MAINTENANCE EFFECTIVENESS

INSPECTABLE AREA: Maintenance Effectiveness

CORNERSTONE: Initiating Events
Mitigating Systems
Barrier Integrity

INSPECTION BASES: The Maintenance Rule (MR) requires licensees to monitor the performance or condition of structures, systems and components (SSCs) within the scope of the rule against licensee-established goals to provide reasonable assurance that these SSCs are capable of fulfilling their intended functions. These goals are to be commensurate with safety and, where practical, should take into account industry-wide operating experience.

NOTE: Words underlined throughout the document are defined in Appendix B of this procedure.

Reliability and availability of SSCs as monitored or demonstrated under the MR directly affect the reactor safety cornerstones listed above 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 Functional Failure, and the Mitigating System Performance Index 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. Although the number of required samples is an annual goal, available work activities should be inspected each quarter to ensure a reasonable distribution throughout the year.

Review of a licensee's (a)(3) Periodic Evaluation can count as one of the required samples.

For one to two samples, perform a review of quality control.

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, extent of condition, common cause issues, and corrective actions.

01.02 To verify the licensee appropriately addresses SSC performance or condition problems within the scope of the MR.

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. Balancing reliability and unavailability (performance).
7. Trending key parameters (condition monitoring).
8. 10 CFR 50.65(a)(1) or (a)(2) classification and reclassification.
9. 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).

NOTE: There are sources of information in the Inspection Guidance section under Block 2 to assist inspectors in their review of maintenance effectiveness.

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

1. Identify and screen equipment problems for review using an issue/problem-oriented approach.

(a) Problems can relate to reliability, availability, condition monitoring, work practices, work control, or common cause failures.

(b) Concentrate on issues/problems associated with SSCs of high-safety-significance,

(1) SSCs not covered by performance indicators, such as structures in the scope of the maintenance rule,

(2) SSCs with declining performance or condition trends, and

(3) SSCs with known equipment problems.

2. An alternative to the issue/problem-oriented approach would be to identify and screen problems with equipment and structures for review using an SSC/function-oriented approach.

   Focus on the performance or condition history (i.e., trends) of selected safety significant SSCs/functions to identify degrading or declining performance.

3. Based on the review of paragraphs 02.01.b.1 and 02.01.b.2, select 8 to 10 potentially risk-significant issues per year and perform detailed reviews.

   NOTE: The inspector(s) have the option of reviewing the licensee's Periodic Evaluation (PE) as one of the required annual samples. Per 10 CFR 50.65(a)(3), the PE is required to be performed (at each unit) every refueling outage cycle, not to exceed 24 months. Additional guidance regarding the PE sample is provided in the Inspection Guidance Section 3 under Block 22.

4. 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. For deficient work controls contributing to the degraded performance or condition of the affected SSC(s):

      (a) Determine the extent of condition.

      (b) If work practices are implicated, observe affected and/or related work activities, as appropriate.

      (c) As necessary, discuss the issue with licensee personnel at the appropriate level, and evaluate licensee corrective actions.

   2. For those issues with common cause or generic implications:

      (a) Determine the extent of condition.

      (b) 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 treatment of the SSCs/issues being reviewed under the requirements of 10 CFR 50.65 and, where applicable, Appendix B to 10 CFR 50.

1. Determine whether the SSCs/functions of interest are within the licensee's MR scope.

   (a) If they are, evaluate the licensee's treatment of the issues under the MR.

   (b) If not, determine whether they should be in scope.

2. Independently evaluate SSC performance in terms of reliability and availability.

   (a) Compare documented functional failures with those being tracked by the licensee under the MR.

   (b) Compare unavailable hours (when required) to those being charged by the licensee.

   (c) For SSCs under condition monitoring (including structures), evaluate the effectiveness of the licensee's tracking and trending SSC condition and recognition of declining trends.

   NOTE: Condition monitoring parameters for structures are typically identified in the licensee's Structures Monitoring Program (SMP) documents. Also, as a result of the NRC licensee renewal review process, licensees may have revised their SMP documents to include specific quantitative and qualitative condition monitoring criteria derived from applicable industry standards. See Section 71111.12-06 (References) of this procedure for reference to NUREG-1801 and the industry standards that may be used by licensees to track and trend the condition of concrete structures. Also see the licensee's site-specific Updated Final Safety Analysis Report (UFSAR) section on aging management for more information on commitments and actions related to aging management.

3. Evaluate licensee corrective action that may be required by the MR for degraded SSC/function performance or condition.

   (a) Appropriate corrective actions must be taken where established goals under (a)(1) are not met. Appropriate means that (a)(1) corrective actions should be broader than repair of the failed SSC and address the cause of poor maintenance effectiveness.

   (b) Evaluate any corrective action that may be required by 10 CFR Part 50, Appendix B, or licensee procedures.

   (c) Evaluate use of industry operating experience.

4. Evaluate functional failures and unavailable hours against the licensee's goals or performance criteria as applicable.

Regarding structures, evaluate the licensee's technical basis and conclusions regarding their condition monitoring results. Licensee SMP's that implement the MR typically monitor structures in accordance with 10 CFR 50.65(a)(2) provided there is no significant degradation of the structure. A structure is monitored in accordance with 10 CFR 50.65(a)(1) if the extent of degradation is such that the structure may not meet its design basis or, if allowed to continue uncorrected until the next normally scheduled assessment, may not meet its design basis.

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) 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). (a)(1) is used to focus activities on areas needing additional attention. The SSC may be transferred back to (a)(2) if monitoring under (a)(1) demonstrated that performance has improved and the cause of the failure has been corrected. See Appendix B, (a)(2) Performance Criteria, for more explanation.

