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NUCLEAR MANAGEMENT AND RESOURCES COUNCIL

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Byron Lee, Jr.
President & Chief
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December 1, 1989

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(3)

8/17/89

Regulatory Publications Branch
Division of Freedom of Information
and Publications Services
Office of Administration
U.S. Nuclear Regulatory Commission
Washington, DC 20555

RE: Draft Regulatory Guide DG-1001,
Maintenance Programs for Nuclear Power Plants
54 Fed. Reg. 33983 (August 17, 1989)
REQUEST FOR COMMENTS

Gentlemen:

These comments are submitted on behalf of the Nuclear Management and Resources Council, Inc. (NUMARC) in response to the request of the U.S. Nuclear Regulatory Commission (NRC) for comments on the referenced NRC Draft Regulatory Guide DG-1001, "Maintenance Programs for Nuclear Power Plants," 54 Fed. Reg. 33988 (August 17, 1989).

NUMARC is the organization of the nuclear power industry that is responsible for coordinating the combined efforts of all utilities licensed by the NRC to construct or operate nuclear power plants and of other nuclear industry organizations in all matters involving generic regulatory policy issues affecting the nuclear power industry. Every utility responsible for constructing or operating a commercial nuclear power plant in the United States is a member of NUMARC. In addition, NUMARC's members include major architect-engineering firms and all of the major nuclear steam supply vendors.

The importance of proper maintenance to safe and reliable nuclear plant operations is recognized by the nuclear utility industry and the NRC and has been the subject of increased focus by both since 1982. This is reflected in the NRC's March 1988 Policy Statement on maintenance and in recent NRC deliberations concerning the need for a maintenance rule. This importance is also reflected in the efforts of the nuclear utilities, with the support of the Institute of Nuclear Power Operations (INPO), the Electric Power Research Institute (EPRI) and NUMARC, to upgrade maintenance performance, improve maintenance facilities, enhance training of maintenance personnel, increase emphasis on good maintenance work practices and use of maintenance procedures, provide better technical guidance, and track equipment performance.

The industry's efforts and the NRC focus have resulted in substantial progress in maintenance performance as reflected in the industry's set of overall performance indicators, in NRC inspections and reports, and in the material condition of the plants. The industry recognizes that progress

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needs to continue and that additional work remains to be done to fully implement maintenance programs at all nuclear plants.

In order to sustain the trend of improvement in the operation and maintenance of nuclear power plants, the industry has initiated several industry activities addressing maintenance that will result in directed and continuing progress to achieve our objective for safe, reliable and economic generation of nuclear power.

An Industry Action Plan is being developed, with input from industry organizations addressing maintenance, that addresses needed industry activities for continued improvements in maintenance. The purpose of this plan is to coordinate and focus overall industry actions to ensure continued improvement in nuclear power plant maintenance. This plan addresses needed actions by nuclear utilities, industry organizations such as EPRI, INPO, and NUMARC, NSSS Owners Groups, and Codes and Standards Developing Organizations. It also contains actions to keep the NRC Commission and Staff informed of the industry programs and their status since that understanding is an essential input to NRC regulatory activities and programs

The Industry Action Plan addresses improvements with emphasis on:

- o Self assessment and follow-up;
- o Performance monitoring techniques and indicators;
- o Long-range goal setting;
- o Training activities directly related to maintenance;
- o INPO maintenance evaluation focus;
- o Maintaining the reliability of plant equipment;
- o Root Cause Analysis training and implementation;
- o INPO Maintenance Guidelines;
- o Special focus on major equipment performance;
- o A methodology for the selection of preventive/predictive maintenance for plant equipment;
- o Owners Groups activities; and
- o Codes and Standards Developing Organizations activities.

The plan provides background discussion, overall industry actions, and specific actions identifying the expected completion date and lead organization for each issue. In many cases, the plan extends and expands successful programs that are already under development. We expect to brief the NRC Commission and Staff on this plan as soon as it is finalized.

Another activity that is now in the conceptual stage is the development of an "industry maintenance program," patterned after the Training Accreditation Program that was endorsed by the Commission in its 1985 Policy Statement. The program would define the criteria for the essential elements of nuclear power plant maintenance programs and could be endorsed by the

Commission. Additional information on this activity will be provided in the near future.

The Commission's policy statement that defines the NRC expectations relative to the maintenance of nuclear power plants combined with existing regulatory and industry programs and controls ensures continued safe operation of nuclear power plants. As the Commission has stated in its Staff Requirements Memorandum of June 26, 1989, the Commission's decision on a final rule and regulatory guide is contingent upon continued progress of industry maintenance programs, the results of on-going special NRC maintenance team inspections, and, to the extent possible, the results of the Maintenance Indicator Demonstration Project currently being jointly evaluated by the NRC and industry.

Recognizing that the issuance and content of a proposed rule is still uncertain, our comments relative to the draft Regulatory Guide will require further iteration. Having reviewed the draft Regulatory Guide in detail, we believe that the NRC's objectives of addressing maintenance through rulemaking and the associated draft Regulatory Guide can be met by other means. Once the details of these industry activities briefly described above are reviewed with the Commission and the Staff, we believe the NRC will agree.

The following general comments and those contained in the enclosures to this letter are provided to further explain the industry's position on these important issues. In summary:

- Although the expectations of the NRC, as defined by the Policy Statement, are appropriate and consistent with the objectives of the industry, some elements addressed by the draft Regulatory Guide, although important to a maintenance program, do not appear to affect safety and reliability. For example, addressing goals and objectives should be retained in the Policy Statement as a licensee management tool to improve maintenance, but should not be in the final Regulatory Guide.

