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DOE-STD-1053-93
March 1993

DOE STANDARD

GUIDELINE TO GOOD PRACTICES FOR CONTROL OF MAINTENANCE ACTIVITIES AT DOE NUCLEAR FACILITIES

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Washington, D.C. 20585

AREA MNTY

FOREWORD

The purpose of the *Guideline to Good Practices for Control of Maintenance Activities at DOE Nuclear Facilities* is to provide contractor maintenance organizations with information that may be used for the development and implementation of a rigorously controlled maintenance program directed at achieving high quality work performance, personnel safety, radiological protection, operating equipment/system protection, and overall site safety and reliability at DOE nuclear facilities. This document is intended to be an example guideline for the implementation of DOE Order 4330.4A, *Maintenance Management Program*, Chapter II, Element 7. DOE contractors should not feel obligated to adopt all parts of this guide. Rather, they should use the information contained herein as a guide for developing maintenance programs that are applicable to their facility.

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1. INTRODUCTION

1.1 Purpose

This guide is intended to assist facility maintenance operations in the review of existing and in developing new programs to ensure maintenance practices provide an administrative method by which maintenance activities are identified, initiated, planned, approved, scheduled, coordinated, performed, and reviewed for adequacy and completeness. It is expected that each DOE facility may use different approaches or methods than those defined in this guide. The specific guidelines that follow reflect generally accepted industry practices. Therefore, deviation from any particular guideline would not, in itself, indicate a problem. If substantive differences exist between the intent of the Guideline and actual practice, management should evaluate current practice to determine the need to include/exclude proposed features. A change to maintenance practice would be appropriate if a performance weakness was determined to exist. Development, documentation, and implementation of other features which further enhance these guidelines for specific applications, is encouraged.

Maintenance work is intended to ensure plant capacity by limiting forced downtime and returning items to service through an effective and timely first effort, consistent with plant goals. Additional information pertinent to the implementation of this guideline is found in the following DOE Guidelines:

1) *"Guidelines to Good Practices for Planning, Scheduling, and Coordination of Maintenance Activities at DOE Nuclear Facilities"*

2) *"Writer's Guide For Technical Procedures"*

3) *"Guidelines to Good Practices for Postmaintenance Testing at DOE Nuclear Facilities"*

4) *"Guidelines to Good Practices for Types of Maintenance at DOE Nuclear Facilities"*

5) "Guidelines to Good Practices for Control and Calibration of Measuring and Test Equipment (M&TE) at DOE Nuclear Facilities"

6) *"Guidelines to Good Practices for Maintenance History at DOE Nuclear Facilities"*

7) *"Guidelines to Good Practice for Training and Qualification of Maintenance Personnel'*

8) *"Guidelines to Good Practice for Modification Work at DOE Nuclear Facilities"*

9) *"Guidelines to Good Practice for Procurement of Parts, Materials, and Services at DOE Nuclear Facilities"*

10) *"Guidelines to Good Practice for Material Receipt, Inspection, Handling, Storage, Retrieval, and Issuance at DOE Nuclear Facilities"*

11) *"DOE Guideline DOE-NE-STD-1004-92 Root Cause Analysis Guidance Document"*

Appendix C is provided for use by facility trainers who intend to provide training regarding this element.

1.2 Background

The information in this guide was developed from commercial and DOE sources. Each facility should select those details that are applicable, add any unlisted knowledge or experience that are applicable, and develop and implement facility-specific maintenance programs. Facilities that have existing documented maintenance programs should review this guide to identify details that may enhance their existing programs.

1.3 Application

The content of this guide is generally applicable to all DOE nuclear facilities. Portions of the programs outlined may not be applicable to all facilities because maintenance organizations, disciplines, titles, and responsibilities may vary among DOE nuclear facilities. Facility maintenance personnel may verify the adequacy or improve existing maintenance programs by adapting this guide to their specific facility and individual maintenance disciplines.

2. DEFINITIONS

2.1 Acronyms Used in this Standard. The acronyms used in this standard are defined as follows:

a. ALARA - As Low As Reasonably Achievable

b. DOE - Department of Energy

c. MIG - Maintenance Importance Generator

d. MJR - Maintenance Job Request

e. SSC - Structures, Systems, and Components

2.2 ALARA (As Low As Reasonably Achievable. A radiation protection philosophy requiring that personnel exposure to radiation and radioactive material be kept not only within regulatory limits, but be maintained as low as reasonably achievable in light of current technology with appropriate consideration for economic and social factors, and benefits derived.

2.3 Corrective Maintenance. Repair and restoration of SSC that have failed or are malfunctioning and are not performing their intended function. As a rule of thumb, if the specific component (such as packing or bearing) requiring maintenance has failed, the action required to repair it should be classified as corrective maintenance.

2.4 Deficiency. Any condition that deviates from the design of a structure, system, component, or equipment and results in a degraded ability to accomplish its intended function.

2.5 Facility. Any equipment, structure, system, process, or activity that fulfills a specific purpose. Examples include storage areas, fusion research devices, nuclear reactors, production or processing plants, waste management disposal systems and burial grounds, testing laboratories, research laboratories, transportation activities, weapons development and production, standards and calibrations labs, and accommodations for analytical examinations of irradiated and un-irradiated components.

2.6 Maintenance. Day-to-day work that is required to maintain and preserve plant and capital equipment in a condition suitable for its designated purpose and includes preventive, predictive, and corrective (repair) maintenance.

