March 4, 1997 SECY-97-055

FOR: The Commissioners

FROM: L. Joseph Callan /s/
Executive Director for Operations

SUBJECT: MAINTENANCE RULE STATUS, RESULTS, AND LESSONS LEARNED

PURPOSE:

To inform the Commission about:

1. The background of the maintenance rule.

2. The status and results of the NRC staff activities related to the maintenance rule, including revising the maintenance rule regulatory guide.

3. Lessons learned from the implementation and initial baseline inspections of the maintenance rule.

4. Insights gained from the NRC staff's experience with the maintenance rule to consider when developing other risk-informed, performance-based rules.

SUMMARY:

Since the effective date of the maintenance rule in July 1996, the NRC staff has completed 18 maintenance rule baseline inspections and revised the applicable regulatory guide. On the basis of the NRC staff's findings to date, the implementation, inspection, and enforcement of the maintenance rule have been successful. Concerns have been identified, but

Contact:
Thomas Bergman, NRR
(301) 415-1021

overall, licensees inspected to date have adequately implemented the rule. Moreover, the lessons learned from the implementation, inspection and enforcement of the maintenance rule should benefit the development of other risk-informed, performance-based regulations.

The remaining maintenance rule activities the NRC staff has planned include: completing the baseline inspection program, issuing an information notice of lessons learned from the early baseline inspections, revising the baseline inspection procedure to reflect lessons learned and revising the implementation guidance documents.

BACKGROUND:

In the 1980s, the NRC became concerned about the number of transients and scrams initiated as a result of problems with balance of plant systems and components. Since most of this equipment was not addressed under existing regulations, the NRC evaluated whether a maintenance rule was necessary. As a result of NRC staff activities, in particular the maintenance team inspections, the NRC decided that the need for such a rule existed. The NRC's determination rested primarily on the conclusion that proper maintenance is essential to plant safety, and that there is a clear link between effective maintenance and safety as it relates to such factors as the number of transients and challenges to safety systems and the associated need for operability, availability and reliability of safety equipment. In addition, good maintenance is also important in providing assurance that failures *of other than safety-related structures, systems, and components (SSCs)* that could initiate or adversely affect a transient or accident are minimized. On the basis of these conclusions, the NRC developed a risk-informed, performance-based maintenance rule that addressed both safety-related and certain nonsafety-related SSCs.

The maintenance rule, 10 CFR 50.65, "Requirements for monitoring the effectiveness of maintenance at nuclear power plants," was issued on July 10, 1991, to be effective on July 10, 1996. The text of the rule is brief, containing the basic requirements for the activities that licensees need to accomplish to monitor maintenance effectiveness. Implementation guidance was developed by the Nuclear Management and Resources Council (NUMARC, now the Nuclear Energy Institute (NEI)), resulting in NUMARC 93-01, "Industry Guideline for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants." The staff endorsed this guideline, with clarifications, in Regulatory Guide 1.160, "Monitoring the Effectiveness of Maintenance at Nuclear Power Plants." Together, NUMARC 93-01 and RG 1.160 provide sufficient guidance for licensees to develop a program that can comply with the requirements of the maintenance rule, though other methods may also be acceptable.

Requirements of the Maintenance Rule

The maintenance rule itself is simple and brief. Specifically, it consists of requirements that establish which structures, systems and components (SSCs) are included within the scope of the rule, requirements for monitoring the performance or condition of those SSCs within the scope of the rule, and a requirement that licensees periodically assess the effectiveness of maintenance. The rule also encourages licensees to consider the impact on safety when removing equipment from service for preventive maintenance.

Paragraph (b) of 10 CFR 50.65 establishes the scoping criteria for the maintenance rule. The scope of the rule includes all the SSCs that are safety-related, and those nonsafety-related SSCs that are: 1) relied upon to mitigate accidents or transients or are used in emergency operating procedures (EOPs), 2) whose failure could prevent safety-related SSCs from fulfilling their safety functions, or 3) whose failure could cause a reactor scram or an actuation of a safety-related system.

Paragraph (a)(1) of the maintenance rule requires licensees to monitor the performance or condition of 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. Paragraph (a)(1) also requires licensees to take appropriate corrective actions when the performance of an SSC does not meet established goals.[1]

Paragraph (a)(2) of 10 CFR 50.65 allows licensees to eliminate the goal setting and monitoring activities specified in Paragraph (a)(1) where the licensee has demonstrated that the performance or condition of SSCs is effectively controlled through preventive maintenance.

Paragraph (a)(3) of the maintenance rule has two parts. First, it requires that licensees periodically evaluate their performance and condition monitoring activities and associated goals, as well as preventive maintenance activities, at least once each refueling cycle not to exceed 24 months between evaluations. Where practical, the evaluations are required to take into account industry-wide operating experience. Licensees are to make adjustments in their programs where necessary to ensure 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. The second part of Paragraph (a)(3) states that licensees **should** take into account the total plant equipment that is out of service in order to determine the overall effect on performance of safety functions when performing monitoring and preventive maintenance activities. Because this provision states "**should,**" licensees are not *required* to perform the safety assessments.