6. Determine if (a)(1) goals are (1) commensurate with safety, (2) reasonable, and (3) take relevant industry operating experience into account.

   The licensee is required to set goals and monitor the performance or condition of those SSCs handled under paragraph (a)(1) of the rule. The licensee should consider monitoring SSCs under the requirements of paragraph (a)(1) of the maintenance rule when failures occur, performance criteria are not being met under paragraph (a)(2), adequate preventive maintenance has not been established, or cause determinations and corrective actions are needed to improve SSC performance. If any of the above conditions exist, the licensee should consider establishing goals commensurate with safety and relevant industry operating experience.

7. Similarly, evaluate (a)(2) performance criteria for SSCs in (a)(2).

   (a) Determine if effective preventive maintenance can be reasonably demonstrated or degraded performance detected.

   (b) The MR states that monitoring of an SSC as specified in (a)(1) is not required if it has been demonstrated that the performance or condition of the SSC is being effectively controlled through the performance of appropriate preventive maintenance so that the SSC remains capable of performing its intended function. The MR Statements of Consideration (SOC) dated 1991 clarified that licensees are not required to monitor under (a)(1) if they have demonstrated that preventive maintenance has been effective or if an SSC has inherent high reliability and availability.

02.02 Quality Control.

a. Review one or more of the following:

1. Parts installed in safety-significant systems that were purchased as commercial grade parts but were dedicated prior to installation in a quality grade application.

2. Control of quality parts during the maintenance process, including consumable items (lubricants, cleaners, sealants, etc.). This review should be performed during any field observation of maintenance.

3. Quality control verifications are properly specified in accordance with the Quality Assurance Program, and are implemented as specified. This last type of sample would include review of multiple work packages.

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.

a. For a sample of selected problems documented in the corrective action program, verify that the corrective actions and resolutions are appropriate and adequate. In addition, verify the following:

1. Perform a review of licensee actions to address maintenance and test equipment that fails calibration. Verify that the licensee tracks which surveillance tests used each piece of maintenance and test equipment, and compares the failed maintenance and test equipment calibration information to each surveillance test that used that maintenance and test equipment, then assesses the impact to the operability of the associated system.

2. For the sample selected, review the maintenance history for indications of repetitive failures, excessive instrument drift, etc. Assess whether the maintenance has been addressing symptoms while missing the real causes. Assess whether the repeat nature of the failure is indicative of greater safety significance.

3. For the sample selected, assess whether the licensee adequately addressed the extent of condition and extent of cause.

See Inspection Procedure 71152, “Identification and Resolution of Problems,” for additional guidance.

71111.12-03 INSPECTION GUIDANCE

General Guidance

For a given maintenance activity, a “vertical slice” review involves performing (as applicable) an associated sample in IP 71111.04, “Equipment Alignment,” IP 71111.12, “Maintenance

Effectiveness," IP 71111.13, "Maintenance Risk Assessments and Emergent Work Control," IP 71111.19, "Post-Maintenance Testing," and IP 71111.22, "Surveillance Testing." Once or twice a year, inspectors should consider conducting a "vertical slice" review of a maintenance activity to assess whether different parts of the maintenance process work together effectively. Vertical slice is not required for the completion of this IP.

03.01 Maintenance Effectiveness.

Reliability and availability of SSCs directly affect the reactor safety cornerstones, and are dependent upon maintenance effectiveness (including proper work practices, effective corrective actions, and the reduction of potential common-cause problems). Appendix A of this procedure provides guidance on how to evaluate aspects of maintenance effectiveness (including, but not limited to, adherence with applicable NRC regulations). The steps referenced in this section provide guidance for completing the corresponding blocks in the Appendix A flowchart.

Start

There are concerns involving degraded performance or condition of SSCs or the licensee's proposed corrective actions. These concerns may be inspector or licensee identified. Place emphasis on SSCs with high safety significance.

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."

Block 1 - Issue/Problem-Oriented Approach

Identify problems with the performance (reliability and/or availability) or condition of SSCs within the scope of the MR using the sources of information listed below (or others as available).

Review 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.

Block 2 - SSC/Function-Oriented Approach

Review the performance or condition history of selected SSCs to identify degraded or declining performance or condition independent of licensee recognition.

Review 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 SSCs may be selected and even scheduled for review. 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)
- Periodic Evaluation per (a)(3)
- 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)
- Periodic condition monitoring reports related to structures, including photos, surveys and examinations, completed as part of the licensee's Structures Monitoring Program
- Maintenance Rule program documents
- Plant walkdown observations and plant status information
- Licensee personnel interviews (e.g., maintenance personnel, work planning staff, system engineers, operators)
- Information discussed at licensee meetings
- Industry operating experience (IOE) information
- Operator workarounds log
- Control room equipment deficiency log

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)
- NRC's Office of Nuclear Reactor Regulation (NRR) Operating Experience BranchConsider the following when selecting samples:
- the risk significance of the problems/issues or of the affected SSC(s)/function(s),
- the duration and frequency of the problem,
- the impact of the problem on the SSC performance (i.e., reliability and unavailability) or condition,
- whether the problem results in frequent or repeated technical specification limiting condition for operations entries,
- 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?),
- whether the apparent cause of the problem could result in a common cause failure, and
- the extent to which the problem has been previously inspected.

Block 3 - Detailed Historical Review

Detailed review includes examining work orders and associated records for corrective and preventive maintenance and related corrective action documents. The inspector should be able 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.

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.

