12 because as of that incident, the (a)(1) reliability monitoring goal for the pump had not been met. The licensee stated that the problem that caused the January failure had been corrected and the expert panel had determined that the pump needed only to operate successfully two times to be placed back in (a)(2). One week later on February 18, the "A" service water pump was placed on service in order to perform preventive maintenance on the "B" pump. After having started the "A" pump once more, operators noticed bearing temperature rising rapidly and shut the pump down just as the high temperature alarm was received. In looking into this failure, the inspector learned that a high bearing temperature alarm had been received in January as well, but that its cause had not been found and corrected. The pump had failed to meet this goal with its failure to be able to run for its required mission time on January 12, but the licensee had not taken adequate corrective action in that it failed to find and correct the cause(s) of the bearing overheating. By now, the licensee had over a month since the January failure when the pump had failed to meet its (a)(1) reliability monitoring goal to find the cause of the overheating problem and correct it, but despite this time and several opportunities to recognize the problem, the licensee had failed to do so. At this point, the inspector determined that the licensee had violated (a)(1) by failing to take adequate corrective action when an SSC in (a)(1) failed to meet its goal. Subsequently, the licensee determined that the cause of the bearing overheating had not been related to the over-tightened packing gland as had apparently been erroneously assumed, but without any confirmation. Instead, after extensive and more rigorous troubleshooting the licensee found that the separately mounted pump and motor had excessive runout (i.e., they had come severely out of alignment). The licensee corrected the misalignment, but its cause had not been determined as of the time of the inspection."

For issues involving MR scoping violations, explain why the affected SSCs/functions should be within the scope of the MR, citing the scoping criterion(a) under which the SSCs/functions in question should have been included. Then discuss any consequences of the scoping deficiencies with some risk significance (e.g., attributable degraded performance or condition of the associated SSCs/functions).

For issues/findings involving in-scope SSCs/functions, discuss the following: performance or condition problems that should have prompted licensee actions and any continued degradation or further unsatisfactory performance after action should have been taken as applicable; licensee recognition and characterization of those problems and your assessment of the appropriateness of that characterization; MR status of the affected SSC(s)/function(s) and its appropriateness, any changes in MR status, licensee rational for making MR status changes (or not) and its validity; whether the problems caused (a)(2) performance criteria or (a)(1) goals not to be met; and licensee handling of the issue and its appropriateness with regard to the MR.

For issues involving SSCs/functions in (a)(2), make it clear that deficiencies related to (a)(2) performance criteria and tracking availability and reliability against those criteria are being described only as supporting information for the determination of whether the licensee has demonstrated effective control of the performance or condition of the affected SSCs/functions through appropriate preventive maintenance; this being the relevant regulatory consideration. Cite basis(es) (e.g., repetitive MPFFs, industry standards, etc.) for any determinations that unreliability and/or unavailability are excessive such that it invalidates the demonstration of effective preventive maintenance under (a)(2) regardless of the performance criteria, if applicable (Note that this determination requires NRR/OE consultation). Also, discuss corrective actions for the equipment problems themselves, stating if and how the corrective action addressed the problem. In addition, discuss any ME issues of broader significance than MR compliance, such as work practices, maintenance support problems, common-cause problems and cross-cutting issue aspects.

<u>In the analysis section</u>, per IMC 0612, describe the logic for entering the SDP, how it was used, and the assumptions, using the guidance and example for determining MR violation significance with the SDP that is prescribed above in the Regulatory Review section of this procedure. If appropriate (RR Category II), characterize the ME finding/MR violation as being an additional, but separate consequence of the degraded performance or condition of the associated SSCs/functions; or, if appropriate (RR Category III), characterize the ME finding/MR violation as a contributing cause of the degraded performance or condition of the associated SSCs/functions. Describe any cross-cutting issue aspects of the finding. In answering Question (1) in Appendix B to IMC 0612, analysis section, use the considerations in the MR section (8.1.11) of the Enforcement Manual and the MR examples in Appendix E to IMC 0612 to establish how/why the issues are more than minor. Example: [(a)(1) violation]

> "<u>Analysis</u>: The inspector determined that the licensee's performance deficiency was failing to address all the failure modes of a risk-significant component. This deficiency posed an actual safety hazard and had resulted in additional component failures. Further, the inadequately addressed degraded condition of the component in question, if left uncorrected could have more serious safety/risk consequences. Therefore, the performance deficiency was more than minor and was a finding. In determining the

