U.S. Department of Energy
Washington, D.C.

ORDER

DOE O 433.1

Approved: 6-01-01

SUBJECT: MAINTENANCE MANAGEMENT PROGRAM FOR DOE NUCLEAR FACILITIES

1. OBJECTIVE. To define the program for the management of cost-effective maintenance of Department of Energy (DOE) nuclear facilities. Guidance for compliance with this Order is contained in DOE G 433.1-1, *Nuclear Facility Maintenance Management Program Guide for use with DOE O 433.1*, which references Federal regulations, DOE directives, and industry best practices using a graded approach to clarify requirements and guidance for maintaining DOE-owned Government property.

2. CANCELLATION. DOE 4330.4B, Chapter II, *Maintenance Management Program*, dated 2-10-94, is canceled. Cancellation of a directive does not, by itself, modify or otherwise affect any contractual obligation to comply with such a directive. Canceled directives that are incorporated by reference in a contract remain in effect until the contract is modified to delete the requirements in the canceled directives.

3. APPLICABILITY.

   a. DOE Elements. Except for the exclusions in paragraph 3c, this Order applies to all DOE elements, including the National Nuclear Security Administration (NNSA), involved in the maintenance of DOE nuclear facilities.

   b. Contractors. The Contractor Requirements Document (CRD), Attachment 1, sets forth requirements to be applied to all contractors responsible for managing and maintaining DOE-owned or -leased nuclear facilities. Contractors must comply with the requirements listed in the CRD to the extent set forth in their contracts. Contractors are responsible for—

      (1) compliance with the requirements of the CRD of this Order regardless of the performer of the work and

      (2) flowing down the requirements of the CRD of this Order to subcontractors and suppliers to the extent necessary to ensure contractor compliance with the requirements.

c. Exclusions. Naval Nuclear Propulsion Program maintenance covered under Executive Order 12344, as in force under section 3216(c) of Public Law 106-65 (50 U.S.C. 2406), is excluded from the provisions of this Order.

d. Other Requirements. This Order does not apply to those portions of nuclear facility maintenance programs that are subject to regulation by other Federal agencies such as the U.S. Nuclear Regulatory Commission. To ensure that nuclear facility maintenance meets DOE expectations, DOE elements may impose additional requirements and/or specific standards as necessary to preserve DOE property. A single maintenance program may be used to satisfy the regulated work; the requirements of DOE O 430.1A, *Life Cycle Asset Management*; any additional requirements imposed by DOE elements; and the requirements of this Order.

4. REQUIREMENTS.

a. In addition to the maintenance program requirements of DOE O 430.1A, a nuclear facility maintenance management program must contain a DOE-approved Maintenance Implementation Plan (MIP) that addresses the following elements using a graded approach.

(1) Structures, systems, and components (SSCs) included in the program.

(2) Periodic inspections of SSCs and equipment required to determine whether degradation or technical obsolescence threatens performance and/or safety.

(3) Management systems used to control maintenance activities associated with the defined SSCs (these include work control, postmaintenance testing, material procurement and handling, and control and calibration of test equipment).

(4) Assignment of roles and responsibilities and appropriate maintenance-related training and qualification requirements.

(5) Interfaces between the maintenance organization and other organizations (e.g., operations, engineering, quality, training, industrial health).

(6) The configuration management process established to ensure the integrity of the identified SSCs using a graded approach.

(7) The prioritization process used to properly emphasize safety requirements, the maintenance backlog, system availability, and requirements for those infrastructure elements identified as part of the nuclear facility safety basis.

(8) The process for feedback and improvement established to provide relevant information regarding operations, maintenance, and assessment efforts.

(9) The systems engineer program established for the management of vital safety systems that is consistent with DOE O 420.1A and designates a "system engineer" with—

(a) the requisite knowledge of the system safety design basis and operating limits from the safety analysis and

(b) the lead responsibility for the configuration management of design.

(10) An accurate maintenance history that compiles maintenance, resource, and cost data in a system which is retrievable and capable of entering required-maintenance costs, actual maintenance costs, and availability data and failure rates for mission-critical and safety SSCs into the DOE Facility Information Management System (see DOE O 430.1A and DOE G 433.1-1, Section 4.15).

b. The nuclear facility maintenance management program must establish metrics to measure program performance and identify appropriate voluntary consensus standards that are incorporated into the program.

c. The nuclear facility maintenance management program must be integrated with—

(1) the Integrated Safety Management System (ISMS) established by DOE P 450.4, *Safety Management System Policy,* and 48 CFR 970.5204-2;

(2) the life-cycle management programs under DOE O 430.1A;

(3) any required nuclear safety basis established under 10 CFR Part 830, Subpart B; and

(4) a Quality Assurance Program established under 10 CFR Part 830, Subpart A.

d. The MIP should be reviewed every 2 years and necessary changes submitted to DOE for approval.

e. The nuclear facility maintenance management program established under DOE 4330.4B remains effective until it is updated to meet the requirements of this Order.

