



# **THE MAINTENANCE RULE**

## **10 CFR 50.65**

**Michael Cullingford**  
**Special Assistant for Technical**  
**Policy and International Liaison**  
**Office of Nuclear Regulatory Commission**

**TECRO-AIT JSC Meeting on Civil Nuclear Cooperation**  
**November 4-6, 2003**  
**Taichung, Taiwan**

# **THE MAINTENANCE RULE, 10 CFR 50.65**

---

- **Published in 1991; allowed five years for implementation.**
  - **Gave licensees three years to implement the rule after industry guidance was published in 1993.**
  - **Full implementation in July 1996; (a)(4) added in 1999.**
- **The rule itself contains few details. To understand it, you need to become familiar with:**
  - **Regulatory Guide 1.160, endorsing industry guidance NUMARC 93-01, and Regulatory Guide 1.182, endorsing 2/22/00 revision of Section 11 of NUMARC 93-01.**
  - **NRC inspection procedures IP 71111.12 and -.13, which contain a significant amount of guidance.**

# **OBJECTIVE OF THE MAINTENANCE RULE**

***To monitor the effectiveness of maintenance activities ...***

***For safety significant plant equipment ...***

***In order to minimize the likelihood ...***

***Of failures and events ...***

***Caused by the lack of effective maintenance.***

# PRESCRIPTIVE RULES

---

**Traditional approach for most rules:**

*Provides detailed processes, requirements, or instructions.*

**Advantage:**

*Requirements are easier to implement and regulate.*

**Disadvantages:**

*Such rules tend to be inflexible.*

*Risk and safety are not addressed directly.*

# PERFORMANCE-BASED RULES

---

**Newer approach for rules:**

*Describes the general process to be followed and the results expected.*

**Advantage:**

*Allows licensees to devise their own means of implementing the rule.*

**Disadvantages:**

*Each licensee must develop details for implementing own program.*

*Such rules are more difficult to inspect and enforce.*

**§50.65 Requirements for monitoring the effectiveness of maintenance at nuclear power plants.**

The requirements of this section are applicable during all conditions of plant operation, including normal shutdown operations.

(a)(1) Each holder of an operating license under §§50.21(b) or 50.22 shall monitor the performance or condition of structures, systems, or components, against licensee-established goals, in a manner sufficient to provide reasonable assurance that such structures, systems, and components, as defined in paragraph (b), are capable of fulfilling their intended functions. Such goals shall be established commensurate with safety and, where practical, take into account industry-wide operating experience. When the performance or condition of a structure, system, or component does not meet established goals, appropriate corrective action shall be taken. For a nuclear power plant for which the licensee has submitted the certifications specified in Sec. 50.82(a)(1), this section only shall apply to the extent that the licensee shall monitor the performance or condition of all structures, systems, or components associated with the storage, control, and maintenance of spent fuel in a safe condition, in a manner sufficient to provide reasonable assurance that such structures, systems, and components are capable of fulfilling their intended functions.

(2) Monitoring as specified in paragraph (a)(1) of this section is not required where it has been demonstrated that the performance or condition of a structure, system, or component is being effectively controlled through the performance of appropriate preventive maintenance, such that the structure, system, or component remains capable of performing its intended function.

(3) Performance and condition monitoring activities and associated goals and preventive maintenance activities shall be evaluated at least every refueling cycle provided the interval between evaluations does not exceed 24 months. The evaluations shall be conducted

taking into account, where practical, industry-wide operating experience. Adjustments shall be made where necessary to ensure that the objective of preventing failures of structures, systems, and components through maintenance is appropriately balanced against the objective of minimizing unavailability of structures, systems, and components due to monitoring or preventative maintenance.

(4) Before performing maintenance activities (including but not limited to surveillance, post-maintenance testing, and corrective and preventive maintenance), the licensee shall assess and manage the increase in risk that may result from the proposed maintenance activities. The scope of the assessment may be limited to structures, systems, and components that a risk-informed evaluation process has shown to be significant to public health and safety.

(b) The scope of the monitoring program specified in paragraph (a)(1) of this section shall include safety related and non safety related structures, systems, and components, as follows:

(1) Safety related structures, systems, and components that are relied upon to remain functional during and following design basis events to ensure the integrity of the reactor coolant pressure boundary, the capability to shut down the reactor and maintain it in a safe shutdown condition, or the capability to prevent or mitigate the consequences of accidents that could result in potential offsite exposure comparable to the guidelines in Sec. 50.34(a)(1), Sec. 50.67(b)(2), or Sec. 100.11 of this chapter, as applicable.