2.7 Maintenance Importance Generator (MIG). A computerized system using predetermined rules to compare data on an MJR and to establish relative-importance ranking for each maintenance job.

2.8 Maintenance Job Request (MJR.) (Appendix D). Means of obtaining maintenance services available on both paper and electronic mediums and initiated by maintenance customers. Issued to Maintenance Planners and Estimators and used to define, plan, and execute maintenance activities. Documentation of a deficient equipment condition, requires detailed documentation of work performed, spare parts, procedures, or testing to verify maintenance was performed correctly. The MJR. may also serve as documentation for completion of minor maintenance activities such as lubrication, light bulb replacement, etc.

2.9 Maintenance Management. The administration of a program utilizing such concepts as organization, plans, procedures, schedules, cost control, periodic evaluation, and feedback for the effective performance and control of maintenance with adequate provisions for interface with other concerned disciplines such as health, safety, environmental compliance, quality control, and security. All work done in conjunction with existing property is either maintenance (preserving), repair (restoring), service (cleaning and making usable), or improvements (modification). The work to be considered under the DOE maintenance management program is only that for maintenance, repair, and modification (temporary).

2.10 Outage. Condition existing whenever normal operations has stopped, due to planned or unplanned occurrences.

2.11 Performance Test. A test of SSC to verify that required performance characteristics may be achieved, to detect any abnormal performance characteristics, and to determine the effect of maintenance and operating activities on equipment performance.

2.12 Performance Monitoring. Systematic monitoring and trending of the performance of selected plant SSC to measure and assess the impact of any performance changes on overall plant efficiency, reliability, and availability.

2.13 Periodic Maintenance. Preventive maintenance activities accomplished on a routine basis (typically based on operating hours or calendar time) and may include any combination of external inspections, alignments or calibrations, internal inspections, overhauls, and SSC replacements.

2.14 Planned Maintenance. Preventive maintenance activities performed prior to SSC failure and may be initiated by predictive or periodic maintenance results, by vendor recommendations, or by experience/lessons learned. These include items such as scheduled valve repacking, replacement of bearings as indicated from vibration analysis, major or minor overhauls based on experience factors or vendor recommendations and replacement of known life-span components. For example, repacking a valve due to packing leakage would be corrective maintenance, but scheduled repacking prior to leakage would be planned maintenance.

2.15 Predictive Maintenance. Predictive maintenance activities involve continuous or periodic monitoring and diagnosis in order to forecast component degradation so that "as-needed" planned maintenance may be performed prior to SSC failure. Not all SSC conditions and failure modes may be monitored; therefore, predictive maintenance should be selectively applied. Reliable predictive maintenance is normally preferable to periodic internal inspection or equipment overhauls.

2.16 Preventive Maintenance. Preventive maintenance includes periodic and planned maintenance actions taken to maintain SSC within their design operating conditions, extend its life, and is performed to prevent SSC failure. This includes technical safety requirements surveillances, in-service inspections, and other regulatory forms of preventive maintenance.

2.17 Root Cause. A determination based on an analytical technic that determines the fundamental cause of failure.

2.18 Structures, Systems and Components (SSC). Physical items designed, built, or installed to support the operation of the plant.

2.19 Technical Support. The engineering, design, specialized inspections, planning, or other such support of capital asset maintenance and repair.

2.20 Work Control Document. Proceduralized document used by facility personnel to perform inspections, testing or work.

3. PLANT MAINTENANCE

3.1 Discussion

3.1.1 The objectives of a plant maintenance program should be to improve plant safety and reliability by preventing equipment breakdown and to maintain the equipment in a satisfactory condition for normal operation and/or emergency use. Various maintenance techniques may be included in a plant maintenance program. It is necessary that the program be well-defined and periodically adjusted to ensure that equipment reliability is maintained.

3.1.2 A maintenance program has the following key elements:

- Management commitment is essential for the success of a maintenance program
- Clearly defined responsibilities
- Dedicated personnel, technically competent in maintenance techniques
- Equipment important to the safe and reliable operation of the plant directed by historical data is included in the scope
- Maintenance techniques selected, are appropriate for the type of plant equipment
- Carefully analyzed and trended data
- Tasks scheduled on a routine basis and performed as appropriate
- Periodically evaluated and, if necessary, upgraded programs

3.1.3 A system of controlling maintenance work activities should be clearly defined based upon the Maintenance Operations Model (Appendix A), which consists of five interrelated processes applicable to each maintenance job. The processes are as follows:

- Plan Maintenance Job. Identify the scope of a needed maintenance job. Produce a maintenance job plan. Determine maintenance job planning category, priority, and safety concerns. Identify and procure materials, and identify other maintenance task resources. Prepare the maintenance job package.

- Schedule Maintenance Job. Calculate estimated start date and project resources for the maintenance job. Schedule and commit required resources and special tools/equipment items to allow performance of all maintenance tasks within the maintenance job.

- Execute Maintenance Job. Initiate and perform a maintenance job and collect job information as defined in the maintenance job package.

- Execute Postmaintenance Test. Verify facilities and equipment items fulfill their design functions when returned to service after execution of a maintenance job.

- Complete Maintenance Job. Perform maintenance job closeout to include completion of all documentation contained in the maintenance job package to ensure historical information is captured.