- The draft Regulatory Guide content appears to be written at an appropriate level of detail, allowing the flexibility for each utility to have its own procedures that define its maintenance program. However, some content and scope improvements can be achieved by adding examples or additional information that describe methods that satisfy the intent. The purpose of the expansion would be to minimize, to the extent possible, confusion derived from varying interpretations. For example, the extensive use of subjective terms such as "effective" throughout the draft Regulatory Guide have the potential to produce significant interpretational, and therefore compliance problems. It is suggested that the terms to be used be defined where necessary, eliminated when possible, or qualified by the words such as "...as determined by utility management assessment." It is suggested that

the NRC consider utilizing a previous regulatory guide technique of posing and answering questions in the regulatory guide in areas that are expected to cause interpretational difficulty.

- The assumption in the Regulatory Analysis of capacity improvement that will result from the rule and regulatory guide over and above the on-going industry initiatives is highly speculative. Our review of the cost basis concludes that the implementation costs associated with maintenance basis documentation has not been included in the Regulatory Analysis. Additionally, the Regulatory Analysis clearly states that the estimated uncertainties are large, and qualitative considerations outweigh the quantitative evaluations of value impact. In our view, the benefits of improved maintenance will be achieved by on-going utility efforts. This has been demonstrated by the documented improvements shown by overall performance indicators and the utility program implementation determined by INPO evaluations and NRC inspections. Therefore, the marginal benefits of the draft Regulatory Guide are not supportable. The differences between the Regulatory Analysis and the industry estimates are explained in Enclosure 2 of this letter.

- Security should not be addressed in the draft Regulatory Guide. The maintenance of fixed site physical protection systems, subsystems and components is adequately addressed in 10 CFR 73.46(g), "Tests and Maintenance Programs."

Additional comments are provided in the enclosures to this letter, including responses to the five questions posed in the letter attached to the draft Regulatory Guide.

We appreciate the opportunity to comment on the draft Regulatory Guide and stand ready to further discuss our comments, as well as alternative approaches, with appropriate NRC personnel. We also plan to schedule meetings with the Commission and the Staff to discuss in detail the industry activities described above.

Sincerely,

Byron Lee Jr.

Byron Lee, Jr.

BL/WJS:plg

Enclosures

INDEX OF ENCLOSURES

*Note 1 — Comments have been capitalized, indented and displayed in **BOLD TYPE**

Note 2 — Areas in the text that are referred to in the comments are indicated in BOLD TYPE and are <u>underlined</u>.

Note 3 — The word effective is underlined and printed in **BOLD TYPE** in the text of Enclosure 3 to emphasize the number of times and variety of contexts in which the undefined term is used.

ENCLOSURE 1

RESPONSES TO DRAFT REGULATORY GUIDE (DG-1001) QUESTIONS

RESPONSES TO

DRAFT REGULATORY GUIDE (DG-1001)

QUESTIONS

Questions 1:

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

Response:

The draft Regulatory Guide content appears to be written at an appropriate level of detail. It appears to allow the flexibility for each utility to have procedures that define its individual maintenance program. However, some content and scope improvements can be achieved.

The draft Regulatory Guide, as written, can be improved by the interaction of the NRC and industry to develop each section by adding examples or additional information that describe methods that satisfy the intent. The purpose of the expansion would be to minimize, to the extent possible, confusion derived from varying interpretations and thereby the ability to determine compliance. It is suggested that the NRC implement a previous regulatory guide technique of posing and answering questions in the regulatory guide that are expected to be areas of interpretational difficulty.

Some elements addressed by the draft Regulatory Guide, although important to a maintenance program, have not been shown to affect safety and reliability. The expectations of the NRC, as defined by the Commission's Policy Statement, are appropriate and consistent with the objectives of the industry. Paragraphs that are recommended for retention in the Policy Statement and deleted from the draft Regulatory Guide have been identified in the detailed comments.

The extensive use of subjective terms such as "effective" throughout the draft Regulatory Guide have the potential to produce significant interpretational problems. The terms to be used should be defined where necessary; eliminated when possible; or qualified by words such as "...as determined by utility management assessment."

Question 2:

Is the scope of systems, structures, and components covered by the Regulatory Guide appropriate?

Response:

No. If the proposed rule were promulgated reflecting the scope as defined in the current Policy Statement, the scope of including all systems, structures and components is too broad. The industry is developing a methodology for the selection of systems, structures, and components to be included in a maintenance program.

This methodology will allow the specific equipment addressed by the draft Regulatory Guide to be determined by each utility and included in the utility's prescribed maintenance program as a result of an appropriate technical assessment. As reflected in the discussion section of the draft Regulatory Guide, it also supports the flexibility that the NRC agrees is desirable. The benefit of this approach is that the program is specific for each plant and can be revised as experience dictates. Additionally, it is anticipated that interpretational differences between the NRC and a utility as to the equipment to be included in the program will be minimized.

It is not intended to indicate that all the equipment in the program has a prescribed maintenance approach (preventive, predictive, or corrective) or other equipment that is not in the program should not be maintained. Utilities generally apply preventive/predictive, and corrective maintenance methodologies to plant equipment to the degree determined appropriate for the functional importance of the equipment. The intent is to converge regulatory and industry emphasis on a known set of the most important equipment in all parts of the plant.

Question 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?

Response:

Multiple measures are needed to determine the effectiveness of maintenance performance. The regulatory processes and industry programs and controls, in the aggregate, when appropriately implemented, monitored, and adjusted on an on-going basis will ensure safety. Long term experience with the NRC and INPO evaluation processes indicates areas of needed improvement are identified and resolved. Similarly, overall performance indicators presently in use by the NRC and industry facilitate short term and long term identification of adverse trends.

