UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

August 1, 1989

August 1989
Division 1
Task DG-1001

REGULATORY GUIDE DISTRIBUTION LIST FOR DIVISION 1

SUBJECT: DRAFT REGULATORY GUIDE DG-1001, "MAINTENANCE PROGRAMS FOR NUCLEAR POWER PLANTS"

The subject draft regulatory guide is being developed to provide guidance to nuclear reactor licensees and applicants on methods acceptable to the NRC staff for planning, conducting, and assessing the effectiveness of nuclear power plant maintenance programs to prevent the degradation or failure of, and to promptly restore the intended function of, structures, systems, and components that can significantly affect safety or security.

On November 28, 1988, the Nuclear Regulatory Commission published a notice of proposed rulemaking (53 FR 47822) that would require commercial nuclear power plant licensees to implement effective maintenance programs. Public comments received on the proposed rule have been analyzed, particularly those related to the structures, systems, components, and extent of activities included in the maintenance program, and are reflected in this draft regulatory guide.

Comments from the public and industry on this guide will be extremely valuable to the NRC staff in establishing a final regulatory position on maintenance programs.

Specific comments are solicited on the following:

1. What level of detail should be included in the regulatory guide?

2. Is the scope of systems, structures, and components covered by the regulatory guide appropriate?

3. What criteria could be used to determine that a maintenance program is fully effective and additional improvement is not essential from a safety standpoint?

4. Is it appropriate to use quantitative goals, which are described in Regulatory Position 3 of the draft regulatory guide, directed toward achieving a satisfactory level of performance in plant maintenance programs consistent with the level achieved by the top performing U.S. plants of similar design?

5. What quantitative measures would be appropriate for such goals? Should they be at the plant level, system level, component level, or some combination thereof?

Comments should be submitted to the Regulatory Publications Branch, Division of Freedom of Information and Publications Services, Office of Administration, U.S. Nuclear Regulatory Commission, Washington, DC 20555. The public comment period will expire on December 1, 1989. Comments received after that date will be considered if it is practical to do so, but assurance of consideration cannot be given unless comments are received on or before December 1, 1989.

The NRC staff is planning to conduct a workshop early in 1990 to discuss this guidance on maintenance programs and the public comments received on it. There will be a public announcement of the workshop when plans have been completed.

Bill M. Morris

Bill M. Morris, Director
Division of Regulatory Applications
Office of Nuclear Regulatory Research

U.S. NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REGULATORY RESEARCH

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DRAFT REGULATORY GUIDE

Contact: M. Dey (301) 492-3730

MAINTENANCE PROGRAMS FOR NUCLEAR POWER PLANTS

A. INTRODUCTION

The Nuclear Regulatory Commission has proposed to amend its regulations in 10 CFR Part 50, "Domestic Licensing of Production and Utilization Facilities," to clarify and extend existing Commission requirements for maintenance programs of nuclear power plants, both explicit and implicit, in plant technical specifications, licensee safety analysis reports, 10 CFR Part 50, and 10 CFR Part 73. Maintenance requirements for structures, systems, and components in the balance of plant (BOP) whose failure would significantly impact plant safety or security are included. Specific requirements pertaining to maintenance activities for nuclear power plants are proposed in § 50.65, "Requirements for Maintenance Programs for Nuclear Power Plants," of 10 CFR 50 (53 FR 47822). This regulatory guide describes methods acceptable to the NRC for complying with the requirements proposed in § 50.65.

It is the NRC's position that, by establishing a standard for an acceptable maintenance program, guidance and stability will be provided to the regulatory process to better ensure that maintenance programs for all licensed plants achieve and maintain a high level of maintenance commensurate with the safety significance of the functions being performed.

To advance the goal of having a uniform source of recommendations and information for the conduct of maintenance activities, the industry is encouraged to develop and establish useful standards for maintenance consistent with the proposed 10 CFR 50.65 and this draft regulatory guide. Such standards will be reviewed by the NRC and, if acceptable, may be endorsed in future revisions of this regulatory guide.

Any information collection activities mentioned in this regulatory guide are required by 10 CFR 50, the regulatory basis for this guide. All current or amended information collection requirements in 10 CFR 50 have been cleared under OMB Clearance No. 3150-0011 or will be submitted to OMB for review.