Implementation Guidance Document Development

Soon after the rule was issued, the NRC staff and NUMARC concurrently began to develop implementation guidance. After it became apparent that NUMARC's proposed implementation guidance, NUMARC 93-01, would be an acceptable method for implementing the rule, the NRC staff determined that NUMARC 93-01 could be endorsed in a regulatory guide.

After developing NUMARC 93-01, industry conducted a verification and validation (V&V) program that was observed by the NRC staff. The purpose of the industry's V&V program was to evaluate the adequacy of NUMARC 93-01 and make changes to NUMARC 93-01 where

[1]Paragraph (a)(1) of the maintenance rule was amended on August 28, 1996, to require plants undergoing decommissioning or decommissioned to include within scope only those SSCs associated with storing, controlling, and maintaining spent fuel in a safe condition.

necessary. After incorporating the changes, NUMARC issued NUMARC 93-01, Revision 0, in May 1993. The NRC staff then endorsed NUMARC 93-01, Revision 0, in RG 1.160, Revision 0, in June 1993.

Between September 1994 and March 1995, the NRC staff conducted a pilot site visit program (also referred to as the pilot program) at nine volunteer sites. The purpose of this pilot program was to confirm that the draft maintenance rule inspection procedure (IP), which was issued by the NRC staff in December 1993, could be used to verify that licensees who implemented the maintenance rule in accordance with RG 1.160 and NUMARC 93-01 were in compliance with the rule. The NRC staff documented the results of these pilot site visits in site-specific reports and in NUREG-1526, "Lessons Learned from Early Implementation of the Maintenance Rule at Nine Nuclear Power Plants" (June 1995). On the basis of lessons learned during the pilot site visits, workshops held with industry, and public meetings, the NRC staff revised the draft inspection procedure and issued the revision as IP 62706, "Maintenance Rule," on August 31, 1995. On the basis of similar information, NEI issued NUMARC 93-01, Revision 2, in April 1996.

The staff then considered endorsing NUMARC 93-01, Revision 2, and issued Draft Regulatory Guide (DG) 1051, "Monitoring the Effectiveness of Maintenance at Nuclear Power Plants," for public comment in August 1996. After the public comment period expired (November 15, 1996), the NRC staff incorporated the appropriate comments and further clarified NUMARC 93-01, Revision 2, on the basis of comments received in public meetings and during maintenance rule baseline inspections conducted since the effective date of the rule. Then, in February 1997, the NRC staff completed its endorsement and clarifications of NUMARC 93-01, Revision 2, in RG 1.160, Revision 2 (attached).[2]

Implementing the Maintenance Rule Using NUMARC 93-01

When implementing the maintenance rule using NUMARC 93-01,[3] a licensee first uses the criteria in 10 CFR 50.65(b) to determine which SSCs are within the scope of the rule. The licensee then categorizes all of the SSCs within the scope of the rule as being either of high or low safety significance. It is important to emphasize that scoping is accomplished solely using the deterministic criteria in Paragraph (b) of the rule. Safety (risk) is only considered **after** the scope has been established.

SSCs that are of high safety significance must be monitored at the system, train, or component level; at a minimum, this monitoring must include SSC reliability and availability. SSCs that are of low safety significance *and in standby* must also be monitored at the system, train, or

---

[2]RG 1.160, Revision 2, has been approved by NRR. The RG has been endorsed by the Committee to Review Generic Requirements and the Office of General Counsel has no legal objection. The RG will be published and distributed in March 1997.

[3]As of February 14, 1997, all licensees that participated in the pilot program (9 sites) or that have been inspected by the NRC staff as part of the maintenance rule baseline inspection program (18 sites) implemented the rule using RG 1.160 and NUMARC 93-01.

component level; at a minimum this monitoring must include reliability. SSCs that are of low safety significance *and normally operating* may be monitored at the plant level; this monitoring typically includes unplanned scrams, unplanned safety system actuations and unplanned capability loss factor.

Except for those SSCs determined to be inherently reliable or that can be run to failure, the SSC will be monitored in accordance with either Paragraph (a)(1) or Paragraph (a)(2) of the rule on the basis of performance. Those SSCs that have demonstrated effective preventive maintenance are monitored in accordance with Paragraph (a)(2), as allowed by the rule. SSCs monitored in accordance with Paragraph (a)(2) must have appropriate performance criteria[4] established. Those SSCs for which the licensee cannot demonstrate effective preventive maintenance are monitored in accordance with Paragraph (a)(1). SSCs monitored under Paragraph (a)(1) must have appropriate goals established. In either case, the goals or performance criteria are to be commensurate with safety.

Provided that an SSC meets its performance criteria or does not experience a repetitive maintenance preventable functional failure (MPFF),[5] the preventive maintenance for that SSC is considered to be effective, and monitoring can continue under Paragraph (a)(2). When the SSC does not meet a performance criterion or experiences a repetitive MPFF, the licensee must determine whether the SSC should be monitored under Paragraph (a)(1). In addition to monitoring reliability and/or availability, as appropriate, SSCs monitored under Paragraph (a)(1) are expected to have goals that specifically address the cause of the problem that resulted in the SSC being monitored in accordance with Paragraph (a)(1).