Within any maintenance program, there are broad spectrums of information that can determine the ranges of program effectiveness,

from broad overall policies to very detailed information pertaining to a single component. Numerous factors such as procedures, training, and supervision need to be considered in an integrated manner when judging overall maintenance program adequacy. For this reason, the criteria to be used in judging maintenance effectiveness needs to include plant specific factors as well as direct observation of the maintenance process.

Question 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?

Response:

No. It is not appropriate from a regulatory perspective. It is appropriate to use goals as a management tool to achieve improvement. Maintenance activities should be performed to ensure that the plant operates in a safe and reliable manner. Focusing on quantitative goals to meet a regulatory requirement may lead to incorrect decisions or misplaced focus on meeting the goal rather than assuring safe plant operation. Goals, whether qualitative or quantitative, should be based on striving for excellence in achieving safe and reliable plant operations.

A plant should compare equipment failures with the experience of similar components or systems at its own plant or at similar plants. Similarly, it is appropriate to compare overall performance of an individual plant with plants of similar design to identify differences that can focus attention to areas for potential improvement. However, specific equipment performance is dependent on the inherent reliability of the design, configuration variations, personnel performance, environmental and operating conditions of the plant in addition to the maintenance program established; and, as such, the performance is not directly comparable from station to station.

Establishing goals to improve or correct specific equipment performance may be appropriate depending on the significance of the performance problem; however the decision must be a specific determination of the utility.

Question 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?

Response:

As described in the response to Question 4, quantitative goals are not appropriate.

Overall performance indicators established by the industry at the plant level are included in the INPO performance indicator program. Each utility, as part of its management program, establishes goals considering current performance against the overall indicators as well as other areas specific to the utility that will benefit from a goal setting program. All utilities monitor performance, not only against established goals and objectives but also for areas that are determined by experience to be important to overall operation, including maintenance, of the individual station. The areas monitored are similar from station to station but are not identical.

Goal setting should include quantitative and/or qualitative measures that are consistent with the improvement needed and could include structures, systems, components and any other maintenance related activity of a programmatic nature that the individual utility determines appropriate to the achievement of long and short term objectives. As discussed in the draft Industry Action Plan, goals can be established that will serve as a continuing stimulus in striving to achieve and sustain improved plant (and maintenance) performance.

In summary, it is appropriate to use goals as a management tool, but it is inappropriate as part of the regulatory process.

ENCLOSURE 2

COMMENTS ON REGULATORY ANALYSIS

IN SUPPORT OF DRAFT REGULATORY GUIDE DG-1001

"MAINTENANCE PROGRAMS FOR NUCLEAR POWER PLANTS"

AUGUST 1989

Comments on Regulatory Analysis

in Support of Draft Regulatory Guide DG-1001

"Maintenance Programs for Nuclear Power Plants," August 1989

The implementation of the draft Regulatory Guide is not justified on the basis of value-impact or cost/benefit.

Since the draft Regulatory Guide is much different in focus from the November 1988 draft Rule, the EPRI/NUMARC comments on the Regulatory Analysis and this new NRC Regulatory Analysis are not comparable line by line. Therefore, the following comments address only the two aspects of the respective analysis that lead to different conclusions: capacity factor improvement and maintenance-basis documentation costs.

The draft Regulatory Guide can be interpreted as much less strict with respect to balance of plant requirements and maintenance-basis documentation than was the draft Rule. Therefore, the Regulatory Analysis estimates of net direct utility costs are reasonable, except for the establishment of maintenance-basis documentation. The draft Regulatory Guide requires a documented basis for all required activities and the frequency at which these activities should be performed. The Regulatory Analysis includes no costs for this documentation. The previous NUMARC comments estimated a cost of $3,143 Million(M) for this documentation for literal compliance for the entire plant. Based on a reasonable interpretation of the new approach contained in the draft Regulatory Guide, the cost estimate for this analysis and documentation is $375M.

The Regulatory Analysis concludes that there will be large cost savings from capacity factor improvement for all plants -- those with satisfactory maintenance performance and those in need of improvement. The cost savings attributed to the draft Regulatory Guide for these categories of plants are $620M and $730M respectively. Based on arguments similar to those in the original EPRI/NUMARC comments, the range of cost savings estimates are between $0 and $183M.

The Regulatory Analysis reduces all costs by a factor of two to account for utility initiatives underway. This assumption is reasonable and has been adopted for the revised estimates presented here.

The table below compares the values from the Regulatory Analysis with a reevaluation of the EPRI/NUMARC comments of February 1989 in light of changes in the draft Regulatory Guide and acceptance of many of the assumptions in the new Regulatory Analysis. All costs and benefits not discussed explicitly above are included under the categories of "Other Costs" and "Total Benefits", as the differences between the two analyses are not significant.

Based on the reevaluation of the EPRI/NUMARC cost and benefit estimates, the draft Regulatory Guide is not justified by calculating the benefit to cost ratio. Based on the Regulatory Analysis with capacity factor improvement

considered as a negative cost (i.e., a benefit), the draft Regulatory Guide could be justified no matter how small the public health benefit. Such a method of calculation is obviously flawed. Based on the Regulatory Analysis with capacity factor improvement considered as a benefit, the draft Regulatory Guide can be justified only if a large capacity factor improvement is realized. The analysts acknowledge that there is great uncertainty in these estimates of capacity factor improvement. Based on the Regulatory Analysis with capacity factor excluded, the draft Regulatory Guide is not justified on the basis of benefit to cost ratio. The latter method of calculation assumes that only public benefits are appropriate for consideration.

The Regulatory Analysis clearly states that the uncertainties are large, and qualitative considerations outweigh the quantitative evaluations of value-impact. This statement is reasonable. On that basis, the benefits of improved maintenance will be achieved by ongoing utility efforts that are demonstrated by the documented improvements in utility programs and implementation, so that the marginal benefits of the draft Regulatory Guide are not justifiable.