B. DISCUSSION

Safe operation of a nuclear power plant is directly dependent on the scope, depth, and quality of the plant's maintenance program. Based on NRC's review, inspection, and audit of existing plant maintenance programs, it is evident that a wide variation exists in the scope, depth, implementation, and effectiveness of licensee maintenance programs. The NRC has determined that part of the reason for such a wide variation is the inconsistent implementation of existing industry guidance coupled with the lack of a comprehensive regulatory standard for maintenance. Further, the NRC has determined that establishment of maintenance standards and formal maintenance programs will lead to increased effectiveness and safety benefits. Accordingly, the Commission has proposed requirements for maintenance (10 CFR 50.65), and with this regulatory guide proposes guidance on the scope and content of an acceptable maintenance program.

Maintenance at nuclear power plants is the aggregate of those planned and systematic actions required to prevent the degradation or failure of, and to promptly restore the intended function of, structures, systems, and components. This applies to all parts of the plant that could significantly impact safe operation and security, including the BOP. The basis for this is the fundamental principle of defense in depth that underlies all NRC regulation. Defense in depth provides for both accident prevention and accident mitigation, with principal and primary emphasis on prevention. Therefore, structures, systems, and components in the BOP are included, because failure of BOP equipment can initiate transients or accidents or adversely affect the course of transients or accidents.

The guidance contained in this regulatory guide describes principles and considerations that, if properly implemented, are expected to contribute toward achieving an effective maintenance program. However, considerable flexibility has been allowed for each licensee to structure and implement a maintenance program consistent with his plant design and organizational structure to achieve an effective maintenance program. It is expected that this regulatory guide

will have minimal impact on those licensees with effective maintenance programs. Therefore, in using this guidance in implementing and assessing a maintenance program, primary emphasis should be on the success of the maintenance program to prevent the degradation or failure of, and to promptly restore the intended function of, those structures, systems, and components.

C. REGULATORY POSITION

The following methods are acceptable to the NRC staff for satisfying the Commission's regulations with respect to planning, conducting, and assessing the effectiveness of nuclear power plant maintenance programs to prevent the degradation or failure of, and to promptly restore the intended function of, structures, systems, and components that can significantly affect safety or security.

1. SUMMARY OF AN EFFECTIVE MAINTENANCE PROGRAM

Each licensee should examine and, where appropriate, strengthen the maintenance program with the purpose of preventing the degradation or failure of, and promptly restoring the intended function of, structures, systems, and components whose failure could significantly impact safety. Fundamentally, the maintenance program should minimize corrective maintenance to the extent practical, and it should rely on sound preventive and predictive maintenance. The maintenance program should describe those structures, systems, and components covered; the maintenance applicable to each; and the process, procedures, and responsibilities to be used to conduct an effective maintenance program.

The maintenance program should cover, as a minimum, structures, systems, and components (and their supporting systems) whose failure could significantly affect the safety or security of the facility, and which are included in the plant's current licensing basis established by existing regulations and described in the documents (e.g., Final Safety Analysis Report) required by 10 CFR 50.34. The licensing basis includes those structures, systems, and components (a) relied upon for the integrity of the reactor coolant pressure boundary, safe shutdown capability, and accident prevention and mitigation; (b) whose failure can cause or adversely affect a transient or accident that significantly challenges structures, systems, and components relied upon for the integrity of the reactor coolant pressure boundary, safe shutdown, or accident mitigation; and (c) other

structures, systems, and components not included above that provide reasonable assurance that the facility can be operated without undue risk to public and plant personnel health and safety or to common defense and security.

An effective maintenance program involves a systematic approach whereby overall policy, goals, and objectives are established; maintenance is conducted based on these goals and objectives; the effectiveness of maintenance is monitored and assessed; and, based on the monitoring and assessment activities and timely feedback, corrective actions are executed. Incorporating these steps in the maintenance program is considered essential to ensuring that an effective maintenance program is achieved and maintained. The following summarizes the key elements of an effective maintenance program.

1.1 Establish Overall Policy, Goals, and Objectives

The maintenance program should define overall policy and objectives for maintenance that are consistent with safe operation and security of the plant. The maintenance required on various structures, systems, and components should be directed toward achieving these objectives. Quantitative goals related to these objectives should be established as one means to measure the progress of the maintenance program in achieving its objectives.