Licensees are expected to monitor the performance or condition of SSCs within the scope of the rule against the goals and performance criteria on an ongoing basis. As required by Paragraph (a)(3), licensees must assess the effectiveness of maintenance at least once per refueling cycle not to exceed 24 months between evaluations.

Transition from Prescriptive to Performance-Based Regulation

When the maintenance rule was issued, it was described as a results-oriented, performance-based rule, but it does have prescriptive aspects as well. Specifically, the maintenance rule includes the SSC scoping criteria and the requirement to periodically evaluate maintenance effectiveness. In the context of the maintenance rule, performance-based referred to two aspects of how the rule is implemented by licensees, and to how the NRC staff would inspect and enforce the rule.

---

[4]NUMARC 93-01 uses goals and performance criteria with a specific meaning. Goals are used for SSCs monitored under Paragraph (a)(1), while performance criteria are used for SSCs monitored under Paragraph (a)(2).

[5]The MPFF is a construct of NUMARC 93-01, defined as a failure that results in a loss of the function that caused the SSC to be within the scope of the rule (e.g., the failure resulted in a scram) and could have been prevented through more effective maintenance prior to the failure.

From an implementation standpoint, the maintenance rule is performance-based because it gives licensees flexibility and because the regulatory requirements vary with SSC performance, as follows:

- Flexibility: The rule gives licensees the flexibility to: 1) establish the performance and condition goals, and the requisite equipment monitoring regimes; 2) modify established goals on the basis of plant or equipment performance; and 3) determine whether to rely on preventive maintenance in lieu of establishing goals and performance or condition monitoring. The rule prescribes no specific methodology to accomplish these activities; it only requires that licensees establish goals that are commensurate with safety.

- Regulatory Requirements Vary With SSC Performance: The rule also allows licensees to forego the monitoring requirements of Paragraph (a)(1) if the licensee can demonstrate that the preventive maintenance for an SSC is effective. Therefore, licensees that establish effective preventive maintenance programs can reduce the monitoring activities imposed by the rule. An effective preventive maintenance program can generally be defined as a program that reduces failures to an acceptable level while achieving the appropriate reliability and availability.

From an inspection and enforcement standpoint, the maintenance rule also has both prescriptive (or programmatic) and performance-based elements. The baseline inspection program is a programmatic inspection of licensees' activities to comply with the rule. In 1994 the NRC staff determined that it would be necessary to perform baseline inspections because the NRC staff could not rely solely on performance-based inspections until the NRC staff developed confidence that the programs licensees developed to implement and comply with the rule would accurately monitor maintenance performance, and that licensees would adjust their maintenance activities and programs where performance indicated changes were necessary.

In the long term, the NRC staff expects to focus on the results of the licensee's maintenance activities using IP 62707, "Maintenance Observation." Inspections conducted in accordance with IP 62707 address, in part, whether maintenance was effective in preventing failures, and where problems occur, the effectiveness of the licensee's corrective actions. Unless performance indicates that a potential programmatic problem may exist, the NRC staff does not expect to be involved in the licensee's programs to accomplish and monitor maintenance (e.g., procedures, training). Therefore, the regulatory burden is expected to be lower for those licensees that have effective maintenance programs.

Risk-Informed Aspects of the Maintenance Rule

At the time the maintenance rule was issued it was considered a performance-based rule; the concept of "risk-informed" was not in general use. While the rule required that licensees establish goals commensurate with safety, the intention of the NRC at that time was not as mature as the current concept of risk-informed thinking. However, in the statements of consideration for the maintenance rule,[6] the NRC clearly encouraged licensees to use

[6]56 FR 31306

assumptions and results associated with probabilistic risk assessments (PRAs) and Individual Plant Evaluations (IPEs) when establishing the goals required by Paragraph (a)(1). The NRC also clearly expected licensees to consider risk when performing the Paragraph (a)(3) assessments of the impact on safety when removing equipment from service. While the use of PRA was not explicitly required, the NRC stated that the Paragraph (a)(3) assessments were expected to be refined on the basis of technological improvement and experience. As previously stated, this provision of Paragraph (a)(3) is not a requirement.

Furthermore, the endorsed method of implementing the maintenance rule in NUMARC 93-01 describes an approach that relies on the assumptions and results of the licensee's risk analyses.[7] When implementing the rule using this approach, licensees consider their risk analyses when categorizing the SSCs that are within the scope of the rule as having high or low safety significance, and when establishing performance criteria and goals for SSCs of high safety significance. Licensees are also encouraged to use risk analyses for the Paragraph (a)(3) safety assessments when removing equipment from service for preventive maintenance.