5. RESPONSIBILITIES. The responsibilities of all DOE elements are delineated in Section 9 of DOE M 411.1-1B, *Safety Management Functions, Responsibilities, and Authorities Manual*. These responsibilities include the following:

   a. ensuring that sufficient resources are budgeted in a timely manner to accomplish the maintenance program's objective of providing DOE with the highest confidence in the reliable performance of mission-critical, safety SSCs through proactive maintenance practices;

   b. ensuring that a cost-effective and efficient maintenance program is developed and implemented for all DOE nuclear facilities consistent with DOE's mission, safety and health, reliability, quality, and environmental protection objectives;

   c. ensuring that the responsibility, authority, and accountability for maintenance are clearly defined, appropriately assigned, and executed;

   d. ensuring that DOE operational awareness review and analysis capability exists for evaluation of maintenance program performance and effectiveness;

   e. ensuring that where maintenance requirements or accepted maintenance standards cannot be met, such instances are appropriately documented and acknowledged by DOE field elements including the granting of exemptions by DOE, as appropriate, when requested; and

   f. ensuring that the requirements and standards for maintenance of nuclear facilities are incorporated into contracts and subcontracts, including support services contracts, as appropriate.

6. REFERENCES.

   a. DOE O 414.1A, *Quality Assurance.*

   b. DOE O 420.1A, *Facility Safety.*

   c. DOE G 424.X-X, *Implementation Guide for Use in Addressing Unreviewed Safety Question Requirements.* (Draft)

   d. DOE O 430.1A, *Life Cycle Asset Management.*

   e. DOE G 433.1-1, *Nuclear Facility Maintenance Management Program Guide for use with DOE O 433.1.* (Draft)

f. DOE O 440.1A, *Worker Protection Management for DOE Federal and Contractor Employees.*

g. DOE P 450.4, *Safety Management System Policy.*

h. DOE G 450.4-1B, *Integrated Safety Management System Guide for Use with Safety Management System Policies (DOE P 450.4, DOE P 450.5, and DOE P 450.6); the Functions, Responsibilities, and Authorities Manual; and the Department of Energy Acquisition Regulation,* Volumes I and II.

i. DOE 5400.5, *Radiation Protection of the Public and the Environment.*

j. DOE 5480.19, *Conduct of Operations Requirements for DOE Facilities.*

k. 10 CFR 830, Nuclear Safety Management; Subpart A, Quality Assurance Requirements.

l. 10 CFR 830, Nuclear Safety Management; Subpart B, Safety Basis Requirements.

m. 10 CFR 830.122, Quality Assurance Criteria.

n. 10 CFR 835, Occupational Radiation Protection.

o. 29 CFR 1910.119, Process Safety Management of Highly Hazardous Chemicals.

p. 41 CFR 101, Federal Property Management Regulations.

q. 41 CFR 101.3, Annual Real Property Inventories.

r. 41 CFR 102, Federal Management Regulation.

s. 41 CFR Subtitle C, Chapter 109, Department of Energy Property Management Regulations.

t. 48 CFR 45.509, Federal Acquisition Regulation, Care, Maintenance, and Use.

u. 48 CFR 945.102-71, Maintenance of Records.

v. 48 CFR 970.5204-2, Integration of Environment, Safety and Health into Work Planning and Execution.

w. 48 CFR 970.5204-78, Laws, Regulations, and DOE Directives.

x. DOE Personal Property Letter 970-3, High-Risk Personal Property.

y. Executive Order 12344, Naval Nuclear Propulsion Program.

z. Public Law 106-65, National Defense Authorization Act for Fiscal Year 2000; Section 3216(c), Deputy Administrator for Naval Reactors (50 U.S.C. 2406).

7. CONTACT. Questions concerning this Order should be addressed to Charles B. Ramsey, EH-53/270CC, U.S. Department of Energy, 19901 Germantown Road, Germantown, Maryland 20874; phone, 301-903-5999; facsimile, 301-903-6172.