1.2 Conduct of Maintenance

The conduct of maintenance activities in the plant should be documented, as necessary, to provide for systematic, coordinated, and accurate implementation consistent with the goals and objectives defined in Regulatory Position 1.1. These activities include the management, coordination, communication, quality assurance, training, and surveillance and technical tasks, including postmaintenance testing, associated with performing maintenance. An effective maintenance program need not require extensive documentation, but rather must be understood and effectively implemented by all involved personnel in a consistent manner.

1.3 Monitor and Assess Effectiveness and Performance

The effectiveness of maintenance activities should be evaluated by assessing the performance of the plant against the goals and objectives established

in Regulatory Position 1.1 and by other quantitative means. In addition, qualitative assessments of maintenance (audit and inspection) should be used. Based upon these assessments, the need for corrective action should be determined.

1.4 Obtain Feedback on the Program and Take Corrective Actions

A feedback mechanism should be an integral part of the maintenance program to ensure that timely corrective actions are taken if the effectiveness of the program is not consistent with the established goals and objectives or if the other quantitative and qualitative assessments indicate improvement is needed. The feedback process should also ensure that any direct or supporting activity associated with the maintenance program that needs improvement is identified and corrected in a timely manner.

2. OVERALL MAINTENANCE POLICY

An effective maintenance program requires the support and involvement of personnel at all levels of the licensee's organization. However, it is the responsibility of senior management to establish the standards and policies for the organization, oversee implementation, and assess the effectiveness of the maintenance program. The maintenance program should include corporate and plant policies regarding the conduct of maintenance. Effective implementation and control of maintenance should be achieved by establishing written standards for the scope, objectives, and conduct of maintenance, by defining responsibilities, and by periodically observing and assessing performance commensurate with importance to safety and security.

The policies should address planning to establish a proactive maintenance program as opposed to reactive maintenance, and to ensure that the maintenance activities for structures, systems, and components are consistent with their importance and function.

The written policies should be communicated to all plant personnel involved in maintenance, including the maintenance staff and craftsmen. Input from such groups should be considered in the development and updating of these policies.

3. ESTABLISHING GOALS AND OBJECTIVES

The following guidance represents an approach acceptable to the NRC staff for selecting goals and objectives for a maintenance program:

3.1 Objective

The objective of maintenance for structures, systems, and components within the scope of the proposed 10 CFR 50.65 should be: "To prevent the degradation or failure of, and to promptly restore the intended function of, structures, systems, and components."

This objective should be implemented commensurate with the safety significance of functions being performed and should be used to guide the plant maintenance program.

3.2 Goals

To aid in assessing whether or not the maintenance program is moving toward its objective, quantitative goals related to maintenance should be established. In this respect, the use of a plant-wide integrated information system and the Nuclear Plant Reliability Data System (NPRDS) is encouraged.

The goals should be directed toward improving or sustaining equipment reliability and performance by effective maintenance in areas key to plant safety and risk. As a minimum, goals for maintenance should be established in those areas that have the potential for a significant impact on plant safety or security. Each licensee may select goals appropriate for the specific plant, and goals may not be necessary for many structures, systems, and components. Extensive goals at the component level are not expected.

In establishing goals, factors such as system function, equipment redundancy, diversity, operating mode (standby or normally running), plant condition during which the function needs to be performed (full power, low power, shutdown, refueling) and the relative importance to safety may be considered. Information from a plant-specific probabilistic risk assessment and the Individual Plant Examination recommended by the NRC could be an acceptable basis for determining the contributions to risk from failures of plant systems, for evaluating the goals and objectives of maintenance, and for identifying structures, systems, and components that deserve special attention. Different goals for different

structures, systems, and components are acceptable commensurate with safety and security significance. In general, goals should be established with the objective of achieving a level of performance consistent with that achieved by the top-performing U.S. plants of similar design.

Equipment history should be compared against the goals, and the maintenance program should be modified, if necessary and appropriate, to achieve the goal. This method of establishing and using goals will help ensure that equipment whose performance as a result of maintenance has the potential to impact safe operation of the plant is specifically identified and monitored. Other parameters may also be useful in monitoring the effectiveness of the maintenance program. These are discussed in Regulatory Position 5.