Therefore, although the maintenance rule was not initially described as a risk-informed rule, the industry's implementation of the rule has evolved to include some aspects that would be considered part of risk-informed regulation. Unlike other potential risk-informed applications (e.g., graded quality assurance, inservice testing) the general issues that have been raised regarding risk-informed regulation, such as quality of PRAs, pose less of a problem for the maintenance rule because the maintenance rule adds, rather than relaxes, regulatory requirements, the SSCs within the scope of the rule are established through deterministic means (PRAs provide only one input, and cannot be used to exclude an SSC from the scope of the rule), and the maintenance rule includes a feedback mechanism that is self-correcting if safety significance ranking errors are made due to poor quality PRAs. The use of PRA in the maintenance rule was described in SECY 95-265, "Response to August 9, 1995, Staff Requirements Memorandum Request to Analyze the Generic Applicability of the Risk Determination Process Used in Implementing the Maintenance Rule," dated November 1, 1995.

DISCUSSION:

From the effective date of the maintenance rule through February 14, 1997, the NRC staff completed 18 maintenance rule baseline inspections using IP 62706,[8] and completed Revision 2 to RG 1.160. The NRC staff has a number of additional activities to complete related to the maintenance rule.

Maintenance Rule Baseline Inspections Findings

---

[7]Licensees that implement the maintenance rule using NUMARC 93-01 are not required to take the PRA alternative described in that document. However, the PRA alternative is the only method described in detail in NUMARC 93-01, and all licensees that participated in the pilot program and have had baseline inspections used the PRA approach.

[8]The NRC staff has also completed three other non-baseline maintenance rule inspections. The results of those inspections are consistent with those identified during baseline inspections.

Each maintenance rule inspection is site-specific. Although all the licensees inspected to date have implemented the rule using RG 1.160 and NUMARC 93-01, each licensee has developed a unique site-specific program. This presents a challenge to the inspectors in that they must fully understand each licensee's approach, and determine whether the licensee's program meets the requirements of the maintenance rule. For example, plants of similar design may have different: numbers of SSCs, numbers of SSCs in scope of the rule, number of SSCs of high safety significance, numbers of SSCs monitored in accordance with Paragraph (a)(1) versus (a)(2), and values of performance criteria and goals. The inspectors must evaluate each licensee's approach on its merits, as the specific values for each of the above factors is affected by the licensee's implementation method. This variation was expected, however, and is consistent with the NRC's intention to give licensees maximum flexibility in implementing the rule.

The NRC staff has been able to accomplish the inspections by dedicating sufficient resources to the inspection effort; providing extensive training for inspectors regarding the requirements of the maintenance rule and the guidance in RG 1.160, NUMARC 93-01, IP 62706 and IP 62707; and ensuring effective communication between the regions and the Office of Nuclear Reactor Regulation (NRR). The following paragraphs summarize the findings from the initial baseline inspections.

In general, the NRC staff finds that licensees have adequately implemented the requirements of the maintenance rule. However, in a few cases, despite the five year implementation period, the inspections identified that some licensees waited until the year prior to the effective date of the rule to aggressively pursue implementation. For those licensees, the baseline inspections identified weak programs and/or weak implementation of those programs.

Even where licensees allowed adequate time to implement the maintenance rule, the baseline inspections identified two issues at most sites. First, many licensees have failed to demonstrate that the goals and performance criteria were established commensurate with safety. For example, the licensees allowed each SSC a standard number of MPFFs per cycle as a reliability performance criterion, without consideration of the number of demands on the SSC. In some cases, when compared to the number of demands, the number of MPFFs allowed would be indicative of much lower reliability than the licensee assumed in its risk analyses. The NRC staff position has been that licensees must demonstrate a sound technical basis for the values of the performance criteria and goals. The second common finding has been that many licensees did not develop *both* reliability and unavailability performance criteria or goals for SSCs of high safety significance. As part of the periodic evaluations required by Paragraph (a)(3), licensees are required to *balance* reliability *and* unavailability; this balance cannot be attained unless the licensee monitors *both* of these parameters.

The inspections have also identified scoping issues at several sites. While some examples were observed where safety-related SSCs were not included within the scope of the rule, in most cases findings related to scoping were limited to nonsafety-related SSCs and were relatively minor. For example: 1) a failure to include the cooling tower system in the scope even though the system's failure had resulted in a scram on one occasion and a near scram on another; and 2) failure to include communications and/or emergency lighting systems in scope even though industry operating experience has demonstrated their importance in mitigating

accidents and transients and completing the activities required by emergency operating procedures.

The staff has observed that some licensees appear reluctant to identify failures as MPFFs. From a regulatory standpoint, the occurrence of an MPFF is not a violation. Rather, an MPFF indicates a potential problem; what is most important is that the licensee take effective corrective actions. This reluctance to identify MPFFs has resulted in some violations for failure to monitor the performance of SSCs within the scope of the rule.