3.1.4 Appendix B (Facility Management) illustrates a comprehensive "Work Control Program" based on the requirements of DOE Order 4330.4A, *Maintenance Management Program*. The implementation of this program should ensure that the maintenance activities in nuclear facilities are conducted in a manner that preserves and restores the availability and operability of the SSC important to safe and reliable plant operation.

3.2 Scope

This document addresses the elements considered essential for maintenance managers and direct line supervisors to ensure maintenance practices result in personnel safety, resource effectiveness, SSC protection, and safe and reliable operations capacity through direct observation, documentation review, and post-activity analysis.

3.3 Responsibilities

3.3.1 The maintenance manager should have overall responsibility for the establishment, implementation, and performance of the maintenance program as described below:

a. maintaining equipment in accordance with applicable manufacturer's recommendations and the requirements of this guideline;

b. specifying maintenance methods, procedures, and controls to ensure the quality of materials, parts, and workmanship;

c. ensuring maintenance personnel are appropriately qualified;

d. ensuring an adequate supply of suitable spare parts, materials, and supplies to service equipment covered by the maintenance program;

e. maintaining maintenance history files, analyzing causes of off-normal equipment, and performing failure analyses;

f. coordinating maintenance with the owner/operator to establish proper plant conditions and obtaining authorizations to conduct maintenance activities;

g. monitoring the overall effectiveness of the maintenance program and incorporating program changes based on plant history, performance, and industry experience;

h. approving revisions to the program.

3.3.2 Maintenance supervisors should have direct responsibility for execution of maintenance activities as follows:

a. ensuring maintenance results are recorded in maintenance history;

b. reviewing, trending, and analyzing data to detect any degradation of equipment condition;

c. coordinating with owner/operator and technical support, as required, to perform additional testing to confirm suspected deficient conditions;

d. providing recommendations to the maintenance manager to upgrade maintenance programs;

e. providing periodic summary reports to maintenance management describing the current status of the maintenance program and summarizing problems recently identified or corrected;

f. ensuring that baseline data is updated after any maintenance or modifications.

3.3.3 The operations manager should be responsible for listing the equipment to be included and the alignment of plant systems and components to support maintenance as noted below:

a. ensuring that maintenance tasks are properly authorized;

b. providing schedule and technical assistance to maintenance;

c. restoring systems and components to correct operating alignment or standby modes upon completion of maintenance tasks;

d. making the final equipment operability/acceptance determination, if applicable, prior to returning the equipment to service.

3.3.4 The technical support manager should be responsible for assisting, as required, in the development and implementation of the maintenance program as noted below:

a. reviewing the list of equipment to be included in the maintenance program;

b. involving engineering personnel (system engineer, if used) in the review and analyses of maintenance results;

c. providing recommendations to maintenance managers to upgrade equipment performance (including processing design changes) or to make necessary maintenance program adjustments.

3.4 Guidelines

3.4.1 Equipment

Equipment should be selected for special attention under this program based on the criteria below. The selection of certain equipment for special attention under this program does not imply that other equipment is to be ignored; normal care and application of sound technical and management controls are needed for all equipment, as well as for all activities associated with the equipment.

3.4.1.1 Equipment with a record of frequent operational failures that either have caused or have significant potential for causing loss of capacity (Failure information considered should include in-house records as well as information available from other facilities by vendor technical information.

3.4.1.2 Equipment whose failure to operate as designed would likely cause significant loss of capacity because of its importance to the facility.

3.4.1.3 Equipment with a record of frequent maintenance or rework that has caused inordinate use of maintenance resources or that has caused significant loss of capacity or actuation of nuclear safety systems.

3.4.1.4 Equipment that maintains environmental conditions for important operating components

3.4.2 Work Control Document

Maintenance conducted on equipment under this program should be planned, controlled by written instructions or procedures, and documented using a facility maintenance job request or another approved work control document. In emergencies, when written instructions or procedures cannot be provided, work should be performed using appropriate technical guidance and directly supervised by experienced personnel. The actual work performed should be documented for maintenance history either during or immediately after completion of the work.

3.4.2.1 A computer-based Maintenance Job Request (MJR) or other work control document should include the basic capacity for the following:

a) Authorize Work

b) Track job status

c) Collect history information/data

d) Collect cost information

e) Management reporting

3.4.2.2 All maintenance activities shall be properly authorized and controlled. The work control document should be prepared for all work consistent with the level of detail fitting the risk/complexity/importance of the tasks involved. The document should clearly define the work to be performed and should address the following items:

a) Equipment identification

b) Name of the person initiating the job request

c) Date job request initiated

d) Description of the symptom, problem, or work requested

e) Job priority (based upon an approved work priority system

f) Personnel safety and radiation protection requirements or permits (such as, confined space entry, welding and burning permit, lockout-tagout, isolation, draining, depressurization of the component, and radiation work permit) in accordance with applicable plant policies and procedures.

g) Applicable Technical Safety Requirements, time restraints, and associated Limiting Conditions for Operations

h) Identification of qualification requirements such as environmental and seismic qualifications

i) Applicable work instructions and references, (including hold points for data/measurement, and inspection/checks)

j) Inspection, safety, or ALARA hold points associated with the work

k) Required postmaintenance testing, inspections, and acceptance criteria

l) Authorization by the appropriate owner/operator and maintenance supervisor to commence work

m) Narrative description of conditions found and adjustments made by the craftspersons

n) Documentation of actual work performed with postmaintenance testing and inspection results

o) Acceptance of the equipment by owner/operator

p) Cost accounting information

q) Final reviews and sign-offs by maintenance, quality control, and other groups in the job request review cycle