Table

Benefits and Costs of Proposed Regulatory Guide

(A negative value indicates a benefit)

	Regulatory Analysis	EPRI/NUMARC Reevaluation
Capacity factor improvement for all plants	$-1350M	$ -183M
Maintenance-basis documentation	$ 0M	$ 375M
Other costs	$ 657M	$ 475M

The original regulatory and EPRI/NUMARC estimates when adjusted for the above line item differences results in an NRC estimated overall cost benefit of 50 million dollars and EPRI/NUMARC estimated overall cost benefit of 30 million dollars.

ENCLOSURE 3

DETAIL INDUSTRY COMMENTS

ON THE

DRAFT REGULATORY GUIDE

MAINTENANCE PROGRAMS FOR NUCLEAR POWER PLANTS

NOTE: The text of the draft Regulatory Guide is in lower case print; comments and, where appropriate, suggested changes on each section are indicated in **BOLD TYPE** and the text is indented.

Paragraphs that are recommended for retention in the Policy Statement and deletion from the draft Regulatory Guide have been identified with an underlined asterisk (*) beside the appropriate section.

REGULATORY GUIDE INDEX

(ADDED FOR REFERENCE)

REGULATORY GUIDE INDEX

(ADDED FOR REFERENCE) cont'd.

DRAFT REGULATORY GUIDE

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.

UTILITY MAINTENANCE PROGRAMS INCLUDE ALL PLANT EQUIPMENT (SAFETY AND NON SAFETY EQUIPMENT). THE APPLICATION AND EXTENT OF SPECIFIC PREVENTIVE, PREDICTIVE OR CORRECTIVE MAINTENANCE IS DETERMINED AS A RESULT OF REGULATORY AND DESIGN REQUIREMENTS IMPOSED AS WELL AS INDIVIDUAL UTILITY CONSIDERATIONS OF SAFETY RELIABILITY, ALARA PRINCIPLES AND COST. CORRECTION OF DEGRADING, DEGRADED, OR FAILED EQUIPMENT IS ACHIEVED ON A BASIS THAT IS CONSISTENT WITH RESTORING THE DESIGN BASIS FUNCTIONS OR PROVIDING REQUIRED ADMINISTRATIVE CONTROL OR EQUIVALENCY ON A SCHEDULE DETERMINED APPROPRIATE BY THE UTILITY. DUE TO PLANT UNIQUE CONSIDERATIONS, THE USE OF THE WORDS "...PROMPTLY RESTORE" AND THE WORDS "...APPLIES TO ALL PARTS OF THE PLANT" NEED TO BE AS DEFINED BY THE SPECIFIC UTILITY IN THE UTILITY'S MAINTENANCE PROGRAM. THE PHRASES LEFT AS STATED WOULD ALLOW BROAD INTERPRETATION THAT COULD BE MORE RESTRICTIVE THAN TECHNICAL SPECIFICATIONS; COULD RESULT IN UNNECESSARY CONFLICT AND SIGNIFICANT COST WITHOUT COMPARABLE BENEFIT; AND, WOULD NOT BE CONSISTENT WITH THE COMMISSION'S INTENT TO ALLOW "CONSIDERABLE FLEXIBILITY" AS STATED IN THE PARAGRAPH THAT FOLLOWS.

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.

PREVENTIVE/PREDICTIVE AND CORRECTIVE (REPAIR OR REPLACE) MAINTENANCE ARE ALL APPROPRIATE TYPES OF MAINTENANCE DEPENDING ON THE EQUIPMENT DESIGN, FUNCTION AND THE COST OF INSTALLATION, MAINTENANCE AND REPLACEMENT AS WELL AS APPROPRIATE RADIOLOGICAL CONSIDERATIONS. IT IS GENERALLY AGREED THAT NOT ALL POWER PLANT EQUIPMENT HAS BEEN ORIGINALLY SELECTED TO FACILITATE PREVENTIVE/PREDICTIVE MAINTENANCE. THE LAST SENTENCE SHOULD BE IMPROVED BY WORDING SUCH AS:

APPROPRIATE MAINTENANCE METHODS SHOULD BE SELECTED TO ENSURE THE AVAILABILITY OF EQUIPMENT FUNCTION THAT IS CONSISTENT WITH THE IMPORTANCE OF THE FUNCTION AND THE AVAILABILITY OF ALTERNATIVE FUNCTIONS AND CONTROLS AS DETERMINED BY THE LICENSEE TO MAINTAIN SAFE PLANT OPERATIONS AS WELL AS MEET ITS OPERATING LICENSE REQUIREMENTS.

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.

A PLANT CONTAINS BETWEEN 30,000 AND 150,000 COMPONENTS DEPENDING ON THE DESIGN OF THE PLANT AND THE DEFINITION OF A COMPONENT. PREDICTIVE, PREVENTIVE AND CORRECTIVE MAINTENANCE IS PERFORMED AT THE SYSTEM LEVEL (ISOLATION BOUNDARIES), AT THE COMPONENT LEVEL, OR AT THE PIECE PART LEVEL. FROM A PRACTICAL STANDPOINT, THE INDIVIDUAL UTILITY MUST HAVE THE FLEXIBILITY TO ESTABLISH THE SYSTEMS, STRUCTURES AND COMPONENTS AND THE MAINTENANCE METHOD AS THE UTILITY DETERMINES NECESSARY. INTERPRETATION DIFFERENCES COULD BE PRECLUDED BY DELETING THE WORD "COVERED" AND ADDING THE WORDS "AS DETERMINED BY THE UTILITY" TO THE END OF THE SENTENCE.

