

## **PERFORMANCE BASED REGULATION - THE MAINTENANCE RULE**

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### **ABSTRACT**

The U.S. Nuclear Regulatory Commission has begun a transition from "process-oriented" to "results-oriented" regulations. The maintenance rule is a results-oriented rule that mandates consideration of risk and plant performance. The Maintenance Rule allows licensees to devise the most effective and efficient means of achieving the results described in the rule including the use of Probabilistic Risk (or Safety) Assessments. The NRC staff conducted a series of site visits to evaluate implementation of the Rule. Conclusions from the site visits indicated that the results-oriented Maintenance Rule can be successfully implemented and enforced.

### **I. INTRODUCTION**

The U.S. Nuclear Regulatory Commission has begun a transition from the "prescriptive" regulations of the past to a more "risk and performance based" approach which takes into consideration risk and plant performance. 10 CFR 50.65, "Requirements for Monitoring the Effectiveness of Maintenance at Nuclear Power Plants" (the Maintenance Rule), which takes effect on July 10, 1996, is an example of a performance based rule that mandates consideration of risk and plant performance. This type of regulation gives each licensee the flexibility to determine the most efficient and effective way to meet the requirements.

This paper provides a discussion of performance based versus prescriptive regulations, and the use of a risk and performance based approach to the implementation of the Maintenance Rule. The NRC has established an Implementation Plan for Probabilistic Risk Assessment to achieve improved regulatory decision-making and more efficient use of licensee and NRC resources. The NRC recognizes that the increased use of PRA in regulatory matters is dependent upon the state-of-the-art in PRA methods and the data available to support PRAs. A goal of the PRA Implementation Plan is to establish decision criteria on the use of PRA and its interdependence with deterministic engineering principles.

### **II. PRESCRIPTIVE VERSUS PERFORMANCE BASED RULEMAKING AND REGULATION**

Although they do not appear to have formal definitions, the terms "prescriptive" and "performance based" are increasingly being used to describe various rulemaking and regulatory activities. A prescriptive rule, the traditional approach for most rules, is one that provides detailed processes, requirements or instructions. 10 CFR 50, Appendix J, "Primary Containment Leakage Testing for Water Cooled Power Reactors" and Appendix R, "Fire Protection Program for Nuclear Power Facilities...." are examples of regulations that are considered prescriptive. They both contain detailed requirements such as test frequency, test pressures, training program and record keeping requirements. The advantage of a

prescriptive rule is that the requirements are generally clearer and more detailed, and thus are easier to implement and regulate. The disadvantage to such rules is that they tend to be inflexible and thus may prevent licensees from using the most efficient and effective means of achieving the desired intent of the rule. Another disadvantage is the lack of a direct link to risk and safety in the implementation of the rule.

A performance based rule is one that describes, in general terms, the process to be followed and the results expected. Such a rule has the advantage of allowing the licensees to devise their own means of implementing the process to achieve the results described in the rule. The disadvantage to such a rule is that it can be more difficult for the licensee to develop the detailed procedures and processes for implementing the program and be assured they have satisfied the rule. In effect, each licensee's program will be customised to meet its individual needs. Also, it may be difficult to monitor compliance with a performance based rule because the requirements are less clearly defined and there may be little uniformity of implementation between different licensees.

One example of the disadvantages of a performance based rule, (e.g., less specific details) became apparent during the development of regulatory and industry guidance for the maintenance rule. Because the guidance had to be general in nature to be consistent with the intended flexibility in the rule, industry representatives asked that the inspection procedure (which is normally developed after the regulatory guidance has been issued) be prepared early and provided to them for their use during the development of the industry guidance document. They wanted to use the inspection procedure to provide some of the details that were not in the rule itself. The industry-developed guidance, which provided much more detail than the rule, was endorsed by the NRC as one acceptable method of implementing the rule.

### **III. THE MAINTENANCE RULE**

#### **A. Requirements**

Being performance based, the Maintenance Rule allows licensees considerable flexibility in developing and adjusting their implementation activities based on plant and equipment performance and risk (or safety) significance. However, no rule is entirely performance based or entirely prescriptive; most rules contain elements of both. The Maintenance Rule contains elements that could be considered to be prescriptive, for example, the requirement that a periodic evaluation be performed each refuelling cycle. Some specific requirements of the Maintenance Rule follow.