4. CONDUCT OF MAINTENANCE

The proper conduct of maintenance is an essential element of an effective maintenance program. Maintenance ranges from simple, straightforward tasks to complex tasks that involve extensive coordination, training, and technical effort, with successful performance essential to safe operation. Activities included in the maintenance program should be addressed in a manner consistent with the complexity and importance to safety and security of the maintenance task to be accomplished and consistent with achieving the maintenance goals and objectives. Some maintenance activities will likely require little, if any, documentation, whereas others may require documentation consistent with Appendix B to 10 CFR 50 (e.g., procedures, quality assurance programs, records).

The remainder of this Regulatory Position 4 describes those activities that, if properly developed, coordinated, and implemented as part of a licensee's maintenance program, contribute to the effective conduct of maintenance. It is the responsibility of each licensee to determine the degree to which the following activities should be applied in the conduct of various maintenance tasks commensurate with (1) the importance of the equipment to security and protecting plant personnel and public health and safety, (2) the complexity of the task, and (3) the established maintenance program goals and objectives. This regulatory position should be used as a guide in assessing whether improvements need to be made in the maintenance program in support of the feedback and corrective action step. If the effectiveness monitoring and assessment step indicates that there are problems in the maintenance program that need correction, this section should be reviewed in determining where the licensee's maintenance program should be modified.

4.1 Plant Organization and Management for Maintenance

4.1.1 Maintenance Management and Organization

The management of maintenance includes a clearly defined maintenance organization with specific lines of authority, responsibility, and accountability. The program should include requirements for communication and interface with other organizations. The task of the maintenance organization should be the effective implementation of the maintenance program in support of established goals and objectives.

4.1.2 Communication

The effective management of maintenance requires effective written and oral communication between the maintenance department and other supporting groups such as operations, health physics, and engineering. Communications within the department and between the maintenance department and plant and corporate management are also essential to an effective program. These lines and types of communication should be defined in the maintenance program and should serve to keep personnel at all levels cognizant of the information needed in order to effectively perform their function.

4.1.3 Staffing

Criteria for selecting personnel with acceptable qualifications to perform their designated assignments are necessary for effective staffing. Resource allocation should include adequate staffing of support organizations to provide for expected contingencies, such as those occurring on weekends and holidays. Staffing should be sufficient to allow for training and qualification of personnel.

4.2 Maintenance Personnel Qualification and Training

The personnel qualification and training requirements should be specified. The Institute of Nuclear Power Operations Training Accreditation Program may be utilized to address training and qualification of both licensee and contractor personnel. The training portion of the program should require classroom and on-the-job training, as well as periodic refresher training, as warranted. The

qualification portion of the program should specify criteria for qualifying personnel to perform maintenance activities. The program should provide for its own modification as a result of feedback from root cause analyses of maintenance-related problems and industry experience.

4.3 Maintenance Support Organizations

A number of support functions are required for the effective conduct of maintenance. These functions may actually be components of the maintenance department or may function independently from the maintenance department. In either case, the groups should function to support the requirements of the maintenance program.

4.3.1 Engineering in Support of Maintenance

Engineering and technical support should have direct and continuous interface with the maintenance organization. Engineering support may be provided by corporate or site engineers or by dedicated systems engineers for each plant system. The overall maintenance program should ensure involvement of engineering support in repetitive equipment failures. The root cause of unplanned events should be investigated to determine if and how failure was caused by the lack of or improper maintenance, and to take appropriate corrective action to preclude recurrence. Regulatory requirements, design requirements, manufacturer's recommendations, specifications for operability, action levels, acceptance criteria, procurement specifications, installation and test requirements, and test equipment and procedures should be effectively incorporated into all maintenance activities. Engineering and technical support should be available to identify and evaluate potential degradation mechanisms caused by environment and service over time and to provide direction for timely mitigation of their effects.

4.3.2. Control of Vendors and Contracted Maintenance Services

The maintenance program should ensure that contracted maintenance services are controlled and overseen by plant staff. Contracted personnel should be trained and qualified for the work they are to perform. Contracted maintenance should be performed to the same standard established for the maintenance organization.

The maintenance program should require that recommendations from industry support groups and individual vendors are reviewed and considered for incorporation into appropriate areas of the maintenance program. Sufficient engineering justification should be provided when the vendor recommendations are not followed.