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.

SECURITY SHOULD NOT BE ADDRESSED IN THE DRAFT REGULATORY GUIDE. THE MAINTENANCE OF FIXED SITE PHYSICAL PROTECTION SYSTEMS, SUBSYSTEMS AND COMPONENTS IS ADEQUATELY ADDRESSED IN 10 CFR 73.46(G).

REGULATORY POSITION 1 OF THIS DRAFT REGULATORY GUIDE ALSO STATES THAT THE FORMAL "MAINTENANCE PROGRAM" SHOULD COVER, AS A MINIMUM, STRUCTURES, SYSTEMS, AND COMPONENTS (AND THEIR SUPPORTING SYSTEMS) WHICH ARE INCLUDED IN THE PLANT'S CURRENT LICENSING BASIS AS DESCRIBED IN THE FINAL SAFETY ANALYSIS REPORT (FSAR). THIS BASIS SHOULD BE RE-EXAMINED. FOR EXAMPLE, ONE UTILITY'S FSAR CONTAINS DESCRIPTIONS OF MANY SYSTEMS THAT HAVE LITTLE, IF ANY, RELATIONSHIP TO REACTOR OR RADIOLOGICAL SAFETY. EXAMPLES OF THESE SYSTEMS INCLUDE THE DOMESTIC WATER SYSTEM, THE TURBINE BUILDING HEATING SYSTEM AND THE CARBON DIOXIDE SYSTEM USED TO PURGE THE MAIN GENERATOR. IN GENERAL, THE AREAS TO BE INCLUDED IN THE MAINTENANCE PROGRAM REQUIRE FURTHER EVALUATION, PARTICULARLY IN REFERENCE TO THE FSAR.

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.

WE AGREE WITH THE PRINCIPLES PROVIDED IN THIS PARAGRAPH; HOWEVER, IT SHOULD BE INCLUDED IN THE POLICY STATEMENT AND OMITTED FROM THIS DOCUMENT. AS A BROADLY STATED PHILOSOPHY, MEASUREMENT IS NOT ACHIEVABLE. THE OBJECTIVES STATED ABOVE AND THE ELEMENTS OF AN EFFECTIVE MAINTENANCE PROGRAM THAT FOLLOW ARE CONSISTENT WITH THE INPO GUIDELINES ESTABLISHED BY THE INDUSTRY AS A METHODOLOGY TO ACHIEVE EXCELLENCE.

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.

(SEE RESPONSE TO QUESTIONS 1 AND 4). IF THE INTENT IS TO ESTABLISH QUANTITATIVE GOALS AT THE COMPONENT LEVEL, A DATA BASE OR CRITERIA DOES NOT EXIST THAT WOULD ALLOW A UTILITY TO SET QUANTITATIVE GOALS FOR ALL COMPONENTS. THE INFORMATION AVAILABLE IN THE NPRDS SYSTEM FOR SOME COMPONENTS ALLOWS THE COMPARISON OF FAILURE RATES BUT DOES NOT PROVIDE ANY INDICATION OF THE INHERENT DESIGN RELIABILITY OF A COMPONENT. ALTHOUGH THEORETICALLY ACHIEVABLE, ESTABLISHING GOALS AND OBJECTIVES ON ALL, MOST, OR MANY COMPONENTS IS NOT ACHIEVABLE WITHOUT AN EXTENSIVE DILUTION OF ENGINEERING RESOURCES FOR AN UNCERTAIN GAIN. IN CASES WHERE A SPECIFIC PROBLEM NEEDS TO BE ADDRESSED A ROOT CAUSE ANALYSIS AND LONG TERM CORRECTIVE ACTION IS MORE APPROPRIATE. GOAL SETTING, WHEN DETERMINED APPROPRIATE BY THE INDIVIDUAL UTILITY IS NOT PRECLUDED.

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 post maintenance 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.

SUGGEST ENDING THE FIRST SENTENCE AFTER THE WORD "...IMPLEMENTATION." FOR THE REASONS IDENTIFIED IN THE COMMENTS RELATIVE TO REGULATORY POSITION 1.1 ABOVE.

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.

SUGGEST ENDING THE FIRST SENTENCE AFTER THE WORD "...PLANT." (BASED ON THE SAME COMMENTS PROVIDED UNDER REGULATORY POSITION 1.1.

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.

SUGGEST DELETING THE PORTION OF THE SENTENCE FROM THE WORDS "...THE EFFECTIVENESS THROUGH THE WORDS "...IF THE OTHER. REASON: THE WORDS ARE UNNECESSARY.

*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.

SUGGEST DELETING THE WORD EFFECTIVE AND ADD THE WORDS "OR PROCEDURES" AFTER THE WORD "STANDARDS" IN THE LAST SENTENCE.

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.

INSERT "APPROPRIATELY" BETWEEN "BE" AND "COMMUNICATED", AND INSERT "(E.G., VERBALLY OR IN WRITING)" AFTER "COMMUNICATED."

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 information systems 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, shut-down, 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.

THE GOALS DESCRIBED ABOVE FOR STRUCTURE, SYSTEM, AND COMPONENT PERFORMANCE APPEAR TO BE DIRECTED TOWARD EQUIPMENT RELIABILITY. IT IS NOT CLEAR WHERE UTILITIES WOULD OBTAIN PERFORMANCE PARAMETERS FOR STRUCTURES, SYSTEMS, OR COMPONENTS OF "TOP-PERFORMING U.S. PLANTS OF SIMILAR DESIGN." IT IS GENERALLY AGREED THAT THE FACTORS OF DESIGN, REDUNDANCY, USAGE, LOCALE, ENVIRONMENT, ET. AL. ARE SUFFICIENTLY DIFFERENT TO SUGGEST THAT THIS APPROACH COULD NOT BE IMPLEMENTED. TO EMULATE A TOP PERFORMER IT WOULD BE NECESSARY TO SUBSTANTIALLY DUPLICATE ALL OF THE CHARACTER-ISTICS THAT CONTRIBUTE TO THE PERFORMANCE, CHARACTERISTICS THAT ARE DIVERSE & CONSTANTLY CHANGING.