Block 4 - Extent of Condition

In conjunction with the detailed historical review, independent review of the problem(s) will enable the inspector to judge the accuracy with which the licensee has assessed the extent of condition.

Block 5 - Work Practices Implicated

(Inspection in this path should be performed in parallel with review of the potential for common cause or generic implications, as discussed in Block 8).

Deficient work practices can cause or contribute to an SSC performance or condition problem. 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 may be necessary to look more broadly at electrical maintenance activities to ensure that the nature and extent of the maintenance problem is fully understood.

NOTE: Although it may require additional effort logistically, observing in progress maintenance activities can add significant value to a sample. Being in the field during maintenance activities can facilitate the assessment of the licensee's procedural preparation and execution of work practices.

Block 7 - Work Practices OK?

If work practices are not acceptable, then evaluate the issue of concern per IMC 0612, Appendix B, "Issue Screening" and Appendix C of this inspection procedure. Continue inspection in other paths as appropriate (including a review of the potential for common cause or generic implications, as discussed in block 8).

Block 8 - Common Cause

(Inspection in this path should be performed in parallel with a review of the licensees work practices, as discussed in Block 5).

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: 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 MR 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, then evaluate the issue of concern per IMC 0612, Appendix B, "Issue Screening" and Appendix C of this inspection procedure; then continue inspecting the licensee's implementation of their MR program.

Block 10 - MR Scope Determination

Is/are the SSC(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. If not, go to block 11.

Block 11 - Should the SSC(s)/function(s) be in scope of the MR?

Determine if the SSCs in question should be in scope. Evaluate the SSC against the criteria in 10 CFR 50.65(b) to determine if it should be in scope.

The references provided in Section 06 of this procedure provide some additional insight on the criteria listed in 10 CFR 50.65(b).

If it is determined that the SSC should be in the scope of the MR, then evaluate the issue of concern per IMC 0612, Appendix B, "Issue Screening" and Appendix C of this inspection procedure. Continue evaluating SSC performance (i.e., reliability and availability) and/or condition.

If the SSC(s) in question are not required to be in scope, MR compliance is not a regulatory issue. Go to Block 21.

Block 12 - Reliability

SSC 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.

NOTE: 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, then review availability/unavailability. If reliability is an issue, continue in this flowchart path.

NOTE: For MR purposes, run-to-failure applies to SSCs that have little safety significance, for which there is little or no meaningful preventive maintenance established, for which conditions indicative of degradation prior to failure are not readily detectable, have fairly predictable failure rates or expected limited service life, and for which failure is self revealing so that the component can be promptly replaced (i.e., no testing would be required to identify a failed component that could impact any function important to safety were it to remain undetected and uncorrected). Examples would be components such as light bulbs, fuses with blown-fuse indicators, etc. An SSC that is inherently reliable applies to SSCs that, without preventative maintenance, have high reliability (e.g., jet shields, raceways). For SSCs categorized as run-to-failure or inherently reliable, the inspector may wish to review the categorization for appropriateness.

Block 13 - Availability

Review the SSC(s) availability/unavailability to determine if availability is affected. If it is, continue in this path. If neither availability nor reliability are affected, go to Block 21.

NOTE: Structures are not typically monitored by licensees in terms of unavailability or MPFFs. For structures, review the licensee's SMP or other applicable documents and identify the screening/acceptance criteria for condition monitoring and additional actions specified if the criteria are not met.

Block 14 - Exceed performance criteria?

Comparison of identified failures and unavailability with the licensee's (a)(1) SSC/function goals and/or (a)(2) SSC/function performance criteria (i.e., reliability and availability) will enable the inspector to determine whether failures or unavailability exceeded them as applicable.

a. If goals are not met or unreliability and/or unavailability goals are exceeded:

    1. The licensee must take corrective actions under the MR for SSCs in (a)(1).

    2. 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).

b. If there are MRFFs or MPFFs, and/or unavailability incurred for SSCs in (a)(2) status, particularly if unreliability or unavailability performance criteria are exceeded:

    1. The licensee must determine whether effective control of SSC performance or condition is being demonstrated.

    2. If not, the licensee must at least consider placing (a)(2) SSCs into (a)(1). SSCs experiencing repetitive MPFFs should be considered for (a)(1).

    3. If reliability and availability performance criteria are being met, reliability and/or availability are not 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. Whatever method the licensee uses to demonstrate performance must be reasonable, technically justifiable, and take into account availability and reliability.

4. If there are no issues of concern associated with reliability and availability, go to Block 21; otherwise continue.

c. If the results of condition monitoring of structures do not meet criteria specified in licensee Structures Monitoring Program (SMP) documents, the licensee should take further actions specified in their SMP, which may include more frequent examinations, application of additional examination techniques or more detailed reviews by responsible structural engineers, to demonstrate effective control of the condition of the structure. Review the results of these additional actions and determine whether they support the validity of the a-(2) demonstration, or alternately, placement of the structure into a(1). Support by an NRC regional inspector responsible for the review of structural issues may be warranted for this activity.

Block 15 - Licensee Aware?

a. Of exceeding unreliability goals or performance criteria, as applicable.

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, then evaluate the issue of concern per IMC 0612, Appendix B, "Issue Screening" and Appendix C of this inspection procedure; and continue inspecting in this path.

b. Of exceeding unavailability goals or performance criteria as applicable

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, then evaluate the issue of concern per IMC 0612, Appendix B, "Issue Screening" and Appendix C of this inspection procedure; and continue inspecting in this path.

Block 16 - Licensee Actions

a. For exceeding unreliability goals or performance criteria as applicable.

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.

b. For exceeding unavailability goals or performance criteria as applicable. Unavailability trend data should show whether system performance is improving.