1. **Monitoring.** The performance or condition of structures, systems, or components (SSCs) must be monitored against licensee-established goals, to provide reasonable assurance that these SSCs are capable of fulfilling their intended functions. These goals should be commensurate with safety, and take into account industry-wide operating experience. The fact that these goals are to be set by the licensee rather than the NRC is an indication that the rule is not prescriptive. The fact that the goals should be commensurate with safety (risk) and take into account industry-wide operating experience are additional risk and performance based aspects of the rule.
2. **Defined Goals.** When the performance of an SSC does not meet established goals, appropriate corrective action must be taken. This corrective action could include modification of the goal if plant experience has shown that the original goal was too restrictive. This flexibility of being able to modify the goals based on plant or equipment performance is another performance based aspect of the rule.

3. **Preventive Maintenance.** The rule permits licensees to eliminate goal setting and monitoring where it has been demonstrated that the performance of SSCs is effectively controlled through preventive maintenance. This flexibility to utilise effective preventive maintenance instead of goal setting and monitoring is another performance based aspect of the rule.
4. **Periodic Evaluation.** The requirement that each licensee perform a periodic evaluation of all activities related to implementation of the maintenance rule program is a prescriptive requirement. However, the requirements to include consideration of industry-wide operating experience and to make adjustments to the program where necessary to balance improved reliability against the objective of minimising unavailability of SSCs, are risk and performance based aspects of the periodic evaluation.
5. **Safety Assessments.** The rule also requires an assessment be made of the total plant equipment that is out of service before removing equipment from service for monitoring or maintenance. Prior to the Maintenance Rule, regulatory requirements for specifying which plant equipment could be taken out of service for any reason, including maintenance, were generally contained in each licensee's technical specifications. Technical specification out of service times were assumed to cover surveillances and corrective maintenance, but not extensive on-line preventive maintenance. In addition, some licensees established self-imposed administrative limits on equipment that could be taken out of service for maintenance. The technical specification requirements specify allowed out-of-service times and compensatory testing that must be performed for specific systems. These technical specification requirements will remain in effect after implementation of the maintenance rule but the need for self-imposed administrative limits may be obviated by implementation of the maintenance rule. The maintenance rule is non-prescriptive in that it does not specify allowed out-of-service times or required testing. It only requires that a risk or safety assessment be performed before removing equipment from service. The process for evaluating risk is left up' to the licensee to determine, however, the NRC will inspect the licensee's process.
6. **Scope of Maintenance Rule.** The scope of systems, structures and components (SSC) in the rule includes all safety related SSCs and those non-safety related balance of plant (BOP) SSCs that are (1) relied upon to mitigate accidents or transients or are used in emergency operating procedures; (2) whose failure could prevent safety-related structures, systems, and components from fulfilling their safety-related function; or (3) whose failure could cause a reactor scram or actuation of a safety-related system. The scope of the Maintenance Rule is spelled out in some detail and would therefore probably be considered a prescriptive aspect of the rule.

#### ***B. Implementation of the Rule***

The NRC has endorsed via a Regulatory Guide, the Nuclear Energy Institute (NEI) guidance for implementing the rule. This guidance describes a process for establishing risk significance, performance criteria, and goals for SSCs covered by the rule. A multidisciplinary expert panel, using input from the PRA/PSA, as well as other plant information, is responsible for determining more-risk significant versus less-risk significant SSCs. The process of determining more risk significance is very important if the staff is to continue implementing risk-based regulation. The process described in the NEI guidance document has been used by most, if not all, licensees. However, the staff has seen some variations in the implementation of the process. The determination of risk significance is based on a combination of PRA insights and expert panel deterministic considerations. Three risk importance measures are considered, which theoretically should result in a listing of systems ranked by relative importance to safety. The results of all three determinations are provided to an expert panel, which is composed of representatives

from operations and maintenance, in addition to a representative who is knowledgeable of the PRA, and its strengths and weaknesses. This expert panel then considers the PRA insights, and determines which plant SSCs are more-risk or less-risk significant. The NRC may determine that additional guidance regarding the use of PRA insights is necessary. This subject is discussed in more detail later in this paper. Those SSCs that are more risk significant or are stand-by systems would be monitored against system specific performance criteria (e.g., reliability and availability), and those that are less risk significant would be monitored against plant level performance criteria (e.g., plant scrams or safety-system actuations). In a few instances, with appropriate supporting analysis, an SSC could be permitted to run to failure. However, after a repetitive failure or a failure to meet performance criteria, the establishment of goals would be required.