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.

IT IS NOT APPROPRIATE FROM A REGULATORY PERSPECTIVE TO ESTABLISH GOALS, EITHER QUANTITATIVE OR QUALITATIVE. iT IS APPROPRIATE TO USE GOALS AS A MANAGEMENT TOOL TO ACHIEVE IMPROVEMENT.

IN MANY CASES THROUGHOUT THE REGULATORY GUIDE, THE REQUIREMENTS ARE DIRECTED AT PERFORMING CERTAIN ACTIONS TO ENSURE GOALS AND OBJECTIVES ARE MET. INSTEAD, MAINTENANCE ACTIONS SHOULD BE PERFORMED TO ENSURE THE PLANT OPERATES IN A SAFE RELIABLE MANNER. FOCUSING ON THE GOALS/OBJECTIVES MAY LEAD TO INCORRECT/INADEQUATE DECISIONS IN ORDER TO SATISFY A GOAL/OBJECTIVE. GOALS SHOULD BE ESTABLISHED BASED ON EXCELLENCE IN ACHIEVING SAFE AND RELIABLE PLANT OPERATIONS RATHER THAN ON ANOTHER PLANTS PERFORMANCE.

SECTION 3.2 STATES, "EXTENSIVE GOALS AT THE COMPONENT LEVEL ARE NOT EXPECTED." HOWEVER, THIS STATEMENT APPEARS TO CONFLICT WITH A LATER SENTENCE IN THE SAME PARAGRAPH THAT STATES, "DIFFERENT GOALS FOR DIFFERENT STRUCTURES, SYSTEMS, AND COMPONENTS ARE ACCEPTABLE COMMENSURATE WITH SAFETY AND SECURITY SIGNIFICANCE."

THE SECOND SENTENCE OF THE LAST PARAGRAPH IN SECTION 3.2 CONTAINS THE FOLLOWING SENTENCE, "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." THE IDENTIFICATION AND MONITORING OF SAFETY SYSTEM COMPONENTS ARE APPROPRIATELY CONTROLLED BY APPLICATION OF TECHNICAL SPECIFICATIONS, CODES AND STANDARDS PRA's AND THE RESULTS FROM THE INDIVIDUAL PLANT EXAMINATIONS BEING PERFORMED. USING GOALS AND OBJECTIVES FOR THIS PURPOSE DOES NOT ENSURE CONTROL AND IS INAPPROPRIATE.

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).

INSERT "THE INPO GUIDELINES ADEQUATELY DESCRIBE A MANNER IN WHICH AN EFFECTIVE MAINTENANCE PROGRAM CAN BE DEFINED AND CONDUCTED." AFTER THE ABOVE PARAGRAPH. DELETE EVERYTHING ELSE FOLLOWING THE ABOVE INSERT.

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

AS THE NRC INDICATES BELOW, THE COMMISSION HAS PREVIOUSLY ENDORSED THE INDUSTRY TRAINING ACCREDITATION APPROACH AS IMPLEMENTED THROUGH THE INPO/INDUSTRY NATIONAL ACADEMY PROGRAM. TO MAINTAIN CONTINUITY, THIS SUBJECT CAN BE APPROPRIATELY COVERED IN THE MAINTENANCE POLICY STATEMENT BY REFERENCE TO THE POLICY STATEMENT ON ACCREDITATION. THE FOLLOWING SECTIONS SHOULD BE OMITTED FROM THIS DOCUMENT TO AVOID CONFLICTING REQUIREMENTS.

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.

DELETE THE WORD "...REQUIRE" AND SUBSTITUTE THE WORDS "...INCLUDE ELEMENTS SUCH AS..."

TRAINING AND QUALIFICATION OF CONTRACT PERSONNEL SHOULD BE BASED ON THE WORK TO BE PERFORMED AND NOT NECESSARILY REQUIRE MEETING

ALL THE STATION TRAINING CRITERIA FOR UNSUPERVISED STATION PERSONNEL.

THIS PARAGRAPH STATES THAT CONTRACT PERSONNEL SHOULD BE "TRAINED AND QUALIFIED", BUT DOES NOT ALLOW FOR THE ACCEPTABLE OPTION OF BEING PROPERLY SUPERVISED.

4.3 Maintenance Support Organization

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.

THE WORD ENGINEERING IN THE TITLE AND IN THE FIRST SENTENCE OF THIS SECTION SHOULD BE FOLLOWED BY THE WORDS "AND OTHER TECHNICAL PERSONNEL..." TO AVOID INTERPRETATION PROBLEMS ASSOCIATED WITH THE QUALIFICATIONS NECESSARY TO PROVIDE TECHNICAL GUIDANCE.

THE WORD SIGNIFICANT SHOULD BE INSERTED IN FRONT OF THE WORD "...UNPLANNED" TO AVOID BROAD APPLICATION OF THE REQUIREMENT TO ALL UNPLANNED EVENTS.

IT SHOULD BE UNDERSTOOD THAT A TECHNICAL ASSESSMENT COULD CONCLUDE THAT A RECURRENCE IS ACCEPTABLE. THE WORDS "... AS APPROPRIATE" SHOULD BE ADDED AFTER THE WORD "...RECURRENCE."