If performance is not improving,

1. Ideally the licensee should take timely and reasonable corrective actions for this problem.

2. Depending on the circumstances, this situation may or may not amount to a violation of 10 CFR 50.65, but it reflects negatively upon maintenance effectiveness and should be evaluated per IMC 0612, Appendix B, "Issue Screening" and Appendix C of this inspection procedure.

3. 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.

4. 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.

5. If licensee actions are not acceptable, then evaluate the issue of concern per IMC 0612, Appendix B, "Issue Screening" and Appendix C of this inspection procedure; and continue to review MR disposition of the issue(s) in question.

Block 17 - 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).

Block 18 - Should it be?

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, then evaluate the issue of concern per IMC 0612, Appendix B, "Issue Screening" and Appendix C of this inspection procedure.

Block 19 - Evaluate Goals and Corrective Actions

The (a)(1) monitoring goals must be appropriate, commensurate with safety and take industry operating experience into account where practicable. 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:

a. Both reliability and availability
b. Balancing of reliability and availability
c. Industry operating experience (IOE) information
d. Actual performance history
e. Frequency of valid demands or expected operation within the monitoring period
f. PRA or some other reasonable risk/safety consideration(s)If (a)(1) goals are not appropriate, not commensurate with safety, or did not take IOE into account where practicable, then evaluate the issue of concern per IMC 0612, Appendix B, "Issue Screening" and Appendix C of this inspection procedure.

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 20 - Evaluate (a)(2) Performance Criteria

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.

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 of the licensee's (a)(3) periodic evaluation (PE) activities.

NOTE: Condition monitoring or predictive maintenance is generally desirable, but when performance criteria allow no failures or unavailability during the monitoring period, typically for very high safety-significant and/or "mission-critical" SSCs, then the condition of the SSC should be monitored or tracked using condition monitoring or "predictive maintenance" parameters that, to the extent practicable, alert the licensee to degradation in time for preventive maintenance prior to failure. For example, some licensees allow no failures of either offsite power source and/or their in-plant distribution SSCs. Therefore, they will track voltage and frequency of the offsite power sources closely, particularly during periods of grid instability or heightened probability of loss of offsite power.

In addition, licensees may designate certain SSCs in a so-called "run-to-failure" category. These are typically SSCs that are simple, of relatively low safety/risk significance, for which

there is little or no meaningful preventive maintenance established, for which conditions indicative of degradation prior to failure are not readily detectable, that have fairly predictable failure rates or expected limited service life, and for which failure is self revealing so that the component can be promptly replaced, i.e. no testing would be required to identify a failed component that could impact any function important to safety were it to remain undetected and uncorrected. Examples would be components such as light bulbs, fuses with blown-fuse indicators, etc.

For SSCs categorized as run-to-failure, the licensee can and should promptly, commensurate with safety, repair or replace failed equipment, but adjustments to PM program may not be necessary and monitoring under (a)(2) may be able to continue, unless the affected component or batch of similar components appear to suffer excessive or too frequent failures or significantly shortened service life compared to vendor expectations and or industry norms. These circumstances even with usual run-to-failure components warrant investigation. However, if an SSCs has a function which caused it to be within the scope of the MR, it has some safety significance; therefore, licensee should provide a sound technical justification which appropriately establishes a run-to-failure determination. An SSC that is inherently reliable applies to SSCs that, without preventative maintenance, have high reliability (e.g., jet shields, raceways). For SSCs categorized as run-to-failure or inherently reliable, the inspector may wish to review the categorization for appropriateness.

Block 21 - END - Develop Regulatory Position and Documentation

Block 22 - Periodic Evaluation (PE) (optional sample)

Performance Verification

a. 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).

b. Verify that the licensee has reviewed its (a)(1) goals, (a)(2) performance criteria, monitoring, and preventive maintenance activities, and effectiveness of corrective actions.

c. Verify that industry operating experience (IOE) has been taken into account where practicable.

d. Verify that the licensee makes appropriate adjustments as result of the PEs.

NOTE: The requirements for performing the PE can be satisfied through the use of ongoing assessments combined with a higher level summary assessment performed at least once per refueling cycle not to exceed 24 months between evaluations.

Balancing Verification

If applicable to the licensee's Maintenance Program, verify that the licensee balanced reliability and availability/unavailability (refer to NUMARC 93-01, Section 12.2.4). Most licensees

reevaluate the balance between a SSCs unavailability and reliability when the 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.

NOTE: 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.

03.02 Quality Control. Additional guidance can be found in IP 43004, "Inspection of Commercial Grade Dedication."

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 84 to 102 hours a year for the routine maintenance effectiveness 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 8 maintenance effectiveness issues (of high risk significance to the extent available) annually per site. Vertical slice is not required for completion of this IP.

71111.12-06 REFERENCES

NOTE: Selected references are available on the NRC public website (http://www.nrc.gov/reactors/operating/ops-experience/maintenance-effectiveness.html).

NOTE: An internal NRC SharePoint site provides links to electronic versions of selected references, along with the names and contact information for MR points of contact (http://portal.nrc.gov/edo/nrr/dirs/irib/Working%20Group/Maintenance%20Rule/default.aspx).