SPENCER ABRAHAM
Secretary of Energy

CONTRACTOR REQUIREMENTS DOCUMENT

DOE O 433.1, MAINTENANCE MANAGEMENT PROGRAM FOR DOE NUCLEAR FACILITIES

The requirements contained in this Contractor Requirements Document (CRD) are in addition to other independent requirements, including but not limited to those required by 48 CFR 45.509, Care, Maintenance, and Use, and DOE O 430.1A, *Life Cycle Asset Management*. Taken together, these items constitute the minimum elements of an acceptable nuclear facility maintenance management program. Regardless of the performer of the work, contractors are responsible for compliance with the requirements of this Order. Contractors are responsible for flowing down the requirements of this Order to subcontractors and suppliers at any tier necessary to ensure the contractors' work requirements and item specifications are met.

The maintenance management program should be developed in an integrated manner. Other regulations and Orders independent of this CRD that apply to nuclear facility maintenance programs include the following:

- DOE O 414.1A, *Quality Assurance*.
- DOE O 420.1A, *Facility Safety.*
- DOE G 424.X-X, *Implementation Guide for Use in Addressing Unreviewed Safety Question Requirements.* (Draft).
- DOE O 430.1A, *Life Cycle Asset Management*.
- DOE G 433.1-1, *Nuclear Facility Maintenance Management Program Guide for use with DOE O 433.1* (Draft).
- DOE O 440.1A, *Worker Protection Management for DOE Federal and Contractor Employees*.
- DOE G 440.1-6, *Implementation Guide for Use With Suspect/Counterfeit Requirements of DOE O 440.1, Worker Protection Management; 10 CFR 830.120; and DOE 5700.6C, Quality Assurance*.
- DOE P 450.4, *Safety Management System Policy*.
- DOE G 450.4-1B, *Integrated Safety Management System Guide for Use with Safety Management System Policies (DOE P 450.4, DOE P 450.5, and DOE P 450.6); the*

Functions, Responsibilities, and Authorities Manual; and the Department of Energy Acquisition Regulation, Volumes I and II.

- DOE 5400.5, *Radiation Protection of the Public and the Environment.*
- DOE 5480.19, *Conduct of Operations Requirements for DOE Facilities.*
- DOE 5480.20A, *Personnel Selection, Qualification, and Training Requirements for DOE Nuclear Facilities.*
- DOE Personal Property Letter 970.3, High-Risk Personal Property.
- DOE-HDBK-1003-96, *Guide to Good Practices for Training and Qualification of Maintenance Personnel*.
- DOE-HDBK-1206-98, *Guide to Good Practices for On-The-Job Training.*
- DOE-STD-1029-92, *Writer's Guide for Technical Procedures.*
- DOE-STD-1039-93, *Guide to Good Practices for Control of Equipment and System Status.*
- DOE-STD-1073-93, *Guide for Operational Configuration Management Program.*
- 10 CFR 830, Nuclear Safety Management; Subpart A, Quality Assurance Requirements.
- 10 CFR 830, Nuclear Safety Management; Subpart B, Safety Basis Requirements.
- 10 CFR 830.121, Quality Assurance Program.
- 10 CFR 830.122, Quality Assurance Criteria.
- 10 CFR 830.204, Documented Safety Analysis.
- 10 CFR 835, Occupational Radiation Protection.
- 29 CFR 1910.119, Process Safety Management of Highly Hazardous Chemicals.
- 41 CFR 101, Federal Property Management Regulations.
- 41 CFR 101.3, Annual Real Property Inventories.
- 41 CFR 102, Federal Management Regulations.

- 41 CFR Subtitle C, Chapter 109, Department of Energy Property Management Regulations.
- 48 CFR 45.509, Federal Acquisition Regulation, Care, Maintenance, and Use.
- 48 CFR 945.102-71, Maintenance of Records.
- 48 CFR 970. 5204-2, Integration of Environment, Safety and Health into Work Planning and Execution.
- 48 CFR 970.5204-78, Laws, Regulations, and DOE Directives.

REQUIREMENTS

1. Develop and submit for DOE approval a Maintenance Implementation Plan (MIP) that clearly defines the following:

    a. structures, systems, and components (SSCs) included in the program (typically all those safety SSCs or other vital safety systems identified in the nuclear facility safety basis, those that are critical to mission objectives or facility operations, or those that may be desirable for inclusion in the maintenance program for other reasons) [10 CFR 830.204(b)(5)];

    b. periodic inspection of SSCs and equipment to determine whether degradation or technical obsolescence threatens performance and/or safety;

    c. the management systems used to control maintenance activities associated with the defined SSCs (these include work control, post-maintenance testing, material procurement and handling, and control and calibration of test equipment);

    d. the assignment of roles and responsibilities;

    e. the interfaces between the maintenance organization and other organizations (e.g., operations, engineering, training); and

    f. the integration of the maintenance management program with—

        (1) the ISMS established by DOE P 450.4 and 48 CFR 970.5204-2;