4.3.3 Control of Radiological Exposure

Radiological exposure control during maintenance activities should be considered in developing procedures and work orders and in planning and scheduling maintenance. Exposure goals should be set for each major work activity and work order. When goals are exceeded, an analysis should be performed to determine the reason; this information should then be fed back into the maintenance program to achieve future ALARA improvement. Training of crafts personnel should be performed on mock-ups to minimize exposure. Health physics personnel should be involved in the planning and execution of appropriate maintenance work to ensure personnel are not unnecessarily exposed and ALARA goals are met. Radioactive materials should be controlled, and radiation surveys should be conducted in support of appropriate maintenance activities.

4.3.4 Quality Assurance and Quality Control of Maintenance Activities

The Quality Assurance (QA) and Quality Control (QC) Program should be applied to maintenance activities commensurate with their safety and security significance. QA and QC activities should focus on the proper conduct of maintenance. The frequency and type of QA and QC activities should be based on program feedback and corrective actions, but should be frequent enough to ensure a level of quality consistent with the established program objectives.

4.3.5 Management of Parts, Tools, and Facilities

The management of parts, tools, and facilities should promote effective maintenance activities in a safe environment. The program should provide for a readily accessible supply of parts and tools appropriate for the expected activities. Timely acquisition of parts and tools, proper storage and maintenance

of parts and tools, and control of their issuance should be addressed in the program. Measures should be included to control the use of consumable materials such as solvents, grease, and weld rod.

4.3.6 Control of Calibration and Test Equipment

Proper control of tools, calibration, and test equipment is necessary to ensure the accurate performance of plant maintenance activities. Calibration and test equipment should be traceable to applicable national standards and clearly documented. Maintenance, storage, and frequency of calibration of test equipment should be established in order to effectively maintain the accurate performance of the test equipment.

4.4 Maintenance Procedures

Procedures should be established and utilized as necessary for the conduct of maintenance activities commensurate with the activity's importance to safety and security. The maintenance procedures should provide systematic guidance to the craftsman; should be technically correct, complete, and up-to-date; and should be presented utilizing sound human factors principles. The maintenance program should document how procedures are to be prepared, verified, validated, reviewed, approved, controlled, updated, revised, and used, as well as where they are to be located.

4.5 Planning and Scheduling

Planning and scheduling activities should be established to ensure program objectives are met and that maintenance activities are accomplished in an accurate and timely manner. Maintenance planning and scheduling includes the aggregate of those actions necessary to ensure the availability, proper timing, and sequence of parts, personnel, procedures, materials, tools, and other resources required to perform the maintenance activities. Effective planning and scheduling requires effective communication with all groups that support and interface with maintenance. They involve the development of priorities, resolution of conflicting work paths, logistic support analysis, and coordination of maintenance support groups. The

program should consider planning and scheduling of long-term capital improvements and various types of outages, both planned and unplanned. The program should provide for systematic monitoring of work request status.

4.6 Types of Maintenance

The maintenance program should include surveillance to obtain inservice performance and operational data; predictive maintenance to analyze data collected from surveillance; preventive maintenance based on manufacturer's recommendations, operating experience, good engineering practice (including aging concerns), and predictive maintenance feedback; and corrective maintenance, as necessary. The maintenance program should ensure that recommendations and information from NRC, industry, and individual vendors are reviewed and considered for incorporation into appropriate areas of the maintenance program. The exact nature and balance among these types of maintenance should be developed by each licensee consistent with meeting the established goals and objectives.

4.6.1 Preventive Maintenance

Preventive maintenance consists of all those systematically planned and scheduled actions performed for the purpose of preventing equipment failure. The preventive maintenance program should define the required activities and the frequency at which they should be performed. Selection of required preventive maintenance actions should be based on manufacturer's recommendations, plant experience, and good engineering practice. The frequency of preventive maintenance should be based on adequately implementing the entire program, considering such elements as predictive maintenance results, vendor recommendations, ALARA considerations, and monitoring of performance. A documented basis for the planned actions should be provided. Further, any deferral of planned tasks should have a technical basis.