Title 10 of the Code of Federal Regulations (10 CFR), Part 50, Section 50.65, "Requirements for monitoring the effectiveness of maintenance at nuclear power plants" (10 CFR 50.65)
Statements of Consideration for 10 CFR 50.65, *Federal Register*, Vol 56, No. 132, July 10, 1991, pages 31306 to 31324

Statements of Consideration for 10 CFR 50.65, Federal Register, Vol 64, No. 137, July 19, 1999, pages 38551 to 38557

NRC Regulatory Guide (RG) 1.160, Rev. 3, "Monitoring the Effectiveness of Maintenance at Nuclear Power Plants" (ML113610098)

Nuclear Energy Institute (NEI) (formerly Nuclear Management and Resources Council (NUMARC)), NUMARC 93-01, Revision 4A, "Industry Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants" (ML11116A198)

NUREG-1648, "Lessons Learned from Maintenance Rule Baseline Inspections"

NUREG-1526, "Lessons Learned from Early Implementation of the Maintenance Rule at Nine Nuclear Power Plants"

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

IMC 0612, "Power Reactor Inspection Reports"

Inspection Procedure (IP) 62706, "Maintenance Rule"

IP 71152, "Problem Identification and Resolution"

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 7.11, "Actions Involving the Maintenance Rule"

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

IP 43004, "Inspection of Commercial-Grade Dedication."

NUREG-1801, "Generic Aging Lessons Learned (GALL) Report," Rev 2, Section XI.S6 Structures Monitoring and XI.27, Inspection of Water-Control Structures Associated with Nuclear Power Plants.

ACI Standard 349.3R, "Evaluation of Existing Nuclear Safety-Related Concrete Structures," American Concrete Institute, 2002

ACI Standard 201.1R, "Guide for Making a Condition Survey of Concrete in Service," American Concrete Institute, 2008.

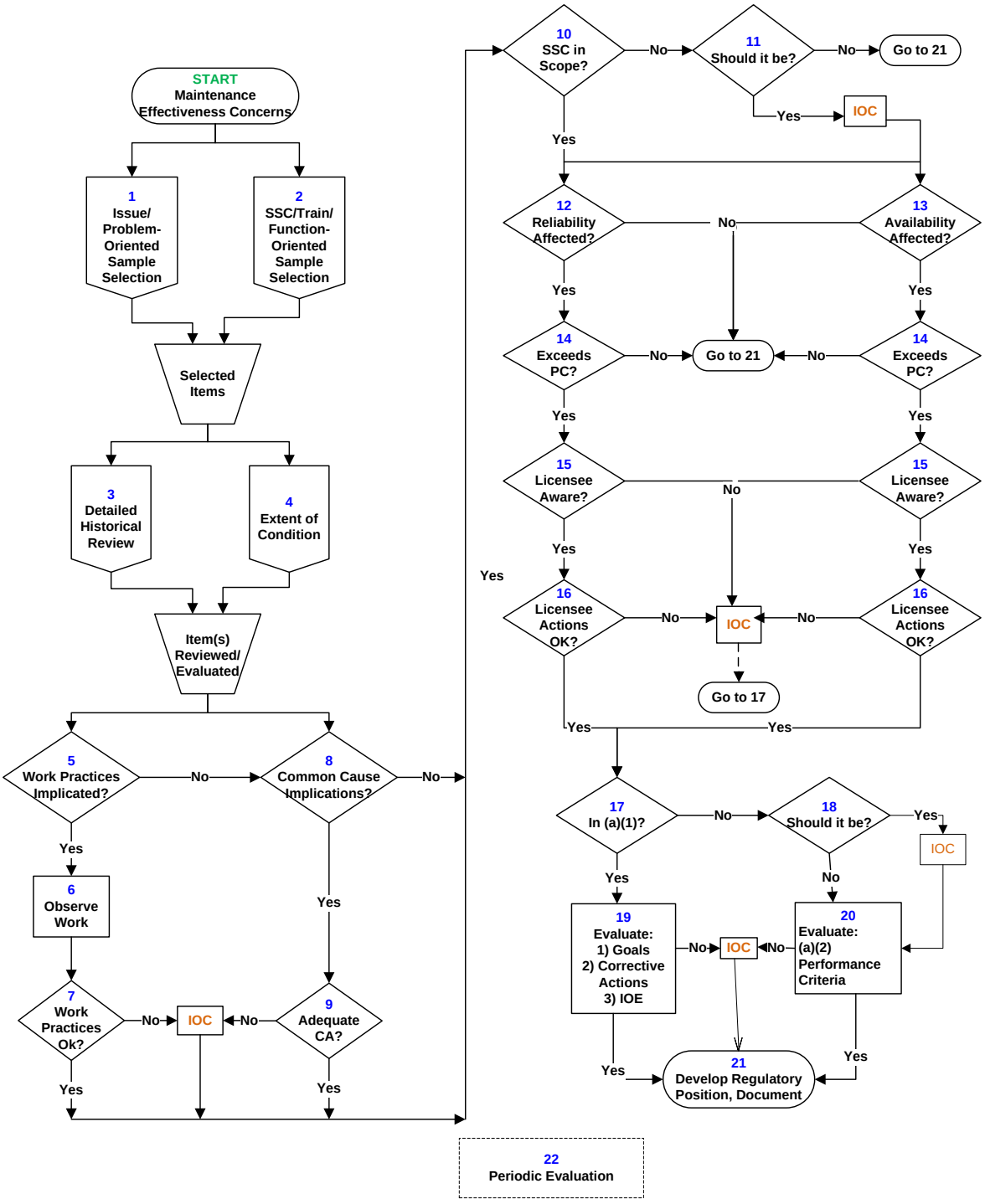
END

Appendices:
Appendix A, “Routine Maintenance Effectiveness Inspection Flowchart”
Appendix B, “Maintenance Rule Terminology”
Appendix C, “Maintenance Issue Screening”

Attachment 1:
Revision History Table

APPENDIX A
Routine Maintenance Effectiveness Inspection Flowchart

FLOWCHART 1



APPENDIX B

Maintenance Rule Terminology

NOTE: Terminology descriptions provided here are meant to aid NRC inspectors in execution of this inspection procedure and in their review and understanding of how potential issues of concern may be applicable to the maintenance rule. The regulations and applicable source documents remain the overriding guidance documents for the maintenance rule.