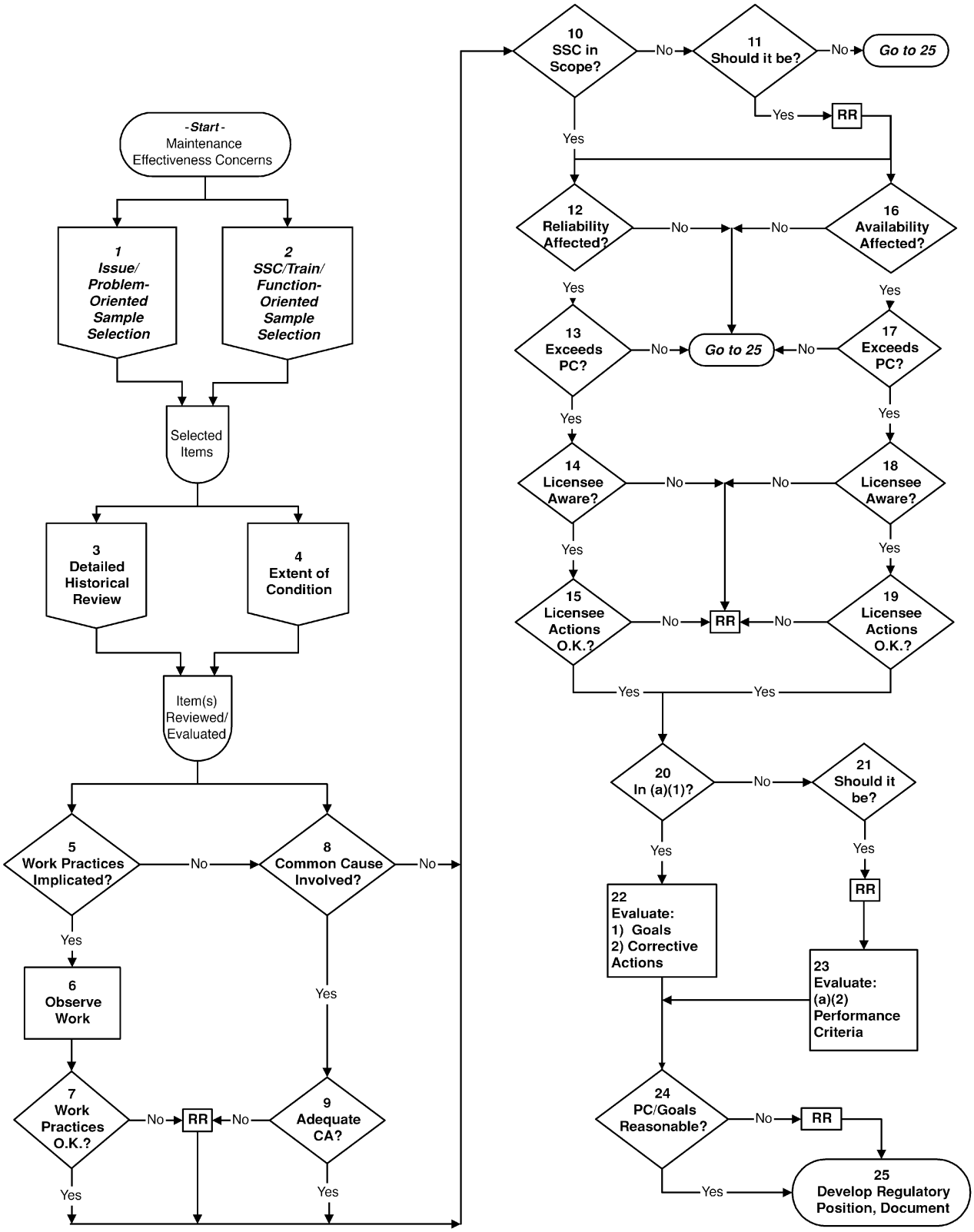
significance of this finding using the reactor safety SDP, the inspector noted that although the "A" service water pump had suffered several failures before the licensee had recognized the problem, determined its cause, and corrected it, the "B" pump had remained available. Therefore, the pump failures were of very low safety significance (Green). This finding also has cross-cutting issue implications, i.e., weakness in problem identification and resolution."

Follow the guidance in IMC 0612 for the enforcement section. For the (a)(1) example violation above, the enforcement section would read as follows:

"Enforcement: Paragraph (a)(1) of 10 CFR 50.65 requires that corrective action be taken for structures, systems or components being monitored under (a)(1) that do not meet their licensee-established monitoring goals. Contrary to the above, the licensee violated paragraph (a)(1) in that it failed to take adequate and timely corrective action for the overheated bearing problem and the resultant failures which caused the pump not to meet its (a)(1) reliability monitoring goal, despite a reasonable length of time and several opportunities to find and correct the problem. Because this violation was determined to be of very low safety significance (Green) and because the licensee entered the finding into its corrective action program, the violation was treated as a non-cited violation."