The need for additional guidance regarding structural monitoring was identified before the effective date of the rule. Revision 2 to NUMARC 93-01 contains some additional guidance, however, the industry was expected to finalize the comprehensive guidance developed in NEI 96-03, "Guideline for Monitoring the Condition of Structures at Nuclear Power Plants." This document is intended to provide structural monitoring guidance for all regulatory applications and not just the maintenance rule. The NRC staff has provided comments to NEI on NEI 96-03, but NEI has not yet finalized NEI 96-03 to address the staff's comments. Therefore, the NRC staff has been unable to endorse NEI 96-03. The result of the unavailability of guidance on monitoring the condition of structures is that, in all but three inspections (which were found acceptable), the inspectors did not assess or were unable to conclude whether the licensee's program for monitoring structures complied with the rule. For these 15 sites the inspections identified structural monitoring as an inspection followup item, to be reevaluated after the structural monitoring guidance became available. Since NEI 96-03 has not yet been endorsed, the NRC staff has provided maintenance rule-specific structural monitoring guidance in RG 1.160, Revision 2.

Finally, licensees have, in general, adequately performed safety assessments when removing equipment from service for maintenance in accordance with Paragraph (a)(3) of the rule. However, some inspections have identified isolated cases of weak safety assessments for removing equipment from service for maintenance. Because this provision of the rule is not an explicit requirement in that the rule states that licenses "**should**" perform the safety assessments, the NRC staff has been unable to enforce this provision (although in most cases the licensees have accepted the NRC staff's comments and corrected their programs).

Maintenance Rule Baseline Inspection Enforcement

Of the 11 baseline inspections for which enforcement action is complete, nine of them have resulted in proposed enforcement actions (two inspections identified no violations). One inspection resulted in escalated enforcement, which resulted in one Severity Level III violation but no civil penalty. Eight inspections resulted in one or multiple Severity Level IV violations. For the remaining inspections the enforcement actions are under evaluation by the NRC staff.

Licensee Reactions to the Baseline Inspections

Most licensees have indicated that they believe the NRC staff is being consistent in the inspection and enforcement of the maintenance rule.

NEI and some licensees have asserted that the violations cited for inadequate reliability performance criteria or goals represent a new staff position and, consequently, the staff should not take enforcement action on this "generic" concern until additional guidance is issued. However, the NRC staff did not agree with this assertion, and in a letter to NEI dated October 22, 1996, reiterated the NRC staff's position that the need for a sound technical basis for reliability performance criteria is not a new staff position and that the guidance available is adequate. Nonetheless, the staff has added a clarification in RG 1.160, Revision 2, to eliminate any confusion regarding this issue.

NEI and some licensees expressed some concern that the baseline inspections are programmatic and not performance-based. The NRC staff agrees that the baseline inspections are more programmatic than performance-based. The NRC staff recognized early in the implementation period that it could not rely solely on performance-based inspection of the maintenance rule until the NRC staff had confidence that the programs licensees developed and implemented to comply with the rule would accurately monitor maintenance performance, and that licensees would adjust their maintenance programs where performance indicated changes were necessary.

In the long-term, the NRC staff expects that maintenance rule inspections will become more performance-based and less programmatic. After completing the baseline inspection program, the maintenance rule will primarily be inspected using IP 62707, which is performance-based with regard to the maintenance rule aspects and has been used by resident inspectors for their maintenance inspections since the effective date of the maintenance rule. The NRC staff will primarily use IP 62706 when licensee performance indicates that potential programmatic problems exist.

Industry expressed a concern prior to the effective date of the maintenance rule that the NRC staff would use the broad wording of the scoping criteria in Paragraph (b) of the rule to eventually include **all** SSCs within scope. NEI restated this concern in a public meeting on January 9, 1997. However, the only examples of inappropriate SSCs added to scope that NEI provided during the meeting were the communications and emergency lighting systems. As previously discussed, the NRC staff believes that industry operating experience has demonstrated that these systems are necessary to mitigate accidents and transients and to complete the activities in the EOPs, and provide a significant fraction of the mitigating function. Therefore, the NRC staff has generally concluded that these systems should be within the scope of the rule.

<u>Revision 2 to RG 1.160</u>

During the implementation period of the maintenance rule it became apparent that the guidance documents would require revision to reflect lessons learned. The need for an iterative process arises from the general requirements of the rule and the flexibility given licensees to implement them; that is, until full implementation can be observed, it is difficult to determine if the guidance has sufficient details to ensure compliance with requirements.

As previously described, the industry conducted a V&V program and the NRC staff conducted a

pilot program to assess, in part, the adequacy of the inspection procedures and implementation guidance documents. Following those programs, NEI issued Revision 2 to NUMARC 93-01 (April 1996). The NRC staff then issued DG-1051 (the proposed RG 1.160, Revision 2) in August 1996, with a public comment period that ended on November 15, 1996. However, the NRC staff did not complete RG 1.160, Revision 2, until February 1997 because of the desire to incorporate lessons learned from the initial baseline inspections.