THE WORD "...TIMELY SHOULD BE EXPANDED TO ALLOW DECISIONS FOR LONG TERM IMPLEMENTATION WHEN APPROPRIATE.

THE WORDS EFFECTIVELY INCORPORATED SHOULD BE CHANGED TO CONSIDERED BECAUSE NOT ALL VENDOR RECOMMENDATIONS ARE APPROPRIATE FOR INCORPORATION.

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.

CHANGE THE WORD "...PLANT" TO THE WORD "...UTILITY."

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.

THE TEXT UNDERLINED ABOVE SHOULD BE REPLACED WITH THE WORDS "...DEFINED IN THE ALARA PROGRAM AND REFERENCED IN MAINTENANCE PROCEDURES AS DETERMINED APPROPRIATE BY THE UTILITY TO MEET THE ALARA PRINCIPLES." TO ENSURE CONSISTENT APPLICATION OF THE RADIOLOGICAL PROGRAM AND AVOID CONFLICTING REQUIREMENTS IN SEPARATE GUIDANCE.

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.

QA/QC REQUIREMENTS SHOULD BE APPLIED TO PLANT STRUCTURES, SYSTEMS AND COMPONENTS IN ACCORDANCE WITH THE QUALITY ASSURANCE SITE PLAN THAT IS REQUIRED BY 10 CFR 50 APPENDIX B AND INCLUDES THE REQUIREMENTS FOR NRC APPROVAL AND MONITORING. INCLUSION IN THIS DOCUMENT OF SEPARATELY STATED CRITERIA CREATES THE POTENTIAL FOR CONFLICTING INTERPRETATION.

IF THIS SECTION IS RETAINED IT SHOULD BE MODIFIED TO REFLECT THE FOLLOWING COMMENT. AFTER THE WORD "...SIGNIFICANCE." ADD THE WORDS ...IN ACCORDANCE WITH THE APPROVED QA PLAN PER 10 CFR 50 APPENDIX B REQUIREMENTS AND DELETE THE NEXT SENTENCE.

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.

DELETE THE WORDS "PROPER... AND ...EFFECTIVELY." A STANDARD OF MEASURE DOES NOT EXIST AND THE SUBJECTIVITY IMPLIED INCREASES THE POTENTIAL FOR INTERPRETATION PROBLEMS. IF RETAINED, DEFINE WHAT IS REQUIRED TO MEET THE INTENT OF THE REQUIREMENT.

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**.

THE WORDS "...SHOULD PROVIDE SYSTEMATIC GUIDANCE TO THE CRAFTSMAN SHOULD BE DELETED AS THE INTENT IS COVERED BY THE REST OF THE SENTENCE OR ADDITIONAL DETAIL SHOULD BE PROVIDED TO EXPLAIN "...SYSTEMATIC GUIDANCE."

OMIT THE WORD "...SOUND..." BECAUSE IT IS SUBJECTIVE AND A STANDARD FOR MEASUREMENT DOES NOT EXIST AS STATED OR DEFINE WHAT HUMAN FACTORS PRINCIPLES ARE APPLICABLE.

OMIT THE WORDS "...AS WELL AS WHERE THEY ARE LOCATED." EVEN IF THE INTENT IS THAT THE RECORDS BE LOCATED TO FACILITATE AND ENCOURAGE USE, THE REQUIREMENT IS UNNECESSARILY PRESCRIPTIVE.

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.

THE ABOVE TEXT ADDRESSES HOW A PROGRAM SHOULD BE CONSTRUCTED WITHOUT ESTABLISHING WHAT RESULTS ARE EXPECTED. THE USE OF THE SUBJECTIVE TERMS "... ACCURATE AND TIMELY MANNER, EFFECTIVE AND SYSTEMATIC..." SHOULD BE OMITTED TO AVOID THE PROBLEMS OF INTERPRETATION THAT WILL BE ENCOUNTERED. IF RETAINED THE ACTIONS OR ACTIVITIES THAT SATISFY THE REQUIREMENT SHOULD BE DEFINED.

4.6 Types of Maintenance

The maintenance program should include surveillance to obtain in-service 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.

THE SECOND SENTENCE IS REDUNDANT TO THE FIRST SENTENCE. RECOMMEND CHANGING THE LAST SENTENCE TO READ AS FOLLOWS:

THE LICENSEE SHOULD DEVELOP A MAINTENANCE PROGRAM THAT INCLUDES THE OPTIONS OF PREVENTIVE (PREDICTIVE) AND CORRECTIVE MAINTENANCE FOR APPROPRIATE APPLICATION TO SELECTED EQUIPMENT. THE BENEFIT FROM MAINTAINING A BALANCE OF PREVENTIVE AND CORRECTIVE MAINTENANCE TECHNIQUES IS UNCERTAIN. THE DETERMINATION OF APPROPRIATE MAINTENANCE SHOULD INCLUDE THE OPTIONS FOR EQUIPMENT REPAIR OR REPLACEMENT UPON FAILURE AND AT A TIME DETERMINED BY THE LICENSEE.

4.6.1 Preventive Maintenance

Preventive maintenance consists of all those systematically planned and scheduled actions performed for the purpose of preventing equipment failure.

SUGGEST DELETING THE WORD SYSTEMATICALLY OR DEFINE WHAT ACTIVITIES OR ACTIONS MEET THE INTENT OF THE WORD. CHANGE THE WORD "PREVENTING" TO "MINIMIZING THE POTENTIAL FOR."

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.