4.6.2 Corrective Maintenance

Corrective maintenance consists of all those actions performed to restore failed or malfunctioning equipment to service. Corrective maintenance activities should ensure that the condition that caused the failure is identified, corrected,

and documented. Analysis should be performed to determine the root cause or causes of failure and corrective action should be taken, including feedback into the preventive and predictive maintenance programs and maintenance training and qualification programs. Priorities for corrective maintenance should be established based on plant objectives and the relative importance of the equipment.

4.6.3 Predictive Maintenance

Predictive maintenance consists of the actions necessary to monitor, find trends, and analyze parameter, property, and performance characteristics or signatures associated with a piece of equipment that indicate the equipment may be approaching a state in which it may no longer be capable of performing its intended function. The predictive maintenance program should be effective in reducing the failure of structures, systems, and components by using techniques that indicate the need for preventive maintenance prior to equipment failure. The data gathered should be analyzed, trends should be identified, and action levels should be defined. Action should be taken to provide feedback to the maintenance program in time to preclude equipment failure. The predictive maintenance program should provide data to the preventive maintenance program and provide and retrieve equipment history data. Root causes should be determined, if possible, and action taken and results fed back into the program.

4.6.4 Maintenance Surveillance

Maintenance surveillance consists of collecting data at a specific frequency that supports the predictive and corrective maintenance programs. The maintenance surveillance program should define the methodologies used to perform maintenance surveillance activities and the interfaces with the predictive and corrective maintenance program.

4.6.5 Updating the Maintenance Program as a Result of Plant Modifications

The maintenance program should require that all plant modifications be reviewed to determine future required maintenance activities and should specify that these activities be added to the maintenance surveillance, preventive, and predictive programs, as applicable. The design, manufacture, and installation

of plant modifications are not within the scope of the proposed 10 CFR 50.65 and are not addressed in this regulatory guide. Changes to the maintenance program to incorporate plant modifications should be commensurate with the complexity of the task, the extent of the modification, and the importance of the equipment.

4.7 Work Control Process

The work control process should be based on procedures that provide for the identification of deficiencies, planning and preparation for work, setting appropriate conditions for work, work procedures, supervisory authority, documentation of completed work, postmaintenance testing, return-to-service procedures, and review of completed work packages.

The work control process begins with the identification of deficiencies or the need for planned or predictive maintenance and the generation of a maintenance request. Planning and scheduling activities should then be performed. The work package should specify the appropriate plant conditions for the work, define the required isolation or tagouts and component deenergization, incorporate appropriate QA and QC functions, and require appropriate supervisory authorization prior to starting work. The work package should contain postmaintenance testing requirements and clearances or return-to-service procedures, provide for documentation of completed work, and provide for a review of the completed package. Postmaintenance testing should be performed after corrective and preventive maintenance activities are completed and prior to returning structures, systems, and components to operational service. Postmaintenance testing should document and verify that the equipment is capable of performing its design functions and meets specified requirements and that the performed maintenance did not affect other functions. The postmaintenance testing program should establish specific performance acceptance criteria that ensure a high level of confidence in the ability of the component to perform its design function when returned to service.

4.8 Recordkeeping

Maintenance records should be maintained to document the historic performance of structures, systems, and components. The maintenance program should establish requirements for record retention and retrieval. The program should define the equipment to be included, what data are to be collected, and how the data are to

be recorded. Equipment maintenance history and equipment performance trends based on equipment history should be maintained for equipment, consistent with the licensee's established goals and objectives. Equipment history should include data obtained from the maintenance surveillance, preventive, predictive, and corrective maintenance programs. These data should be trended and results used for improving the maintenance program as well as determining the need for equipment modification, repair, or replacement. Equipment history and trending information should be kept current.

5. MONITORING AND ASSESSMENT OF EFFECTIVENESS

Maintenance activities and their overall effectiveness should be regularly monitored and assessed. The results of this monitoring and assessment process should be the basis for making corrections and adjustments to the maintenance program in order to achieve improvement. This monitoring and assessment process should include two basic elements: (1) management oversight and assessment and (2) monitoring maintenance performance.

5.1 Management Oversight and Assessment

The most timely information on the maintenance program will come through management's involvement in its implementation. Management should conduct audits, inspections, and assessments and should ensure that feedback is used to achieve needed improvements in the elements of the program as discussed in Regulatory Position 6. The need for improvement should be based on qualitative assessments as well as the results of monitoring maintenance performance as discussed in Regulatory Position 5.2. The results of any assessments, including the need for actions, should be documented.