(a)(2) Performance Criteria- A means, established by the NRC-endorsed 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. Note that (a)(2) performance criteria are not required or even recognized per se by the MR. 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.

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. 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.

Common Cause Failures - Failure of two or more SSCs due to single specific event or cause. For example, a design deficiency, operation and maintenance errors, a natural phenomenon, personnel-induced event, or an unintended cascading effect from any other operation or failure within the plant or a change in ambient conditions.

Corrective Actions - Appropriate corrective actions must be taken where established goals under (a)(1) are not met. “Appropriate” means that (a)(1) corrective actions should be broader than repair of the failed SSC and address the cause of poor maintenance effectiveness.

Extent of Condition - The extent to which the problem(s) may affect other trains, systems, units or plants, or similar components in other applications.

Inherently Reliable - Pertains to an SSC that, without preventative maintenance, has high reliability. Inherently reliable SSCs could be included in the formal preventative maintenance program under (a)(2) in which the condition could be monitored via visual inspection during walkdowns. Inherently reliable SSCs are normally not placed in (a)(1). However, the need to place an SSC under (a)(1) and establish goals may arise if the inherently reliable SSC has experienced a failure. In such cases, the SSC cannot be considered inherently reliable. Examples of SSCs that are generally considered inherently reliable include, but are not limited to, jet shields, raceways, and in some cases electrical cabling depending on vendor specifications.

Maintenance Activities - All activities associated with the planning, scheduling, accomplishment, post-maintenance testing, and return to service activities for surveillances and preventive and corrective maintenance. These activities are considered maintenance regardless of which organization performs the activity (e.g., maintenance, operations, and contractors). (Also, refer to discussion of maintenance support activities in MR Reliability Performance Criteria in this Section.)

Maintenance Preventable Functional Failure - Failure of an SSC within the scope of the MR to perform its intended function (i.e., the function performed by the SSC that required its inclusion within the scope of the Rule), where the cause of the failure of the SSC is attributable to a maintenance-related activity. The maintenance-related activity is intended in the broad sense of maintenance.

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, 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. (Also, refer to MR Reliability Performance Criteria definition in this Section.)

Maintenance Rule Functional Failure - Failure of an SSC within the scope of the MR to perform its intended function (i.e., the function performed by the SSC that required its inclusion within the scope of the MR). Degraded performance may constitute a functional failure, even without a complete loss of function. (Also, refer to MR Reliability Performance Criteria definition in this Section.)

MR Reliability Performance Criteria (Block 12) - Reliability: 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 MRFFs, 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, there may be PI&R and/or corrective action implications, in addition to some risk or safety significance that could possibly be assessed through the significance determination process (SDP), provided that a performance deficiency exists.

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.

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 deficiencies 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. Contributing factors, such as certain operator errors committed in direct support of maintenance (e.g., clearances, valve or equipment lineups, etc.) may require a failure to be deemed a 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.

Periodic Evaluation - An evaluation of maintenance activities at the unit which shall be conducted at least once a refueling cycle, not to exceed 24 months between evaluations. The evaluation shall take into account relevant industry experience.

Reliability - A measure of the expectation that an SSC will perform its function on demand, at any future instant in time (assuming that the SSC is available). Reliability is typically measured in terms of the number of failures in some pre-established number of valid demands over a pre-established tracking or monitoring period. Along with availability, reliability is a performance measure.

Run-to-Failure - Applies to SSCs that are typically simple, of relatively low safety/risk significance, for which there is little or no meaningful preventive maintenance established, for which conditions indicative of degradation prior to failure are not readily detectable, that have fairly predictable failure rates or expected limited service life, and for which failure is self revealing so that the component can be promptly replaced, i.e. no testing would be required to identify a failed component that could impact any function important to safety were it to remain undetected and uncorrected. Examples would be components such as light bulbs, fuses with blown-fuse indicators (particularly in standby SSCs), etc. For such SSCs, the inspector may wish to review the categorization for appropriateness.

The licensee can and should promptly, commensurate with safety, repair or replace failed equipment of this type, but adjustments to PM program may not be necessary and monitoring under (a)(2) may be able to continue, unless the affected component or batch of similar components appear to suffer excessive or too frequent failures or significantly shortened service life compared to vendor expectations and or industry norms. These circumstances even with usual run-to-failure components warrant investigation. However, if an SSCs has a function which caused it to be within the scope of the MR, it has some safety significance; therefore, licensee should provide a sound technical justification which appropriately establishes a run-to-failure determination. For such SSCs, the inspector may wish to review the categorization for appropriateness.

Scope of the Maintenance Rule (Block 11) - SSCs/functions that have one or more of the following attributes must be scoped into the maintenance rule program:

- Safety-related SSCs/functions [50.65(b)(1)]
- 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)
- Non-safety-related SSCs that are used in the emergency operating procedures (EOPs) [50.65(b)(2)(i)]
- Non-safety-related SSCs that could prevent the fulfillment of a safety-related function [50.65(b)(2)(ii)]
- Non-safety-related SSCs that could cause an unwanted reactor trip or engineered safety feature (ESF) activation [50.65(b)(2)(iii)]

Technically Justifiable - means justifiable in terms of logic for both qualitative and quantitative considerations. For example, the reliability performance criterion for emergency diesel generators (EDGs) is typically expressed in terms of the number of failures to properly start

and/or run on demand for some given number of attempts or demands within the monitoring (or (a)(2) "tracking") period.