10 CFR APPENDIX B CORRECTIVE ACTION. For safety-related MR SSCs (MR paragraph (b)(1)), the determination of adequacy of corrective actions may also be evaluated against the requirements of 10 CFR Part 50, Appendix B, Criterion XVI.

FLOWCHART 1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SSC in
Scope?
No
Yes
11
Should it be?
No
Go to 25
Yes
RR
12
Reliability
Affected?
No
Yes
16
Availability
Affected?
No
Yes
13
Exceeds
PC?
No
Go to 25
Yes
17
Exceeds
PC?
No
Yes
14
Licensee
Aware?
No
Yes
18
Licensee
Aware?
No
Yes
15
Licensee
Actions
O.K.?
No
RR
Yes
19
Licensee
Actions
O.K.?
No
Yes
20
In (a)(1)?
No
Yes
21
Should it
be?
Yes
RR
22
Evaluate:
1) Goals
2) Corrective
Actions
23
Evaluate:
(a)(2)
Performance
Criteria
24
PC/Goals
Reasonable?
No
RR
Yes
25
Develop Regulatory
Position, Document

APPENDIX B
MAINTENANCE EFFECTIVENESS
PERIODIC EVALUATION INSPECTION GUIDANCE

This appendix provides the specific inspection guidance for Section 03.02, "Periodic Evaluation" (PE), of IP71111.12. Biennially, assess the effectiveness of the licensee's PE(s) and resulting adjustments performed pursuant to paragraph (a)(3) of 10 CFR 50.65, the Maintenance Rule (MR), since the last PE inspection.

In addition to a general review of the PE for balancing, adjustment, and use of industry operating experience, review the handling under the MR of three to five specific examples of SSCs/functions with degraded performance or condition (preferably of high risk significance) indicative of the effectiveness of the licensee's PE process. Using Flowchart 2 as a guide, assess the effectiveness of licensee PE activities including, as appropriate, the following:

1. Use of SSC/function performance history (i.e., reliability and availability data) in adjusting preventive maintenance
2. Use of SSC/function performance history in adjusting (a)(1) goals
3. Use of SSC/function performance history in adjusting (a)(2) performance criteria
4. Balancing the objective of maintaining or improving reliability against the objective of maintaining or improving availability
5. Use of industry operating experience in adjusting preventive maintenance
6. Use of industry operating experience in adjusting (a)(1) goals
7. Use of industry operating experience in adjusting (a)(2) performance criteria
8. Review and adjustment of MR scoping (50.65(b), RG 1.160, NUMARC 93-01)
9. Review and adjustment of definitions of functional failures (FFs), Maintenance Rule FFs (MRFFs) (i.e., failures of one or more MR-scoped functions), and maintenance-preventable FFs (MPFFs)
10. Review/adjustment of definitions of available/unavailable hours and required hours
11. Review and adjustment of condition-monitoring parameters and action levels

As learned through field experience, maintenance effectiveness, particularly in terms of minimizing risk to public health and safety, is dependent on the appropriate use of insights from the probabilistic safety assessment (PSA) or probabilistic risk analysis (PRA) in the maintenance rule program. Therefore, when deemed necessary or appropriate, risk experts (e.g., regional staff and/or inspectors with sufficient risk knowledge), with support as necessary and as available from other agency risk analysis resources, may review maintenance effectiveness activities related to the plant's PSA or PRA, if any, in conjunction with the PE inspection, including:

1. Use of risk insights in high/low safety significance (HSS/LSS) categorization
2. Use of risk insights in establishing/adjusting (a)(1) goals
3. Use of risk insights in establishing/adjusting (a)(2) performance criteria
4. Use of risk insights in establishing/adjusting preventive maintenance
5. Updating the PRA/PSA with actual reliability and availability data
6. Updating the PRA/PSA with industry operating experience
7. Updating the PRA/PSA with major plant or procedure modifications
8. Updating the PRA/PSA consistent with major routine maintenance changes

9. Maintaining risk assessment tools consistent with updated PRAs

The documentation related to any PRA/PSA peer reviews that may have been conducted should provide considerable insight into the quality and fidelity of the PRA/PSA.