THE NEXT TO LAST SENTENCE, IF LEFT AS STATED, COULD HAVE A MAJOR IMPACT ON DILUTION OF ENGINEERING RESOURCES AND RESULT IN THE PRODUCTION OF SUBSTANTIAL PAPER. MAINTENANCE PROGRAMS AND SELECTED PREVENTIVE OR CORRECTIVE METHODS APPLIED TO PLANT EQUIPMENT ARE THE SUM OF DESIGN REQUIREMENTS, EXPERIENCE AND EVALUATION OF VENDOR RECOMMENDATIONS THAT HAVE NOT NECESSARILY BEEN DOCUMENTED. RECOMMEND THAT CHANGES TO A DEFINED MAINTENANCE APPROACH BE DOCUMENTED AND THAT THE BASE PROGRAM BE GRANDFATHERED UNLESS AND UNTIL A DEFICIENCY IS IDENTIFIED.

THE LAST SENTENCE SHOULD BE MODIFIED TO READ: THE SCHEDULING OR DEFERRAL OF PREVENTIVE OR CORRECTIVE MAINTENANCE SHOULD CONSIDER THE IMPORTANCE OF THE DEGRADED FUNCTION AND APPROPRIATE ALTERNATIVES.

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.

THE WORDING OF THE THIRD SENTENCE COULD IMPLY AN IN-DEPTH ANALYSIS OF EVERY FAILURE. THE FOCUS OF THIS SECTION SHOULD BE THAT THE CAUSE OF DEGRADED IMPORTANT EQUIPMENT BE DETERMINED AND APPROPRIATE ACTION TAKEN TO ELIMINATE ADVERSE CONSEQUENCES. EXAMPLES OF DEGRADED CONDITIONS, APPROPRIATE ASSESSMENT, AND CORRECTIVE ACTION COULD MINIMIZE THE POTENTIAL FOR INTERPRETATION DIFFERENCES.

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.

CHANGE THE WORD "PRECLUDE" TO "MINIMIZED THE POTENTIAL FOR."

PREDICTIVE MAINTENANCE SHOULD BE CONSIDERED AS A TYPE OF PREVENTIVE MAINTENANCE AND INCLUDED UNDER THE PM PROGRAM.

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.

THE TERM MAINTENANCE SURVEILLANCE IS NOT CLEAR. THE REGULATORY GUIDE ADDRESSES HISTORY/TRENDING AND PREDICTIVE MAINTENANCE DATA COLLECTION, BUT WHAT ARE MAINTENANCE SURVEILLANCES: IT DOES NOT APPEAR THAT THE REGULATORY GUIDE IS ADDRESSING TECHNICAL SPECIFICATION SURVEILLANCES.

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, post-maintenance 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 de-energization, incorporate appropriate QA and QC functions, and require appropriate supervisory authorization prior to starting work. The work package should contain post-maintenance testing requirements and clearances or return-to-service procedures, provide for documentation of completed work, and provide for a review of the completed package. Post maintenance testing should be performed after corrective and preventive maintenance activities are completed and prior to returning structures, systems, and components to operational service. Post-maintenance 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 post-maintenance 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.

THIS SECTION (4.7) "WORK CONTROL PROCESS" IS REDUNDANT TO SECTION 4.5, "PLANNING AND SCHEDULING." IN THE SECOND PARAGRAPH ABOVE THE REFERENCE TO QA AND QC FUNCTIONS IS REDUNDANT TO 4.3.4.

THE FUNCTION OF POST MAINTENANCE TEST TO VERIFY THE EQUIPMENT IS CAPABLE OF PERFORMING ITS DESIGN FUNCTIONS AS STATED IS TOO BROADLY APPLIED. THE MAINTENANCE PERFORMED MAY NOT AFFECT A SIGNIFICANT PORTION OF THE EQUIPMENT OR IT MAY BE IMPOSSIBLE TO TEST THE CAPABILITY OF THE EQUIPMENT TO PERFORM ALL OF ITS INTENDED FUNCTIONS. POST MAINTENANCE TEST SHOULD PROVIDE ASSURANCE THAT THE MAINTENANCE WAS PROPERLY PERFORMED. WHEN NECESSARY, APPROPRIATE PORTIONS OF SURVEILLANCE OR OPERABILITY TESTING SHOULD BE SPECIFIED.

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

SOME EXAMPLES ARE INCLUDED IN SECTION 5.2.4. NO DEFINITIONS ARE PROVIDED. HOW WILL NRC TEAMS INSPECT PLANTS THAT HAVE DIFFERENT DEFINITIONS FOR REWORK, ETC.?

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."[1] 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.

THE INDUSTRY IS CURRENTLY PARTICIPATING WITH THE NRC IN THE ASSESSMENT OF THE PROPOSED MAINTENANCE INDICATOR. COMMENTS WILL BE PROVIDED UNDER SEPARATE COVER WHEN THE PILOT PROGRAM IS SUFFICIENTLY COMPLETE.

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 provide insight regarding potential problem areas in the conduct of maintenance activities as well as causes of maintenance ineffectiveness. Examples are (a) post-maintenance test results, (b) periodic surveillance test results, (c) ratio of preventive to corrective maintenance, (d) maintenance

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[1] Available for inspection or copying for a fee in the NRC Public Document Room, 2120 L Street, N.W., Washington, DC.

work order backlog, (e) time to restore component function after failure discovery, and (f) frequency of rework.

6. FEEDBACK AND CORRECTIVE ACTIONS

THIS SECTION IS REDUNDANT TO SECTION 1.3/1.4 AND SHOULD BE COMBINED.

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.

RECOMMEND DELETION OF THE WORDS "...EFFECTIVELY AND TIMELY AND..." TO MINIMIZE THE POTENTIAL FOR INTERPRETATION DIFFERENCES.

6.1 Feedback

THIS SECTION IS REDUNDANT TO SECTION 1.4.

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

THIS SECTION IS REDUNDANT TO SECTION 1.4

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.