Technically justifiable criteria in terms of deterministic considerations would include, for example, allowable demand failures that are consistent with industry operating experience that are reasonably sensitive to declining performance (i.e., degraded performance would be recognized before complete failure), but not be so restrictive as to become unbalanced with availability. For example, the risk-informed EDG reliability performance criteria discussed above might also be judged against operating experience, among other deterministic considerations, by the expert panel to ensure they made sense for the plant in terms of tracking SSC health and monitoring the effectiveness of maintenance.

Performance criteria may need to be adjusted logically as well. For example, if the industry average demand failures in a refueling cycle for some piece of equipment was two, then a reliability performance criterion of two demand failures allowed might be reasonable, except for a plant at which the equipment was never challenged more than twice during the monitoring period. In that case, it could fail two times and never exceed the performance criterion such that it would be considered for transition to (a)(1) status. If the equipment in question were non-safety-related, there would be no regulatory requirement to take corrective action.

In such a case, the prudent licensee would consider the operating history of the equipment at its plant. If the equipment was more reliable historically than the industry average, then it might be more prudent to set the reliability performance criterion at zero or one in order to promptly flag degraded performance or establish condition monitoring to detect declining trends.

If the inspector questions the performance criteria or a change in performance criteria (or a shift from HSS to LSS status), then the licensee should be asked to explain the basis for the criteria and/or change. If the inspector believes that the criteria or changes are not reasonable, or that the justification is inadequate, then the inspector should consider consulting with the regional SRA and MR contacts in the Region and NRR.

Note that having (a)(2) performance criteria that are not technically justifiable or that are not commensurate with safety is not necessarily a violation of the rule. However, it could be a contributing cause of the licensee's failure to demonstrate effective control of performance or condition if there are an excessive number of functional failures or excessive unavailability. Determining what is excessive may be difficult, and inspector(s) should consider consulting cognizant MR staff in the region and NRR to assist in evaluating the situation and making the case for a violation if warranted.

Unavailable Hours - The numerical complement of availability. The hours within a period during which an SSC is required to be available when the SSC cannot perform its function. An SSC that is required to be available for automatic operation must be available and respond without human interaction. (See Availability in this Section).

Work Practices - 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.

APPENDIX C

Maintenance Issue Screening

Issues of concern (IOCs) related to maintenance effectiveness should be screened in accordance with IMC 0612, Appendix B, "Issue Screening." The guidance provided below supplements the guidance in IMC 0612, Appendix B for the specific block and figure number provided.

Based on the results of the inspector's reviews and discussions with the licensee, the inspector should consider consulting with other knowledgeable sources, such as: other inspectors on site, the senior resident inspector (SRI), regional supervision, regional maintenance rule contact(s), regional enforcement specialist(s), the headquarters maintenance rule staff in the Division of Inspection and Regional Support (DIRS), and Office of Enforcement (OE) staff as necessary.

Block 6, Figure 2: Does the IOC involve a PERFORMANCE DEFICIENCY (PD)?
Performance deficiencies associated with maintenance issue(s) should be clearly identified. A maintenance related PD 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).

When answering the PD screening questions in IMC 0612, Appendix B, consider the terminology descriptions provided in Appendix B of this inspection procedure for the IOC. NUMARC 93-01 and RG 1.160 may provide some additional insight on properly characterizing a potential PD; however, inspectors should note that these are not regulatory requirements.

In some instances, an issue of concern (IOC) may cause or contribute to degraded performance of an SSC or function within the scope of the maintenance rule (a SSC IOC) and a separate issue of concern may cause or contribute to improper consideration of that performance within the licensee's maintenance program (a Program IOC). In this case the SSC IOC should normally be screened separately from the Program IOC.

Block 9, Figure 2: Is the PD More-than-Minor (e.g., Is it a FINDING)?
The identified performance deficiency (or deficiencies) should be screened against the criteria in IMC 0612, Appendix B to determine whether they are minor or more than minor. When answering the Minor screening questions in IMC 0612, Appendix B, consider the terminology descriptions provided in Appendix B of this inspection procedure for the applicable PD. A maintenance-related performance deficiency may be more than minor if it results in a degraded performance or condition of an SSC that is likely to adversely affect an associated cornerstone objective, regardless of whether the degraded performance or condition has been recognized, appropriately categorized and characterized by the licensee. In these instances, inspectors should consider how the PD impacted the function of the SSC.

In cases where there is a SSC PD and a separate program PD (separate IOCs that screen as performance deficiencies as discussed above), the program PD can often be determined to be more than minor because actual problems with the equipment have occurred.

Block 10, Figure 2: Does FINDING involve a non-Traditional Enforcement (TE) VIOLATION?
One or more of the identified findings may constitute a violation of one or more NRC regulations. It is possible that a licensee may take action to avoid a violation of 10 CFR 50.65; however, a violation of separate NRC regulations may exist and inspectors should consider which requirements/regulations are applicable for each finding.

For guidance on what constitutes a potential MR violation, refer to Section 7.11 of the Enforcement Manual. NUMARC 93-01, RG 1.160, and NUREG-1648 may provide some additional insight on properly characterizing a potential MR violation; however, inspectors should note that these documents are not regulatory requirements.

Block 14, Figure 3: Is the FINDING POTENTIALLY GREATER-THAN-GREEN?
All FINDINGS will be screened using the Phase 1, "Initial Screening and Characterization" worksheet described in Attachment 4 to IMC 0609 to determine if they are POTENTIALLY GREATER-THAN-GREEN.