Note that because there is no regulatory requirement for a PRA/PSA, this review is not expected to identify any violations (except possibly (a)(1) goals not commensurate with safety or potentially flawed (a)(4) risk assessments or assessment tools). If it is determined that the PRA/PSA is not being properly updated or applied, the impact on the licensee's risk-related activities must be evaluated as more than minor for the issue to be classified as a finding. Should an impact on (a)(4) risk assessment tools or risk assessments themselves be suspected, refer to IP 62709 or IP 71111.13 respectively. Note that IP 62709 is normally performed only for cause (e.g., as part of an IP 95002 type supplemental inspection).

Block 1 - PE Performance

Verify that PEs have been completed within the time constraints of the MR (i.e., once each refueling cycle, but not to exceed 24 months between PEs). Verify that the licensee has reviewed its (a)(1) goals, (a)(2) performance criteria, monitoring, and preventive maintenance activities. Verify that industry operating experience (IOE) has been taken into account where practicable. Verify that the licensee makes appropriate adjustments as result of the PEs.

The inspector should perform all three parts on the flow chart [i.e., balancing, (a)(1), and (a)(2)]. Refer to NUMARC 93-01, Section 12.0.

Path 2 - Balancing

Verify that the licensee balanced reliability and availability/unavailability (R&U) based on the results of each PE performed since the last PE inspection. Examine licensee review and adjustment of (a)(1) goals (refer to NUMARC 93-01, Section 12.2.4). Most licensees reevaluate the balance between an SSCs unavailability and reliability if the SSC performance criteria are exceeded. The licensee's assessment of balance should determine:

a. whether preventive maintenance should be reduced if unavailability performance criteria are exceeded with few MPFFs

b. whether preventive maintenance should be increased if reliability performance criteria are exceeded with low unavailability.

The PE and resulting adjustments should meet the MR requirement that the objective of preventing failures of SSCs through maintenance is appropriately balanced against the objective of minimizing unavailability of SSCs due to monitoring or preventive maintenance.

Path 3 - (a)(1) Activities

Review SSCs/functions that are in (a)(1) status (goals and action plan) and those that have been in (a)(1) and were moved to (a)(2) (evaluation) since the last PE inspection. Verify that (a)(1) goals were met, or if not, that timely and adequate corrective action (CA) was taken, that the corrective action considered IOE, and that (a)(1) activities and related goals were adjusted as needed. Samples selected should be mostly high-safety-significant SSCs or scoped functions to the extent practicable. Note that for certain SSCs, the licensee may monitor and trend SSC condition in addition to or instead of SSC performance (reliability and availability). Condition monitoring parameters can include vibration, temperature, pressure, flow, lubricant analysis, corrosion and erosion, response time, clearances, and electrical operating characteristics (refer to NUMARC 93-01, Section 12.2.1).

Path 4 - (a)(2) Activities

Review SSCs/functions in (a)(2) status. Verify that the licensee has established (a)(2) performance criteria (PC), examined any SSCs that failed to meet their PC or reviewed any SSCs that have suffered repeated maintenance-preventable functional failures (RMPFFs). Verify the failed SSC was considered for (a)(1). Note: Some licensees use condition monitoring such as vibration, lubricant or working fluid analyses, temperature monitoring and the corrosion/erosion program) (refer to NUMARC 93-01, Section 12.2.2).