Revision 2 to RG 1.160 endorses and clarifies the guidance provided in NUMARC 93-01, Revision 2. It also incorporates clarifications that resulted from public comments regarding DG-1051, experience with the baseline inspections, and two public meetings held on October 15, 1996, and January 9, 1997. The following paragraphs discuss the most significant clarifications incorporated in Revision 2 to RG 1.160:

- Changes to the Rule: The maintenance rule has been amended twice since RG 1.160, Revision 1 was issued.[9] As noted previously, on August 28, 1996, the rule was amended to specifically address the SSCs within the scope of the rule for decommissioned plants. On December 11, 1996, as part of the final rule-making for "Reactor Site Criteria Including Seismic and Earthquake Engineering Criteria for Nuclear Power Plants," the NRC changed the definition of safety related SSCs in Paragraph (b)(1) of the maintenance rule to make it consistent with its use in other regulations. Neither of these rule changes is expected to impact operating reactor licensees.

- Safety Significance Categorization Process: This clarification notes that the NRC staff's endorsement of the safety significance categorization process described in NUMARC 93-01, Revision 2, is limited to the maintenance rule. It also notes that RG 1.160 is expected to be revised in the future, if needed, to reflect the proposed regulatory guide on the use of PRA in regulatory matters. Such a revision to RG 1.160 is desirable for reasons of regulatory consistency, and is also consistent with the NRC's intent (as presented in the statements of consideration for the maintenance rule) that licensees' approaches to the rule could change as a result of technological improvements and experience. Licensees will be encouraged to use this guidance when it is available.

- Scoping: Despite the fact that the scoping-related requirements defined in Paragraph (b) are prescriptive, experience indicated the need for four clarifications, of which the following two are significant:

  - Could Cause: This clarification provides guidance on how to identify the nonsafety-related SSCs that should be included within scope because their failure *could cause* a reactor scram or safety system actuation.

  - SSCs Relied Upon to Mitigate Accidents or Transients or Used in EOPs: This

[9]Revision 1 to the regulatory guide was issued in January 1995 to reflect an earlier rule change that extended the period of the Paragraph (a)(3) periodic assessments from at least once every 12 months to at least once per refueling cycle not to exceed 24 months between evaluations.

modification clarifies that this scoping criterion includes those SSCs that are used to directly address the accident or transient or are explicitly used in the EOPs, and provide a significant fraction of the mitigating function. In addition, this scoping criterion includes within scope those SSCs whose use is *necessary* to mitigate accidents or transients or to use the EOPs (even though the SSCs do not directly address the accidents or transients or may not be explicitly used in EOPs) and provide a significant fraction of the mitigating function (the NRC staff added this clarification after a number of licensees excluded communications and emergency lighting systems, as was previously discussed).

- MPFFs as a Reliability Indicator: As previously discussed, the staff has cited numerous licensees for failure to establish reliability performance criteria that are commensurate with safety because the licensees did not have a sound technical basis for the values of the performance criteria. Revision 2 to the RG clarifies how MPFFs can be used as an indicator of reliability.

- Structural Monitoring: During the pilot program, it became apparent that there was a need to improve the guidance in NUMARC 93-01 for structural monitoring (some additional guidance was provided in Revision 2). As previously noted, most inspections identified structural monitoring as an inspection followup item until additional guidance became available. The industry is developing comprehensive guidance in NEI 96-03, but the staff determined that it was important to provide additional guidance to licensees quickly. Therefore, the NRC staff added guidance in RG 1.160, Revision 2.

- Normally Operating SSCs of Low Safety Significance: As previously noted, normally operating SSCs of low safety significance are generally monitored at the plant level. Experience during the pilot program and baseline inspections indicated the need for additional clarification in this area. RG 1.160, Revision 2, provides three clarifications regarding the treatment of normally operating SSCs of low safety significance; one of these clarifications is significant. Specifically, during the pilot site visits and baseline inspections, the NRC staff noted that some licensees were only monitoring the number of unplanned *automatic* scrams, and were not monitoring unplanned *manual* scrams even when the manual scram was initiated in anticipation of an automatic scram. Given that one of the principal reasons for developing a maintenance rule was the number of reactor scrams (*both* manual and automatic) caused by failures in the balance of plant, the NRC staff position has been that licensees should monitor *all* unplanned scrams in order to assess the effectiveness of their preventive maintenance for those SSCs monitored at the plant level.

Additional NRC Staff Activities Related to the Maintenance Rule

The remaining NRC staff activities related to the maintenance rule are as follows:

- Complete Baseline Inspections: The NRC staff's goal has been to complete a baseline inspection of every licensee's maintenance rule program by July 10, 1998. The regional offices are committed to achieving this goal.

- Issue an Information Notice: As part of its efforts to maintain effective communication with the industry and public regarding the maintenance rule, the NRC staff is developing an information notice to communicate the results and lessons learned from the initial baseline inspections thus far.

- Revise IP 62706: The baseline inspection procedure needs to be revised to reflect the changes to Revision 2 to RG 1.160 and NUMARC 93-01.