5.2 Monitoring Maintenance Performance

5.2.1 General

An acceptable program to monitor maintenance performance should include monitoring of goals and performance indicators. To ensure the integrity of the

perf mance indicator monitoring process, the program should include provisions to ensure that definitions of quantities used in indicators are established and consistently applied.

5.2.2 Goals

Information or parameters, indicative of the degree to which the goals for maintenance established in Regulatory Position 3 are being met, should be monitored.

The information used to monitor and assess the goals should be used along with the maintenance effectiveness indicators described in Regulatory Position 5.2.3 and the process indicators in Regulatory Position 5.2.4. This information should be used in assessing the overall effectiveness of the maintenance program and as a guide in identifying the root cause of maintenance-related problems and the need for corrective action.

5.2.3 Maintenance Effectiveness Indicators

Maintenance effectiveness indicators based on component failure data should be monitored to provide indication of the effectiveness of the overall maintenance program. One acceptable method is to establish indicators based on the number of failures experienced or discovered per unit time for one or more defined sets of components and to monitor for increases in such failure rates indicative of changes in maintenance effectiveness. An example of a maintenance performance indicator based on NPRDS data is described in an NRC staff report, AEOD/S804B, entitled "Application of the NPRDS For Maintenance Effectiveness Monitoring."* The reporting to and use of NPRDS is acceptable as a means of establishing such indicators based on component failure data. Additional components, central to meeting program goals, should also be monitored consistent with the definitions and guidance contained in NPRDS.

5.2.4 Maintenance Process Indicators

Process indicators, which provide information regarding the effectiveness of execution of the elements of the maintenance program, should be monitored to

*Available for inspection or copying for a fee in the NRC Public Document Room, 2120 L Street NW., Washington, DC.

provide insight regarding potential problem areas in the conduct of maintenance activities as well as causes of maintenance ineffectiveness. Examples are (a) postmaintenance test results, (b) periodic surveillance test results, (c) ratio of preventive to corrective maintenance, (d) maintenance work order backlog, (e) time to restore component function after failure discovery, and (f) frequency of rework.

6. FEEDBACK AND CORRECTIVE ACTIONS

Feedback and corrective actions are the mechanisms through which long-term, substantive, programmatic improvements are realized. Feedback and corrective action should be effective and timely and based on the monitoring and assessment of performance.

6.1 Feedback

Feedback from the monitoring and assessment should be used to determine the need for corrective action. The specific groups or individuals responsible for feedback of information and the specific channels of communication for feedback should be clearly established and defined in the maintenance program. In order to effectively address performance problems, feedback should be provided as soon as possible after the performance assessment has been completed.

6.2 Corrective Action

Following identification of maintenance program deficiencies, the need for corrective action should be determined and the action taken. This corrective action should be directed toward ensuring that identified program deficiencies are corrected and program goals are met. The corrective action process should determine the cause of the deficiency (administrative, procedural, training, technical, etc.) and provide for timely and documented corrective action. Regulatory Position 4 should be used as a guide to help pinpoint any causes of deficiency, as necessary.

6.3 Timeliness

Analysis of deficiencies, feedback, and corrective action should be timely. The maintenance program should describe the process for timely feedback and corrective action and should identify the group or groups responsible for implementing the process.

6.4 Management Involvement

Effective feedback and corrective action should involve the management of the departments affected and should involve corporate management for significant recurrent issues.

D. IMPLEMENTATION

The purpose of this section is to provide information to licensees and applicants regarding the NRC's plans for using this regulatory guide.

This draft guide has been released to encourage public participation in its development. Except in those cases in which an applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the method to be described in the active guide reflecting public comments will be used in the evaluation of maintenance programs.

REGULATORY ANALYSIS

A regulatory analysis has been prepared for this draft regulatory guide that examines the costs and benefits of implementing the guide. The analysis is available for inspection and copying for a fee in the NRC Public Document Room, 2120 L Street NW., Washington, DC. Free single copies may be obtained upon request to Moni Dey, U.S. Nuclear Regulatory Commission, Washington, DC 20555, telephone (301) 492-3730.

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NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555