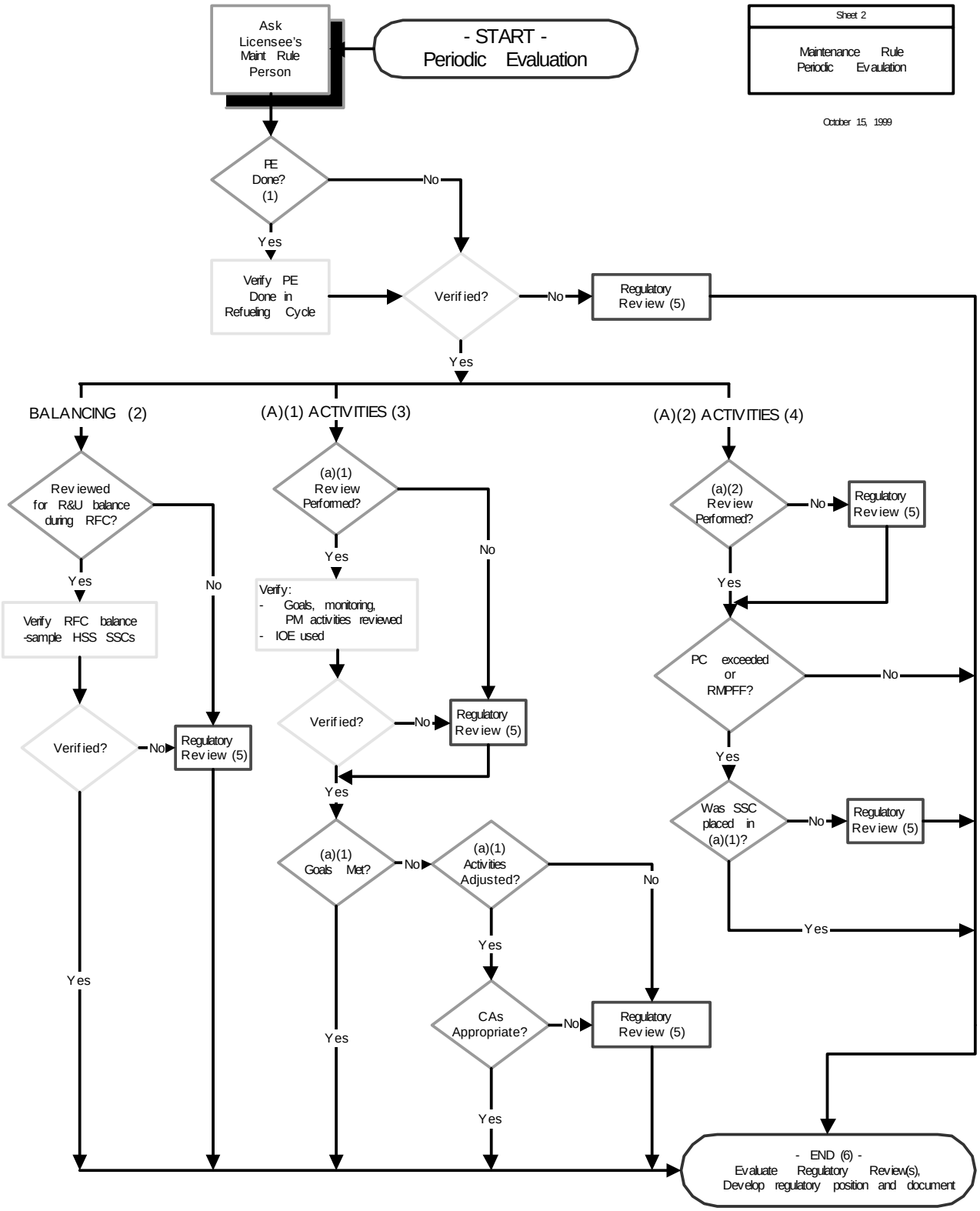
Block 5 - Regulatory Review

The regulatory review block recurs at critical points throughout the process to provide the inspector with assistance for clarification and classification of a finding. Throughout this regulatory review process, the inspector must perform regulatory evaluations and make related decisions. The regulatory review process consists of licensee engagement, the inspector's own judgment and peer review, contact with supervision as dictated by regional protocols, and consultation with other agency resources, including regional and/or headquarters SRAs, DRS and/or headquarters MR-cognizant staff, and regional enforcement staff. For further specific guidance, see Regulatory Review in Appendix A to this procedure.

Block 6 - END

End the process through a final evaluation, develop a regulatory position, and document the results of the inspection. See Appendix A to this procedure for further guidance.

FLOWCHART 2


Sheet 2
Maintenance Rule Periodic Evaulation
October 15, 1999
Ask Licensee's Maint Rule Person
- START - Periodic Evaluation
PE Done? (1)
No
Yes
Verify PE Done in Refueling Cycle
Verified?
No
Regulatory Review (5)
Yes
BALANCING (2)
(A)(1) ACTIVITIES (3)
(A)(2) ACTIVITIES (4)
Reviewed for R&U balance during RFC?
Yes
No
Verify RFC balance -sample HSS SSCs
Verified?
No
Regulatory Review (5)
Yes
(a)(1) Review Performed?
Yes
No
Verify:
- Goals, monitoring, PM activities reviewed
- IOE used
Verified?
No
Regulatory Review (5)
Yes
(a)(1) Goals Met?
No
(a)(1) Activities Adjusted?
No
Yes
CAs Appropriate?
No
Regulatory Review (5)
Yes
Yes
(a)(2) Review Performed?
No
Regulatory Review (5)
Yes
PC exceeded or RMPFF?
No
Yes
Was SSC placed in (a)(1)?
No
Regulatory Review (5)
Yes
- END (6) -
Evaluate Regulatory Review(s), Develop regulatory position and document