        (2) the life-cycle management programs under DOE O 430.1A [see 10 CFR 830.121(c)(2) and 10 CFR 830.122(a); DOE G 450.4-1B; ISMS Principles 1 and 2 and ISMS Function1];

(3) any required nuclear safety basis established under 10 CFR Part 830, Subpart B; and

(4) a Quality Assurance Program established under 10 CFR Part 830, Subpart A.

g. a configuration management process to ensure the integrity of the identified nuclear facility safety SSCs using a graded approach. [See DOE-STD-1073-93; 10 CFR 830.122(d) and (e).]

h. a prioritization process that places proper emphasis on safety requirements, the maintenance backlog, system availability, and requirements for those infrastructure elements identified as part of the nuclear facility safety basis.

i. a process for feedback and improvement based on relevant information from the results of operations, maintenance, and assessment efforts. [See 10 CFR 830.122(c), (i), and (j); and DOE G 450.4-1B, ISMS Function 5.]

j. a systems engineer program for the management of vital safety systems that is consistent with DOE O 420.1A and designates a "system engineer" with—

(1) the requisite knowledge of the system safety design basis and operating limits from the safety analysis and

(2) the lead responsibility for the configuration management of the design.

k. accurate maintenance history that compiles structures, systems, and components data and other maintenance, resource, and cost data in a system which is retrievable and capable of entering required-maintenance costs, actual maintenance costs, and availability data and failure rates for mission-critical and safety SSCs into the DOE Facility Information Management System (see DOE O 430.1A and DOE G 433.1-1, Section 4.15).

2. The contractor maintenance management program should establish metrics to measure the performance of the program and incorporate appropriate voluntary consensus standards.

3. The contractor maintenance management program should address the following elements, as appropriate:

a. Maintenance Organization and Administration. The organization and administration of the maintenance function must ensure a high level of maintenance performance through effective implementation and control of maintenance activities. [See DOE G 433.1-1, Section 4.1; 10 CFR 830.122(a) and 10 CFR 830.121(c)(4); and DOE G 450.4-1B, ISMS Principles 1, 2 and 7.]

b. Training and Qualification of Maintenance Personnel. A maintenance training and qualification program must be implemented to develop and maintain the knowledge and skills needed by maintenance personnel to effectively perform maintenance activities. [See DOE 5480.20A; DOE O 414.1A; DOE G 433.1-1, Section 4.2; DOE-HDBK-1206-98; DOE-HDBK-1003-96; 10 CFR 830.122(b); and DOE G 450.4-1B, ISMS Principle 3.]

c. Maintenance Facilities, Equipment, and Tools. Maintenance facilities, equipment, and tools should efficiently support nuclear facility maintenance and maintenance training. [See DOE G 433.1-1, Section 4.3.]

d. Types of Maintenance. Corrective and preventive maintenance should be balanced properly to provide a high degree of confidence that nuclear facility equipment degradation is identified and corrected, that equipment life is optimized, and that the maintenance program is cost effective. [See 48 CFR 45.509; DOE G 433.1-1, Section 4.4; 10 CFR 830.122(c) and (e); and DOE G 450.4-1B, ISMS Principle 4 and ISMS Function 1.]

e. Maintenance Procedures. Maintenance procedures and other work-related documents (e.g., drawings and instructions) must be prepared and used to provide appropriate work direction and to ensure that maintenance is performed safely and efficiently. [See DOE G 433.1-1, Section 4.5; DOE-STD-1029-92; 10 CFR 830.122(d) and (e); and DOE G 450.4-1B, ISMS Principles 5 and 6 and ISMS Functions 4 and 5.]

f. Planning, Scheduling, and Coordination of Maintenance. An effective system for planning, scheduling, and coordinating maintenance activities is implemented to—

(1) ensure that maintenance, including surveillances associated with Technical Safety Requirements (TSRs), is accomplished in a timely manner;

(2) improve maintenance efficiency;

(3) reduce chemical and physical hazard radiation exposure (ALARA);

(4) increase equipment availability;

(5) ensure worker safety through training and proper use of personal protective equipment; and

(6) ensure hazardous waste is properly segregated, treated, or disposed.