- Update and Make Maintenance Rule Home Page Publicly Accessible: As part of its efforts to maintain effective communication with the industry and the public regarding the maintenance rule, the NRC staff has developed a prototype "home page" for the world wide web. Once the home page is updated with the most recent information and prototype testing is completed, the NRC staff will make the home page publicly accessible. The intent of the home page is to provide a comprehensive resource of maintenance rule-related regulatory documents, guidance documents, inspection procedures, and inspection reports in a searchable format.

- Revise the Enforcement Guidance: The NRC staff has used an enforcement guidance memorandum (EGM-96-002) to determine the appropriate enforcement action for maintenance rule inspection findings. This EGM needs to be revised to reflect lessons learned.

- Develop Continuing Training Program: To date, maintenance rule training has been provided by the Quality Assurance and Maintenance Branch (HQMB) in NRR, which has programmatic responsibility for the rule. In the future, however, the responsibility for training the NRC staff on the maintenance rule will be transferred to the Technical Training Division (TTD) of the Office for Analysis and Evaluation of Operational Data. The TTD has participated in the training program's development and is preparing to assume this responsibility.

LESSONS LEARNED:

The implementation and initial baseline inspections have provided the NRC staff with a number of lessons learned regarding what was effective and what could be improved. These lessons learned can be grouped into four categories: importance of communication, value of the pilot program, importance of training, and inspection and enforcement; as described in the following sections.

Importance of Communication

The development and implementation of the maintenance rule has involved extensive communication and interaction within the NRC staff (headquarters and the regional offices) and between the NRC staff and the industry and public. These interactions included numerous public meetings, industry workshops, and active solicitation of industry and public comments on proposed guidance documents and inspection procedures.

Communication between the industry and the NRC staff has been enhanced by keeping a core

NRC staff stable and accessible during the implementation period. This improved communication because the NRC staff became well known to industry representatives.

The NRC staff also maintained extensive communication among the affected internal organizations. For example, the inspection procedures and enforcement guidance were developed by headquarters with regional office input. The training program provided to all maintenance rule inspectors improved communication through personal contact and development of a sense of community as a result of the shared experience of the training. A maintenance rule-specific enforcement panel was created to address enforcement actions; members of the panel include representatives from NRR, the Office of Enforcement (OE), and the appropriate regional office. In addition, representatives of the NRC staff held an internal workshop in December 1996; participants included NRR and all four regional offices. The working relationships developed through these activities aided the consistency of inspection and enforcement across the regions, which directly addressed the industry's concern that the NRC would be inconsistent when inspecting and enforcing the maintenance rule.

As previously noted, the NRC staff plans to continue to maintain open communication by issuing an information notice, revising IP 62706, developing a continuing training program, and providing public access to maintenance rule information over the internet.

Conclusion: The maintenance rule provides a good example of the importance of communication among the NRC staff and between the NRC staff and the industry and public in the effective implementation, inspection and enforcement of a performance-based rule.

Value of the Pilot Program

Early in the implementation period the NRC staff decided that a pilot program would yield substantial benefit with regard to the utility of the implementing guidance and inspection procedure for the maintenance rule. The pilot program provided an early test application of the guidance and IP from which a great deal was learned by both industry and the NRC staff. As an added benefit, these findings were not encumbered by enforcement actions since the rule had not yet gone into effect. The pilot program, lessons learned document (NUREG-1526), and public workshop of the results of the pilot program were completed more than one year before the effective date of the rule. This should have given licensees ample time to refine the implementation of their maintenance rule programs on the basis of the lessons-learned.

Conclusion: The NRC staff's pilot program improved the implementation guidance and inspection procedure, and helped licensees and the NRC staff reach an understanding regarding what constitutes acceptable maintenance monitoring required by the rule.

Importance of Training

As a new major regulatory initiative, the maintenance rule was made more complex both for licensees to implement and for the NRC staff to inspect and enforce because it involved a

performance-based regulatory approach. This approach did not clearly define what was "acceptable," and the NRC staff had little experience with inspection and enforcement of such a rule. This required extensive training of the NRC staff assigned to participate in oversight of the maintenance rule.

As a result, HQMB developed a three-tier training program. The first tier comprised an overview course (one to two hours) developed for managers and those NRC staff who would only be marginally involved with the maintenance rule (e.g., most headquarters staff and management). The second tier comprised a one day course for NRC staff who would be directly involved in oversight of the maintenance rule, although they might not participate in the baseline inspection program (e.g., resident inspectors, some headquarters staff, and regional management). The third tier comprised a three day course for the NRC staff who would participate in or lead the maintenance rule baseline inspections (e.g., regional inspectors, some resident inspectors, and some headquarters staff). HQMB has given 36 training sessions. Over eight hundred members of the NRC staff have received at least one of these training courses as follows: 134 received the three day course; 376 received the one day course; and 412 received the overview course.

Conclusion: The inspection and enforcement of the maintenance rule has benefited from the training program.

Inspection and Enforcement

The initial baseline inspections have demonstrated that inspection of the maintenance rule is challenging, but that the rule can be inspected and enforced in a consistent manner. It is also apparent that inspection and enforcement has been complicated because the maintenance rule includes one provision that is not a requirement.