3.4.2.3 Planning for work under this program should normally include selection or preparation of authorized maintenance procedures (or written instructions) and references, preparation of clearance requests and tagouts, and selection and assembly of expected repair parts and materials (see *"Guidelines to Good Practices for Planning, Scheduling,* and *Coordination of Maintenance Activities at DOE Nuclear Facilities.* " Maintenance procedures (or written instructions) should be prepared with a level of detail appropriate to the complexity of the work to be performed and the skill level of the workers (see *'Writer's Guide for Technical Procedures").* The procedures should include appropriate work inspection points based on the probability and consequences of an error, accident, or oversight during performance of the work. Factors that should be considered when selecting inspection points include the complexity of the work, the experience of the workers, previous results with similar work, the detail provided in work instructions, and the importance of the work to reliable system or component operation. For example, inspection points should be used to verify results such as the following:

a) "As-found" data useful for root cause failure analysis is recorded.

b) Critical dimensions and tolerances are met.

c) Correct repair parts and materials are used.

d) Special processes (such as welding) achieve desired results.

e) Fasteners and locking devices are properly installed; proper torque values are determined and used where appropriate.

f) Internal conditions are acceptable before closeout of large equipment/components.

g) Postmaintenance tests are completed satisfactorily (see *"Guidelines to Good Practices for Postmaintenance Testing at DOE Nuclear Facilities").*

3.4.2.4 Planners and engineers should exercise sound judgment and a good understanding of plant management practices to select work controls that contribute to work quality without unnecessarily restricting workers. The following guidance applies:

a) Prior to release for work, maintenance work packages should be reviewed by a qualified maintenance engineer. The maintenance engineer should ensure that work instructions are clear and correct; appropriate work controls, inspection points, and performance tests have been specified; proper materials are available; and the work is ready to proceed.

b) Preventive maintenance conducted on equipment under this program should be performed in accordance with *"Guidelines to Good Practices for Types of Maintenance at DOE Nuclear Facilities"* and approved plant procedures, and should include all manufacturer or vendor recommended maintenance unless otherwise authorized by the maintenance manager. Preventive maintenance intervals should be adjusted as needed, based on maintenance history, to minimize failures of operating equipment.

c) Measuring and test equipment used in this program should be controlled and calibrated as required by *"Guidelines to Good Practices for Control and Calibration of Measuring and Test Equipment (M&TE) at DOE Nuclear Facilities.*

d) Descriptive information and data on completed work should be entered in the maintenance history (see *"Guidelines to Good Practices for Maintenance History at DOE Nuclear Facilities").* History information should be reviewed and modified as necessary by a maintenance engineer, before filing, to ensure the information is accurate, complete, and understandable. Maintenance history information should normally be retained for the life of the associated equipment.

3.4.3 Supervision of Maintenance Activities

Maintenance supervision should routinely monitor work in progress to help ensure that maintenance activities are conducted in accordance with DOE and facility policies and procedures. Good work practices should be recognized and encouraged; poor work practices should be corrected on the spot. Causes of poor work practices should be identified and corrected, and generic corrective activities should be initiated as needed. Examples of work practices that should be reviewed and verified include the following:

a) Safety is the first priority for all work, ensure unsafe conditions and deficiencies are clearly identified

b) Industrial safety and radiological protection practices such as appropriate use of safety equipment, proper handling of hazardous chemicals, proper use of ALARA concepts, minimizing spread of contamination

c) Exposure of personnel to hazardous materials and conditions is minimized

d) The potential for the spread of radioactive or other hazardous materials is minimized through proper containment and handling

e) Proper use of pre-job briefings and applicable training

f) Quality of workmanship, material, and parts

g) Work being performed on the correct SSC

h) Applicable authorizations, procedures, documents, permits are available at the job site

i) Individuals performing work or responsible for work are adequately trained and have a clear understanding of work scope and the effect of the work being performed

j) The purpose and importance of plant SSC

k) General facility layout (including emergency egress routes and assembly locations)

l) Maintenance activities are under the control of the applicable owner-operator

m) Maintenance personnel exhibit an attitude of first-effort quality workmanship

n) The concept of ALARA includes "value-added" considerations when planning work to minimize potential exposure

o) Maintenance personnel are:

   1) Attentive to identifying deficiencies and off-normal conditions and bringing them to the attention of applicable managers

   2) Responsive to priority correction of deficiencies and off-normal conditions when approved by applicable managers

p) Environmental protection/regulations

q) Proper handling and storage of hazardous materials and waste minimization

r) Procedure use, including adherence to step-by-step requirements, sign-offs, and work hold points

s) Open system and component protection (foreign material exclusion)

t) Accountability of tools, chemicals, and materials

u) Use of proper tools for the job, such as short, non-sparking tools for batteries; pry-bars, chisels, or punches used as intended, rather than substituting screwdrivers; and test instruments used on correct ranges

v) Work progress and time required to perform the job, especially if a Limiting Condition for Operation exists

w) Work sites are maintained and left clean and orderly

x) Operations and support organizations involvement is coordinated into applicable activities

y) Effective troubleshooting techniques

z) By-passing or deactivation of safety controls, interlocks, and SSC for test purposes, calibration/certification, or maintenance is performed in accordance with detailed, approved procedures and permits

aa) The requirements and conditions for restoring SSC to service following deactivation or by-passing is documented and verified

ab) Postmaintenance testing instructions should be clearly defined, understood, and include the following:

1) Clearly written instructions
2) Specific parameter acceptance criteria
3) Applicable test precautions and safety considerations
4) A test scope adequate to verify the adequacy of completed work
5) Conditions for SSC return to normal service
6) Documentation of test results/data
7) Test results review and written acceptance by operations

ac) Proper use of post-job reporting and, when applicable, post-job critiques

ad) Backlog is effectively managed

3.4.4 Inspection

Work inspections required by operating and maintenance procedures should normally be accomplished by persons who are qualified to perform the work to be inspected, but not by the persons assigned to perform the work. For example, work supervisors routinely may perform required inspections of maintenance activities.

3.4.4.1 Personnel who perform material receipt inspections should be trained and qualified for this work. Except for non-destructive examination (NDE), use of certified inspectors should not be necessary. NDE should be performed as specified in applicable codes, standards, and plant or vendor procedures by persons trained and certified in the specific technique.

3.4.5 Qualification and Training

Personnel assigned to perform activities covered by this program should be qualified in accordance with *"Guidelines to Good Practice for Training and Qualification of Maintenance Personnel"* and appropriate plant procedures to perform their assigned functions or should work under direct supervision of persons who are so qualified.

3.4. 5.1 Cognizant department managers should approve associated training programs and qualification requirements and should ensure that personnel are qualified before being assigned to work without direct supervision.

3.4. 5.2 Training programs should be developed, training resources should be provided, and training records should be maintained to support plant personnel qualification requirements.

3.4.6 Control of Non-facility Contractor and Sub-Contractor Personnel

Non-facility contractors (personnel not directly employed by the facility operating contractor) and sub-contractor personnel who perform maintenance or modifications on facility systems should be trained and qualified for the work they are to perform. These personnel should also receive general employee training and specific training in appropriate facility administration, safety, quality control, and radiation protection procedures and practices. Adequate time should be provided for this training. Recognition should be given to individual needs and previous training and experience. Experienced personnel may be allowed to bypass training by proving proficiency through examination and demonstration. Non-facility contractor and sub-contractor personnel who are not fully trained and qualified for the job to be performed should be continually supervised by qualified personnel.

3.4.6.1 Non-facility contractor and sub-contractor personnel should perform maintenance under the same controls as, and to the same high work standards expected of, facility maintenance personnel. Non-facility contractor and sub-contractor managers and supervisors should be held accountable for the work performance of their personnel. Facility supervisors should review the work of these personnel during preparation for work, at the job site, and during postmaintenance testing and acceptance inspections to the extent needed to enforce these requirements.

3.4.6.2 Use of subcontractor personnel to perform routine facility maintenance should not be relied upon to the extent that it deters the development of permanent staff expertise.

3.4.7 Modification Control

Modifications to equipment and structures covered by this program should be approved and controlled in accordance with *"Guidelines to Good Practices for Modification Work at DOE Nuclear Facilities"* and the plant modification program.

3.4.8 Procurement

Procurement documents for material, parts, or services for equipment covered by this program should specify the desired attributes of products and services in sufficient detail to ensure that equipment reliability is not inadvertently degraded. Purchase specifications should be in accordance with *"Guidelines to Good Practices for Procurement of Parts, Materials, and Services at DOE Nuclear Facilities."*

3.4.9 Material Control

Receipt inspections should be performed to ensure that material meets purchase specifications before release for use in the plant or as spare stock. Material that fails to meet purchase specifications may be released for use only when authorized by the cognizant maintenance or design engineer. This authorization should only be given when the deviation does not have a significant degrading effect on equipment performance. Material, parts, and components should be identified and controlled in accordance with *"Guidelines to Good Practices for Material Receipt, Inspection, Handling, Storage, Retrieval, and Issuance at DOE Nuclear Facilities"* and approved plant material handling and storage procedures. Acceptance, hold, or reject tags should be used to show the status of items that have been receipt inspected. The storage environment and the age of stored materials should be controlled in accordance with DOE Guidelines, approved plant procedures, and manufacturer's recommendations.

3.4.10 Document Control and Records

Instructions, procedures, drawings, and vendor technical manuals for equipment in this program should be controlled in accordance with approved plant document control procedures to ensure that they remain current.

3.4.10.1 Satellite files or other suitable means should be established to ensure that reference materials are readily available at major work centers in the plant.

3.4.10.2 Personnel should report inaccurate procedures and drawings in accordance with approved plant administrative procedures, proposing an appropriate correction whenever possible.

3.4.10.3 Records resulting from operation, maintenance, and testing of equipment in this program should be maintained by the cognizant departments until they are forwarded to the document control center for storage.

3.4.10.4 Records should be retained in secure, retrievable storage for the life of the associated equipment.

3.4.11 Equipment Analysis

The maintenance engineers, with assistance from other technical personnel as necessary, should perform detailed failure analyses for equipment failures that either cause or have a significant potential for causing a loss of capacity, whether or not the equipment has been selected for special attention covered under this program (see DOE Guideline DOE-NE-STD-1004-92 *"Root Cause Analysis Guidance Document').* Analyses should also be performed for repetitive minor failures that have a potential to cause lost capacity or require excessive use of maintenance resources. The purpose of the failure analysis is to identify the basic and contributing causes of the failure and to develop corrective recommendations. Failure analyses should delve, as necessary, into all functional areas that might have contributed to the failure. Results of failure analyses and intended corrective actions should be reported in writing to the plant manager, cognizant owner/operators, and department managers. Possible addition of equipment or activities for coverage under this program should be considered in the development of corrective action. Corrective actions resulting from the analyses should be tracked to completion.