[See DOE G 433.1-1, Section 4.6; 10 CFR 830.122(a); and DOE G 450.4-1B, ISMS Principles 1 and 4 and ISMS Function 1.]

g. Control of Maintenance Activities. Management involvement in control of maintenance activities should ensure that maintenance practices are effective in maintaining safe and reliable nuclear facility operation and are integrated with the work authorization and control requirements for conduct of operations requirements for DOE facilities. [See DOE 5480.19; DOE-STD-1039-93; DOE G 433.1-1, Section 4.7; 10 CFR 830.122(a) and (e); DOE G 450.4-1B, ISMS Principles 1, 2, and 7 and ISMS Function 4.]

h. Postmaintenance Testing. Postmaintenance testing should be performed to verify that components will fulfill their design function when returned to service after maintenance. [See DOE-STD-1039-93; DOE G 433.1-1, Section 4.8; and 10 CFR 830.122(h).]

i. Procurement of Parts, Materials, and Services. Parts, materials, and services required for maintenance activities should be available when needed. [See DOE G 433.1-1, Section 4.9; DOE G 440.1-6; and 10 CFR 830.122(g).]

j. Receipt, Inspection, Handling, Storage, Retrieval, Issuance, and Disposal Turn In of Personal Property. All phases of receiving, inspecting, handling, storing, retrieving, issuing, and turning in for disposal of personal property used for maintenance should be covered by effectively implemented policies and procedures; suspect and counterfeit item control requirements; and, as appropriate, high-risk personal property management and control requirements from the time an item is received [for installation] in or maintenance of the nuclear facility until it is turned in for disposal. [See DOE O 414.1A; DOE O 440.1A; DOE G 433.1-1, Section 4.10; DOE G 440.1-6; DOE Personal Property Letter 970-3; and 10 CFR 830.122(g).]

k. Control and Calibration of Measuring and Test Equipment. The program for control and calibration of measuring and test equipment should be consistent with quality assurance requirements and ensure the accurate performance of nuclear facility instrumentation and equipment for testing, calibration, and repairs. [See DOE O 414.1A; DOE G 433.1-1, Section 4.11; and 10 CFR 830.122(e) and (h).]

l. Maintenance Tools and Equipment Control. Methods should be established to provide for storage, issuance, and maintenance of an adequate and readily available supply of tools and equipment and also for the development of special tools and equipment needed in the maintenance program. [See DOE G 433.1-1, Section 4.12 and 10 CFR 830.122(e).]

m. Facility Condition Inspection. Management should conduct periodic inspections and direct independent assessments of equipment and facilities to ensure safe nuclear facility condition and housekeeping and to meet the fire protection and natural hazard phenomena mitigation requirements of DOE O 420.1A, *Facility Safety*. [See DOE O 420.1A; DOE G 433.1-1, Section 4.13; and 10 CFR 830.122(h) and (j).]

n. Management Involvement. Contractor corporate and nuclear facility managers should be sufficiently involved with nuclear facility operations to be technically informed and personally familiar with conditions at the operating nuclear facility. [See DOE G 433.1-1, Section 4.14 and 10 CFR 830.122(a) and (i).]

o. Maintenance History. A maintenance history and trending program should be maintained to document data, provide historical information for maintenance planning, and support maintenance and performance trending of nuclear facility systems and components; all records and documentation should be maintained according to the approved site-specific Records Retention and Disposition Schedule. [See DOE G 433.1-1, Section 4.15; DOE O 200.1; and 10 CFR 830.122(d).]

p. Analysis of Maintenance Problems. Systematic analysis should be used to determine and correct root causes of unplanned occurrences related to maintenance. [See DOE-NE-STD-1004-92; DOE G 433.1-1, Section 4.16; and 10 CFR 830.122(c).]

q. Modification Work. Nuclear facility modification work, including temporary modifications, should be accomplished under the same basic administrative controls as those applied to nuclear facility maintenance activities so that risk to the facility, equipment, environment, or personnel does not increase because of the modification work. [See DOE-STD-1039-93; DOE G 433.1-1, Section 4.17; DOE-STD-1073-93; 10 CFR 830, Subparts A and B; and DOE G 450.4-1B, ISMS Principle 7 and ISMS Function 4.] These controls should be integrated with—

(1) safety basis, nuclear safety, fire protection, and natural hazard phenomena mitigation [see DOE O 420.1A];

(2) pressure safety and suspect and counterfeit item control [see DOE O 440.1A]; and

(3) control of equipment and system status [see DOE 5480.19].

r. Seasonal Facility Preservation. A program should be in place to prevent equipment and building damage due to weather conditions. [See DOE G 433.1-1, Section 4.18; 10 CFR 830.120(c)(2)(i); and 10 CFR 830.122(e).]

4. Confirm that the nuclear facility maintenance management program established under DOE 4330.4B remains effective until it is updated to meet the requirements of DOE O 433.1.

5. The contractor will review and update the MIP every 2 years and submit any changes to DOE for approval.