A maintenance rule baseline inspection is challenging primarily because of the flexibility that the rule gives licensees. This flexibility results in a unique site-specific implementation of the rule at each site. The inspections therefore require additional resources so that each licensee's program can be fully understood and evaluated.

Although the maintenance rule does not explicitly require the use of PRA, all licensees inspected to date have used PRA methods. This required the inspection team to include an inspector with considerable PRA expertise (to date this expertise has primarily come from the senior reactor analysts and significant contractor support). The net result is that, at a minimum, a maintenance rule inspection team consists of a team leader, four inspectors (one of which has PRA expertise), and a staff support member from HQMB whose primary role is to promote consistent inspection and provide guidance on staff positions (the staff support member also frequently fulfills an inspector role). The inspections consist of a week for preparation, a week of onsite inspection, and a week for documentation.

Despite the site-specific approach of each licensee's implementation of the maintenance rule, the NRC staff believes that the maintenance rule is being inspected and enforced in a consistent manner across the regions. In general, the NRC staff has achieved consistency through the training program, joint participation by all four regions in the first baseline

inspection, HQMB participation in all baseline inspections, and the maintenance rule-specific enforcement panel.

Another challenge in inspecting and enforcing the maintenance rule is that the rule includes a provision that is not a requirement. Specifically, Paragraph (a)(3) states that licensees "**should**" assess the impact on safety when removing plant equipment from service for preventive maintenance. In general, licensees have voluntarily complied because it is obvious that there is a nexus between safety and equipment out of service; had there not been such a clear relationship to safety, fewer licensees may have elected to implement a provision that is not a requirement. However, in the few cases where the NRC staff has observed either weak implementation or plant configurations for which the licensee did not adequately assess the configuration's safety impact, the staff was unable to enforce this provision of the rule. Under the current enforcement guidance, the NRC staff cannot enforce this part of Paragraph (a)(3) unless the failure to perform an adequate assessment causes an event or contributes to the severity of or complicates recovery from an event. Even then, enforcement is limited to using the inadequate safety assessment as an escalating factor on other enforcement actions that are taken as a result of the event.

One way to resolve the enforcement problem created by the safety assessment provision of Paragraph (a)(3) would be a rule-making to change the "should" in Paragraph (a)(3) to "shall," which would make this part of the rule a requirement. However, the NRC staff does not believe that a rule change is necessary at this time because the NRC staff has only identified isolated instances of weak safety assessments to date and licensees are in effect treating this provision as a requirement. If the NRC staff finds more cases of weak safety assessments during other maintenance rule inspections, the NRC staff may recommend that the rule be changed.

Conclusions: 1. The NRC staff can consistently inspect and enforce a risk-informed, performance-based rule such as the maintenance rule.

*2. Because the provision in Paragraph (a)(3) that states that licensees "**should**" assess the impact on safety when removing equipment from service is not a requirement, this provision is unenforceable. At this time the NRC staff does not believe a rule change is necessary because licensees are in effect treating this provision as a requirement. However, the NRC staff may recommend a rule change if other maintenance rule inspections identify additional cases of weak safety assessments.*

INSIGHTS FOR OTHER RISK-INFORMED, PERFORMANCE-BASED REGULATIONS:

As a result of the initial baseline inspections of the maintenance rule, the NRC staff has identified the following insights for consideration in the development of other risk-informed, performance-based rules:

- Because of the flexibility given to licensees by performance-based rules, effective communication among the NRC staff and between NRC staff, industry and the public is essential to the successful implementation, inspection and enforcement of these rules.

- Consideration should be given to conducting a pilot program to test implementation and inspection of these rules.

- The NRC staff and licensees should anticipate several iterations of the implementation guidance and inspection procedures in order to benefit from lessons learned through the pilot program and initial inspections.

- A programmatic baseline inspection program may be necessary to provide confidence that the licensees have programs that effectively monitor performance, and that licensees adjust their activities and programs where performance indicates changes are necessary. The NRC staff should not take a performance-based approach to inspection unless such confidence has been obtained.

- NRC resource requirements for these rules are high, and should be acknowledged and committed to up front. Effective communication, development of guidance documents and inspection procedures, training, program oversight, and baseline inspections probably require more resources for performance-based rules than for prescriptive regulations in general.

- The rules must be written in a manner to only contain requirements. Other types of language in the rules, such as hortatory provisions, are unenforceable. Where practical, the rules should define the minimum performance standards (this was not practical in the case of the maintenance rule).

CONCLUSIONS:

On the basis of the NRC staff's findings to date, the implementation, inspection, and enforcement of the maintenance rule have been successful. Concerns have been identified, but overall, licensees inspected to date have adequately implemented the rule. The NRC staff has completed the activities that needed to be completed, and a schedule for the remainder of the activities related to the rule has been established. Moreover, the lessons learned from the implementation, inspection and enforcement of the maintenance rule should benefit other risk-informed, performance-based regulations.

L. Joseph Callan,
Executive Director
for Operations

Attachment: RG 1.160, Revision 2