### **C. *Site Visits to Verify Implementation of the Rule***

The NRC staff performed a series of nine site visits to determine the validity of the draft inspection procedure that will be used to evaluate licensees' implementation of the rule, as well as to provide feedback to the industry on the strengths and weaknesses of the various programs. In June 1995, the staff issued a formal evaluation document, NUREG 1526 and held a public workshop to present the results of these visits and to describe any revisions to the inspection procedure. The NRC also provided comments to NEI for their consideration when revising the guidance document. This will give licensees approximately one year to study the results of the site visits and make any changes to their maintenance program before the effective date of the Maintenance Rule, July 10, 1996.

### **D. *Results***

Results of the pilot site visits indicated that the risk and performance based Maintenance Rule can be successfully implemented and enforced. The NRC will continue its evaluation of the implementation of the Maintenance Rule to assure consistent results by all licensees.

### **E. *Inspections***

Beginning on July 10, 1996, NRC inspectors will verify licensees compliance with the maintenance rule. On a routine basis, NRC site resident inspectors will use a new inspection procedure IP 62707 to evaluate licensees' day to day maintenance activities. The approach to inspections after the rule goes into effect will be somewhat different than those currently conducted. Currently, inspectors focus was on the actual maintenance activity being performed on selected equipment, if licensees followed procedures while performing maintenance tasks and on the results achieved by maintenance as reflected in equipment operability. Inspectors also verify that licensees' maintenance activities are conducted in accordance with plant technical specifications including verification that allowed outage times for equipment taken out of service for maintenance are not exceeded. The new focus of routine maintenance inspections after the rule goes into effect will be on how licensees monitor the results of their maintenance activities as reflected in the performance or condition of plant equipment under the scope of the maintenance rule as well as the controls they have in place to perform maintenance. Inspectors will also review licensees processes for evaluating equipment performance or condition including trending, cause determinations for poor performance and failures and corrective actions. Also, inspectors will verify that licensees execute overall plant safety assessments prior to removing equipment from service to perform maintenance activities in addition to verifying plant technical specifications are met.

After the effective date of the rule, the NRC will begin a two year program of baseline inspections that will be conducted at every site. These baseline inspections will include a comprehensive review of licensees' processes to implement the rule following the guidance contained in IP 62706. A team of 4 to 5 inspectors will spend one week preparing for each on site inspection including reviewing plant performance information such as LERs, inspection reports, and SALPs. The team will also develop a list of SSCs which they believe are under the scope of the maintenance rule for that particular site. This list will be derived from FSARs, EOPs and PRA/IPE results. The onsite evaluation will last one week and will consist of the following activities:

- overview of the licensee's maintenance rule program and status;
- comparison of inspectors' SSC scoping list to the licensee's list;
- evaluation of SSC risk determination processes, including interviews with the expert panel members;
- detailed review of selected SSCs in the (a)(2) and (a)(1) categories including performance criteria or goals, performance and condition monitoring activities and results, cause determinations and corrective actions, use of industry wide operating experience and interviews with system engineers;
- review of licensees' safety assessments performed prior to taking equipment out of service for maintenance;
- review of licensees' periodic evaluations (or plans) and reliability and availability balancing processes and results.

Consistency in inspection and enforcement of the maintenance rule is crucial to the success of the baseline effort as well as all inspections dealing with the maintenance rule. To help assure the necessary consistency, there will be only one inspection in July, two in August and September and four per month thereafter. The first inspection is scheduled for the Palo Verde Station and the team will be comprised of a headquarters team leader and inspectors from each of the four regional offices. These regional inspectors will lead baseline teams after the Palo Verde inspection. This team composition should ensure that all regional and headquarters inspectors perform the inspections in a consistent manner. Furthermore, headquarters maintenance rule inspectors will assist the regional inspectors on each inspection. To foster consistency in the enforcement of the rule requirements across all regions, all potential maintenance rule enforcement actions will be evaluated and approved by a joint headquarters and region panel.

The challenges with inspecting this first performance based rule will be significant. Both the industry and NRC will closely monitor rule implementation, inspections and enforcement results to assure consistency and fairness.