The safety significance of the SSC(s) (as defined by the license's maintenance rule program) is a key factor in this screening process. This includes cases where there exists a SSC FINDING and a separate maintenance rule program FINDING. This is discussed in the IMC 0609 SDP phase I screening guidance.

Example of screening Maintenance Rule FINDING(s):
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 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).

In either case, 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. 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 this scenario, it is possible that a performance deficiency and associated finding exists without a violation of the maintenance rule. For instance, the licensee can maintain the affected SSC in (a)(2) status and remain in compliance with the maintenance rule as long as there is adequate justification (i.e., the root cause is being corrected or is unrelated to the equipment itself (e.g., personnel issues only)). Or, if the circumstances warrant monitoring the affected SSC/function under (a)(1), and the licensee takes the necessary and appropriate actions under

(a)(1) within a reasonable amount of time, there has (thus far) been no violation of the maintenance rule. However, if the inspector's review determines the time that has passed since the licensee's first opportunity to comply with the maintenance rule is excessive, then a violation may exist. 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 consider putting the affected SSC into (a)(1). In this case, the licensee may have avoided a 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 inspector should also expect the licensee to take prompt corrective action for the degraded performance or condition of the SSC regardless of the maintenance rule disposition. In this case, a separate performance deficiency, and associated finding may exist.

- Another possibility 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, or previous 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 is likely 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.

ATTACHMENT 1
Revision History Table - IP 71111.12

Commitment Tracking Number	Accession Number Issue Date Change Notice	Description of Change	Description of Training Required and Completion Date	Comment and Feedback Resolution Accession Number (Pre-Decisional, Non-Public)
N/A	03/13/06	Completed Four-year historical review	None	N/A
N/A	07/01/2002 CN 02-025	Revised to clarify inspection objectives and to improve effectiveness of this procedure based on feedback and lessons learned from implementation. This revision provides greater focus on reviewing licensee's effectiveness at performing routine maintenance. The revised procedure also focuses on review of equipment performance issues associated with availability and reliability, preferably on high-risk significant systems, maintenance work practices, and common cause issues. Sample size and inspection resource requirements were revised based on experience gained from four verification and validation visits at one site in each region.	None	N/A
N/A	01/05/2006 CN 06-001	Inspection frequency was changed from a biennial to a triennial frequency based on a mature industry maintenance program. Additionally, estimated inspection hours were changed to 36 hours every 3 years or annualized estimate of 12 hours based on the actual inspection resources expended to complete this inspection procedure during last several ROP cycles. Completed historical CN search.	None	N/A

Commitment Tracking Number	Accession Number Issue Date Change Notice	Description of Change	Description of Training Required and Completion Date	Comment and Feedback Resolution Accession Number (Pre-Decisional, Non-Public)
NA	03/13/06 CN 06-006	IP71111-12 has been revised to clarify inspection objectives and to improve effectiveness of this procedure based on feedback and lessons learned from implementation.	None	N/A
N/A	10/31/07	IP 71111.12 has been revised to reflect the ROP FY-2007 realignment. The triennial inspection was eliminated because it was determined adequate oversight of licensee performance in the area of maintenance can be maintained through the quarterly portion of IP 71111.12 and other inspection activities.	None	N/A
N/A	01/31/08 CN 08-005	IP 71111.12 has been revised to clarify the level of effort section in which the inspection procedure clearly states that the samples are not required on a quarterly basis.	None	N/A

Commitment Tracking Number	Accession Number Issue Date Change Notice	Description of Change	Description of Training Required and Completion Date	Comment and Feedback Resolution Accession Number (Pre-Decisional, Non-Public)
N/A	11/16/09 CN 09-027	IP 71111.12 has been revised to reflect the ROP realignment 2009. The (a)(3) sample previously removed from the biennial/triennial portion of 71111.12 was added back as an optional annual sample (see ROPFF 71111.12-1306). App D was revised to correct inconsistencies with IMCs 0612, 0609, and 0305 (see ROPFF-71111.12-1422), the flowchart and references were updated, NRR MR lead contact info was changed from DRA to DIRS, and ROPFF 71111.12-1407 was incorporated. Inspection requirement 02.01.b.2 was added to remain consistent with the current Block 2 of the guidance section. Added definition of inherently reliable.	None	ML093010331
N/A	ML102910230 04/29/11 CN 11-008	IP 71111.12 has been revised to remove guidance in that is redundant or contrary to guidance in IMC 0612 and IMC 0609. Guidance was also removed from the IP that could be misinterpreted as establishing or conveying an inaccurate regulatory position.	None	ML11068A019

Commitment Tracking Number	Accession Number Issue Date Change Notice	Description of Change	Description of Training Required and Completion Date	Comment and Feedback Resolution Accession Number (Pre-Decisional, Non-Public)
N/A	ML15023A120 02/03/16 CN 16-005	Revision 3 to RG 1.160 and Revision 4A to NUMARC 93-01 were recently issued. IP 71111.12 has been revised to update references to the new revision numbers. SSC scoping guidance that is contrary to regulatory requirements has also been removed. SSCs that meet 10 CFR 50.65(b) must be scoped into maintenance rule. NUMARC 93-01 contains SSC scoping guidance. Two definitions in Appendix B that are not found elsewhere in the IP have been deleted. Information discussed in the deleted definitions is covered by other definitions. Changes made in accordance with ROP Enhancement Project (see ML14017A381, ML14027A576, and Feedback Form IP 71111.12-2061).	None	ML16006A430 71111.12-2061 ML16033A367