(2) Nonsafety related structures, systems, or components:

(i) That are relied upon to mitigate accidents or transients or are used in plant emergency operating procedures (EOPs); or

(ii) Whose failure could prevent safety-related structures, systems, and components from fulfilling their safety-related function; or

(iii) Whose failure could cause a reactor scram or actuation of a safety-related system.

(c) The requirements of this section shall be

# MAINTENANCE RULE OVERVIEW

---

***The rule deals with plant structures, systems and components (SSCS):***

- (b) Some SSCs are in the program scope; some aren't.***
- (a)(1) Some in-scope SSCs need to be monitored closely.***
- (a)(2) Some don't.***
- (a)(3) Program needs to be balanced and periodically self-assessed.***
- (a)(4) Risk needs to be assessed and managed before maintenance activities.***

# SCOPE OF THE RULE

---

- **(b)(1) safety-related SSCs.**
- **(b)(2) non-safety-related SSCs:**
  - **needed to mitigate accidents or used in EOPs;**
  - **whose failure could cause the failure of a safety system; or**
  - **whose failure could cause a reactor scram or safety system actuation.**
- **All SSCs in scope are subject to risk determination process; all SSCs outside scope subject to existing programs.**

# RISK DETERMINATION PROCESS

---

- Rule requires "Goals shall be established commensurate with safety."
- Guidance recommends identification of risk-significant SSCs as a combination of quantitative (PRA importance measures) and qualitative (expert panel judgement) processes:
  - PRA importance measures include Risk Reduction Worth (RRW > 1.005), Risk Achievement Worth (RAW > 2), and core damage frequency contribution (top 90% cutsets).
  - Taking importance measures into consideration and using their knowledge and experience to compensate for the limitations of PRA, the expert panel decides which SSCs are risk significant.

## (a)(2)

---

- **Monitoring under (a)(1) is not required where it has been demonstrated that performance or condition is adequately controlled through preventive maintenance.**
  - **NUMARC 93-01 initially places all SSCs under (a)(2) and establishes Performance Criteria which are used to demonstrate adequate preventive maintenance.**
  - **Monitoring is performed at the train level for risk-significant and non-risk-significant *standby* SSCs.**
  - **Monitoring is permitted at the plant level for non-risk significant *normally operating* SSCs.**
- **Where Performance Criteria are exceeded, or a repetitive maintenance preventable functional failure (MPFF) occurs, SSC must be monitored under (a)(1).**

## **(a)(1)**

---

- **Performance or condition of SSCs shall be monitored under (a)(1) against licensee established goals to provide reasonable assurance that SSCs are capable of fulfilling their intended function.**
  - **Goals are to be commensurate with safety and, where practical, take into account industry-wide operating experience.**
  - **Corrective action must be taken where goals are not met.**
- **The SSC may be transferred back to (a)(2) if monitoring under (a)(1) demonstrated that performance has improved and the cause of the failures has been corrected.**

## **(a)(3)**

---

- **Perform an evaluation of maintenance activities at least once every refueling outage cycle; not to exceed 24 months between evaluations.**
- **Make adjustments where necessary to balance unavailability due to maintenance against the reliability improvements achieved by performing preventive maintenance.**

## **(a)(4)**

---

- **Before performing maintenance activities, assess and manage the increase in risk that may result from the proposed maintenance activities.**
  - **Maintenance activities include, but are not limited to:**
    - **surveillance**
    - **post-maintenance testing**
    - **corrective maintenance**
    - **preventive maintenance**
  - **The increase in risk must be managed.**
  - **The scope of the assessment may be limited.**

# **RISK-INFORMED, PERFORMANCE-BASED MAINTENANCE RULE**

---

***Provides licensees flexibility in developing and adjusting implementation activities.***

***Requires monitoring against licensee-established goals.***

***Requires goals to be commensurate with safety (risk) and to take into account industry-wide operating experience.***

***Requires appropriate corrective action when performance does not meet established goals.***

***Permits elimination of goal setting and monitoring where adequate preventive maintenance has been demonstrated.***

# **RISK-INFORMED, PERFORMANCE-BASED MAINTENANCE RULE (cont.)**

---

***Requires periodic evaluation of performance, to include the balancing of reliability and availability.***

***Allows flexibility in methods for assessing and managing the increase in risk resulting from maintenance activities.***

# REMINDERS

---

- **Rule does not require submittals or reports.**
- **Failure to take appropriate corrective action for some balance of plant equipment will be subject to enforcement.**
- **Goals set under (a)(1) are to be licensee- (not NRC-) established.**
- **The number of SSCs in (a)(1) should never be used as an indicator of the effectiveness of the maintenance program.**
- **(a)(4) addresses the risk of maintenance activities. These requirements of are in addition to technical specification requirements. That is, the licensee must follow the most restrictive requirement.**