3.4.11.1 For equipment performance deviating significantly from normal, pre-failure analysis should be performed. This should attempt to determine the cause(s) for deteriorating performance and whether the equipment should be repaired or replaced to preclude further degradation of performance.

3.4.12 Periodic Assessments

Periodic assessments should be conducted to evaluate the effectiveness of the program and to identify opportunities for improvement.

3.4.12.1 Periodic assessments should be conducted under the direction of the maintenance division manager. They should be performed by persons selected by the maintenance division manager, who are knowledgeable in plant operation, maintenance, design, or management, but not involved in this program on a day-to-day basis.

3.4.12.2 The periodic assessments should evaluate all aspects of the program (including support activities) to assess the overall program effectiveness. Recommendations should be developed to correct noted weaknesses and to make needed improvements.

3.4.12.3 Periodic assessment should be performed at regular intervals.

3.4.13 Performance Monitoring

In addition to regular monitoring by operators, equipment performance should be regularly evaluated by performance tests and analysis of operating and maintenance data.

3.4.13.1 The performance test program should be structured so that tests are performed often enough to detect and correct degrading equipment performance before failures result in capacity reductions or forced outages. Performance tests should also be used to evaluate equipment performance after maintenance work as part of postmaintenance testing. These tests should be based upon manufacturer's recommendations and operational experience with specific equipment both at the plant and elsewhere in the industry. These tests should be performed by qualified personnel in accordance with approved plant procedures. The procedures should state the desired test interval and should include provisions for recording test results. The following are examples of performance tests that may be included:

(a) pump speed control system performance

(b) flow instrument loop calibration

(c) pump performance

(d) lube oil system performance

(e) trip valve performance

(f) control building air conditioning system performance

(g) instrument air compressor performance

(h) instrument air dryer performance

(i) voltage control system test

(j) air ejector/vacuum pump performance

(k) rotating equipment vibration tests

(l) valve leakage tests

3.4.13.2 Performance test results should be analyzed by a performance engineer. The performance engineer should report significant analysis results and trends to cognizant owner/operators, department managers, and the plant manager, along with recommended corrective actions based on the analyses. When analyzing trends and developing corrective recommendations, the performance engineer should consult with other cognizant technical personnel and analyze performance information and trend data maintained by other departments.

3.4.13.3 Analysis and trending of selected routine operational data such as calibration results, and maintenance history should be performed by the cognizant departments. Selection of the data to be trended is the responsibility of the department manager. Corrective action for adverse trends or unacceptable performance should be taken promptly by the cognizant department.

3.4.14 Review of Completed Maintenance Job Requests

The operations supervision on shift should compare the work accomplished to the postmaintenance testing or inspection performed to determine that all work is acceptable prior to returning the SSC to normal service.

3.4.14.1 Maintenance supervisors should review completed job requests for the adequacy of repair, complete documentation, and identification of rework. A post-job review should be held with the craftspersons involved. This review may be a brief discussion or an involved critique. The purpose of the review is to determine whether any unexpected problems occurred and/or how the activity may be accomplished more efficiently the next time. Other reviews should be accomplished by the technical support, quality control, radiation protection, and other organizations, as appropriate and in accordance with facility instructions. Feedback should be provided to planning, scheduling, and maintenance personnel to highlight areas that were exemplary and areas that needed improvement. Maintenance supervision should, as a minimum, ensure the following:

a) Affected individuals/organization are kept knowledgeable of applicable lessons learned from other sources;

b) The identity of the individual who certifies successful completion of maintenance work is traceable;

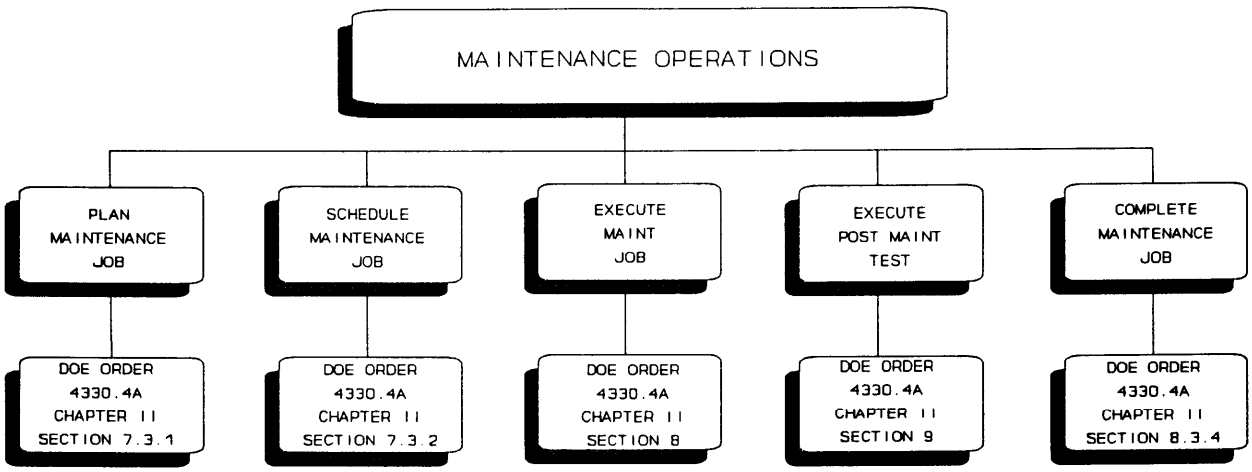
c) Maintenance rework is identified and regularly reviewed for implications and applicable actions to minimize recurrence;

d) Maintenance managers and supervisors use personal observations for:

1) Identifying and correcting violations
2) Ensuring established policy and procedure compliance
3) Conveying management expectations for standards of excellence
4) Verifying that unauthorized changes or modifications do not exist
5) Ensuring that the design integrity of SSC is maintained, (includes associated protective devices).

APPENDIX A
MAINTENANCE OPERATIONS MODEL

APPENDIX A



The Maintenance Operations Model incorporates five interrelated processes applicable to each maintenance job. These five processes are Plan Maintenance Job, Schedule Maintenance Job, Execute Maintenance Job, Execute Postmaintenance Testing, and Complete Maintenance Job.

The Plan Maintenance Job process is identifying the jobscope; producing a job plan; determining the planning category, priority, and safety concerns; identifying and procuring parts, materials, and supplies; identifying other task resources required; and preparing the work package. This process was developed based on DOE Order 4330.4A Chapter II Section 7.3.1.

The Schedule Maintenance Job process is calculating estimated start date and project resources required for job; scheduling and committing required resources and special tools/equipment to allow performance of all job tasks associated with the job. This process was developed based on DOE Order 4330.4A Chapter II Section 7.3.2.

The Execute Maintenance Job process is initiating and performing the job; and collecting job information as defined in the work package. This process was developed based on DOE Order 4330.4A Chapter II Section 8.

The Execute Postmaintenance Testing process is verifying facilities SSC fulfill their design functions prior to return to service after execution of the job. This process was developed based on DOE Order 4330.4A Chapter II Section 9.

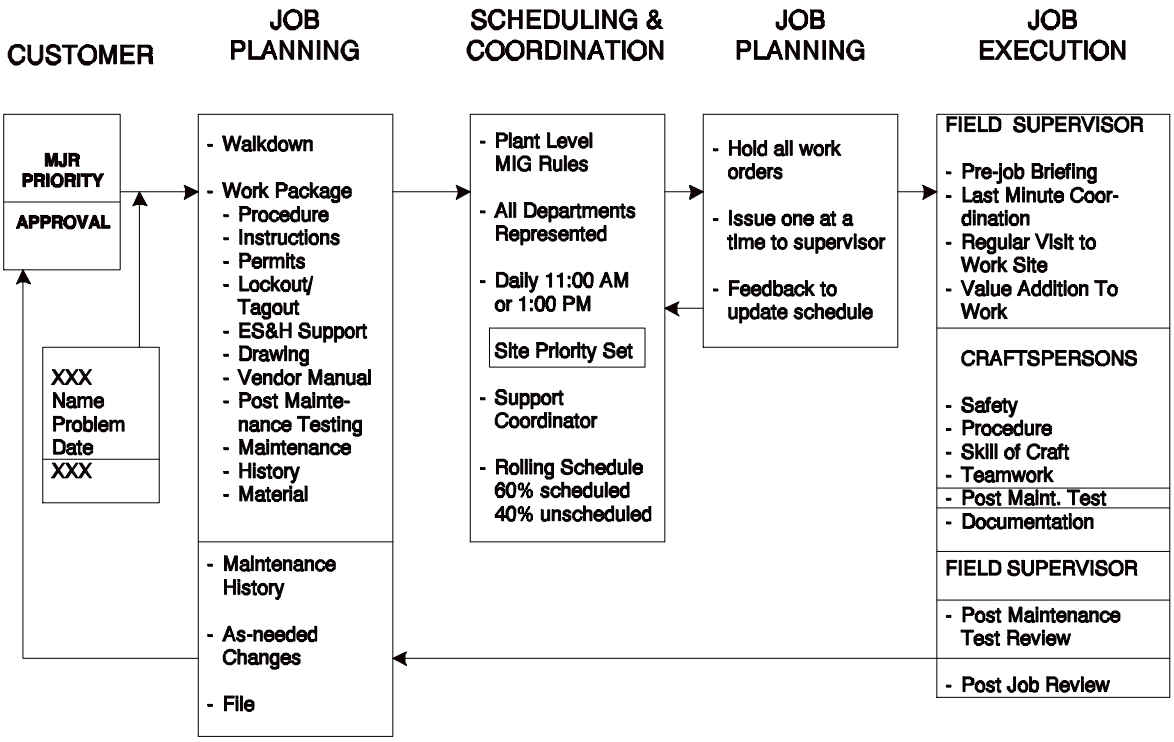
The Complete Maintenance Job process is performing job closeout to include completion of all documentation contained in the work package to ensure historical information is captured. This process was developed based on DOE Order 4330.4A Chapter II Section 8.3.4.

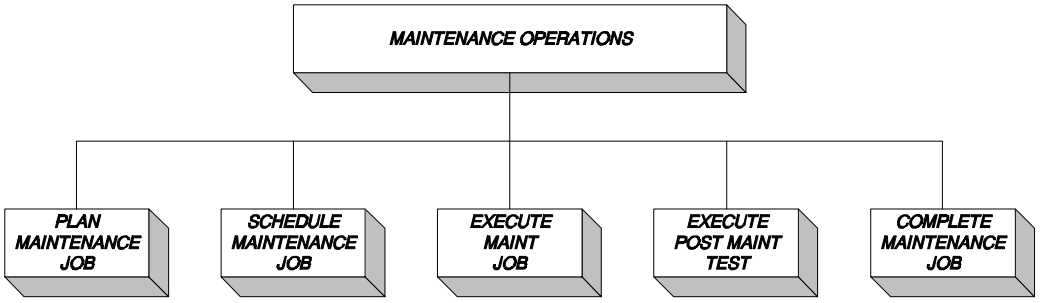
APPENDIX B
FACILITY MANAGEMENT

APPENDIX B

FACILITY MANAGEMENT

MAINTENANCE WORK CONTROL PROCESS FOR 4330.4A IMPLEMENTATION





APPENDIX C
CONTROL OF MAINTENANCE ACTIVITIES
SAMPLE LESSON PLAN

CONTROL OF MAINTENANCE ACTIVITIES
SAMPLE LESSON PLAN

1. The instructor should be familiar with the following background information:

   a. Rigorous control of maintenance activities should be directed at achieving high quality work performance, personnel safety, radiological protection operating equipment/system protection, and overall site safety and reliability. This control should be a function of a graded approach to maintenance.

   b. A work control program is an administrative method to manage the site-wide identification, planning, approving, scheduling, coordinating, performing, and reviewing of maintenance activities. This program should contain the following elements:

      - an administrative procedure governing the program,
      - a maintenance job request form,
      - a system of job site guidance and overview by supervision,
      - a method to control troubleshooting,
      - guidance for addressing rework,
      - postmaintenance testing review, and
      - a method to control contractor activities.

2. To teach this lesson, the following training housekeeping items are required:

   a. Location for the training,

   b. Approximately 30 minute time period for the training,

   c. Notification of selected employees, and

   d. A copy of the work control program procedure and a selection of completed job requests from previous maintenance activities.

3. This lesson has the following trainee enabling objectives:

   a. Outline the work control system,

   b. Know the content, use, and review of a maintenance job request, and

   c. Explain the duties of a supervisor in monitoring and adding value to the work activity.

4. A work control program is an administrative method to encompass the site-wide identification, planning, approving, scheduling, coordinating, performing, and reviewing of maintenance activities. This program should contain the following:

   a. The basic intent of the work control system is to identify all plant deficiencies and ensure they are corrected in a timely, efficient, and quality fashion. A formal procedure is required to communicate and standardize the site work control activities. The work control system helps all personnel understand the requirements and controls necessary for performing work. The following criteria should be addressed:

      - personnel responsibilities to identifying and initiating a corrective action for plant deficiencies,
      - the supervisory responsibility for controlling the maintenance activity,
      - responsibilities for job planning and site scheduling,
      - the priority system,
      - the flow path of the job request through the review, performance, and post-review process,
      - guidance for permits, tagouts, and safety support,
      - postmaintenance testing, and
      - completed documentation and maintenance history updates.

   b. The maintenance job request form is a document that when combined with specific drawing, procedures, and instructions becomes what is referred to as a work package. This package is then handed to the work crew for completion of the task and should include the following:

      - equipment identification,
      - person's name and date of initiation of the work order,

- description of the problem or deficiency,
- site work priority,
- personnel safety and permit requirements,
- work instructions or applicable procedures,
- ALARA recommendations,
- inspection hold points,
- work authorization approvals,
- postmaintenance testing instructions,
- description of conditions found and actions taken by the craftsperson, and
- final reviews and sign-offs.

c. Maintenance supervisors should periodically monitor work activities in progress to ensure a quality maintenance product. Their task is not one of "bird-dogging" the job, but should add value to the overall activity by taking a "big picture" look at the conditions surrounding the task. In short the supervisors should provide overview guidance and coordination where needed. Some examples include the following:

- concise job briefings,
- proper radiological and safety practices,
- emphasis on quality of workmanship,
- ensuring procedure use,
- enforcement of protection for open process systems or components,
- accountability of tools, chemicals, or materials used,
- a clean and orderly work sites,
- work performed on the correct system or component,
- effective response to unanticipated problems,

- timely completion of the activity,
- accurate reporting and documentation of actions taken, and
- ensuring acceptance of completed maintenance by the customer.

d. Contract personnel should perform maintenance under the same controls, high standards, and expectations as site maintenance personnel. Their completed work and documentation should meet the same scrutiny as that expected of site maintenance personnel.

5. Discuss with the trainees the site work control system, and review the selected work orders in light of the previous discussion.

CONCLUDING MATERIAL

Review Activities:

DOE	Field Offices
AD	AL
DP	CH
EH	ID
EM	NV
ER	OR
NP	RL
NS	SR
RW	SF

Area Offices
Amarillo
Brookhaven
Kansas City
Kirtland
Princeton

Facilities
ANL
BNL
LBL
PNL
PPPL
SNL
NV REECo.
NV EG&G
OR OSTI
WHC
EG&G
RF
SLAC
WSRC

Preparing Activity:

DOE-NE-73

Project Number:

MNTY-0006