High-Level Waste Storage Tank Farms/242-A Evaporator Standards/Requirements Identification Document (S/RID), Vol. 3

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- Contains no Limited-Use information
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Volume 1	Revision
Management Systems	1
Configuration Management	1

Volume 2	
Quality Assurance	0
Training and Qualification	1
Emergency Planning and Preparedness	1
Construction	1

Volume 3	
Safeguards and Security	0
Engineering Design	1
Maintenance	0

Volume 4	
Radiation Protection	0
Operations	0

Volume 5	
Fire Protection	1
Packaging and Transportation	2

Volume 6	
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REQUIREMENTS

IDENTIFICATION

DOCUMENT

FACILITY:

HIGH LEVEL WASTE STORAGE
TANK FARMS/242-A
EVAPORATOR

FUNCTIONAL AREA:

Safeguards and Security

REVISION 0

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6.0 SAFEGUARDS AND SECURITY

INTRODUCTION

SCOPE

The Safeguards and Security (S & S) Functional Area includes the S & S programs, systems, controls, activities, and personnel involved in executing the mission of the Tank Farm Facility.

Numerous S & S responsibilities are performed on behalf of the Tank Farm Facility by site level organizations. Certain other responsibilities are shared, and the remainder are the sole responsibility of the Tank Farm Facility. This Requirements Identification Document describes a complete functional Safeguards and Security Program that is presumed to be the responsibility of the Tank Farm Facility unless otherwise designated.

The following list identifies the programmatic elements in the Safeguards and Security Functional Area:

1. Program Management
2. Protection Program Scope and Evaluation
3. Personnel Security
4. Physical Security Systems
5. Protection Program Operations
6. Material Control and Accountability
7. Information Security
8. Key Program Interfaces

PHYSICAL BOUNDARIES

The physical boundaries within which the requirements of this functional area apply are the Single-Shell Tank Farms; the Double-Shell Tank Farms; the 242-A Evaporator-Crystallizer; the 242-S,T Evaporators; the Liquid Effluent Retention Facility (LERF); the Purgewater Storage Facility (PWSF), and all interconnecting piping, valves, instrumentation, and controls up to and including the last locked valve (under the control of the Tank Farm Facility) associated with facilities that interface the Tank Farm Facility.

SAFEGUARDS AND SECURITY BOUNDARIES

For to a variety of reasons, including the strategic and economic significance of the nuclear material involved, certain basic S & S requirements are not applicable to the Tank Farm Facility and therefore are not included in this Requirements Identification Document. The S & S boundaries which substantiate that these requirements are not applicable to the Tank Farm Facility are as follows:

1. The nuclear material involved has been previously declared waste, has been written off the MC&A books, and is currently under the control of a waste management

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organization. (Per DOE Order 5633.3A)

2. The nuclear material involved is Category IV, Attractiveness Level E or lesser. (Per DOE 5633.3A)
3. The following are not present in the Tank Farm Facility:
 - a. Vital equipment (Per DOE Order 5632.2A)
 - b. Classified computer systems (Per DOE Order 5639.6)
 - c. Nuclear material surveys (Per DOE Order 5634.1B)
 - d. Security alarm systems
 - e. Personnel Security Assurance Program (PSAP) positions (Per DOE Order 5631.6A)

SPECTRUM OF REQUIREMENTS

The Safeguards and Security (S & S) Functional Area addresses the programmatic and technical requirements, controls, and standards which assure compliance with applicable S & S laws and regulations.

The Washington Administrative Code and Federal regulations such as 10 CFR Parts 95, 710, 1016, and 1017 are source documents for S & S requirements pertaining to physical security, personnel security, and information security. The following DOE Orders are also the major sources for the S & S requirements in this Requirements Identification Document:

- DOE Order 5630 Series - Program Management
- DOE Order 5631 Series - Personnel Security
- DOE Order 5632 Series - Protection Program
- DOE Order 5633 Series - Material Control and Accountability
- DOE Order 5635 Series - Information Security
- DOE Order 5639 Series - Information Security
- DOE Order 5650 Series - Information Security

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6.1

PROGRAM MANAGEMENT

An effective Safeguards and Security Program should utilize a comprehensive management system which:

- Clearly defines program policy and organization, including program definition, structure, and deviations;
- Supports a thorough planning function, including programmatic direction for major planning documents and specific guidance for relevant management issues;
- Provides program administration, including document/records management, quality assurance controls, budgetary measures, and resource management for personnel and equipment; and
- Identifies general criteria for personnel selection, qualification, and training.

The components of this program management system may be addressed through execution of facility-specific practices, through facility implementation of common site approaches, or through direct facility support in collaborative S&S efforts.

The general aspects of program management which are applicable to the Tank Farm Facility are presented in the Requirements Identification Document for the Management Systems Functional Area. The unique aspects of program management for Safeguards and Security at the Tank Farm Facility are discussed in the subelements that follow.

6.1.2

Program Planning

6.1.3

Program Administration

The Program Management Element of the Safeguards and Security Program should include program administrative functions to ensure that safeguards and/or security systems, equipment, activities, and personnel are receiving the support and service necessary to maintain a successful S&S program.

Program administration should address document and records management, quality assurance controls, program budgets, and resource requirements for personnel and equipment.

SITE REQUIREMENT SOURCE: DOE5630.17 Preamble, Section 7

"POLICY AND OBJECTIVES.

- a. It is Departmental policy to standardize S&S equipment and systems where operational and financial benefits can be achieved.
- b. The objectives of this program are to determine where equipment standardization is appropriate and to achieve cost savings and other efficiencies through the examination and implementation of procurement alternatives, including full and open competition wherever possible."

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6.1.3.1

Document and Records Management

The Program Administration Subelement of the Safeguards and Security Program should include a document and records management system which provides current and accurate documentation on safeguards and/or security systems, equipment, materials, information, and personnel and which specifies consistent methods for the preparation, processing, issuance, use, and destruction of this documentation.

Programmatic measures should address the development and revision of directives, procedures, instructions, and manuals that are generated in response to S&S requirements, threat guidance and facility-specific provisions. Other programmatic controls should establish a process for ensuring that the level of detail contained in this documentation is commensurate with the complexity of the security issue involved and consistent with applicable facility commitments.

The document and records management system should also define controls governing documentation on routine operations, foreseeable contingencies, and abnormal or emergency situations. In addition, system measures should ensure that this documentation is current and readily available to protective forces or other S&S personnel.

SITE REQUIREMENT SOURCE: DOE1360.2B Preamble, Section 11.b

"The CPPM shall:

- (1) Implement and administer a management control process appropriate to the environment of the site to ensure that the sensitivity and/or essentiality of the information processed on a computer is determined by the owners of automated information and that appropriate administrative, technical, physical, and personnel protection measures and procedures are incorporated into all new and operational unclassified computer systems and unclassified computer applications processing sensitive information to achieve and sustain an acceptable level of security. (See paragraph 11c, below, for description of this management control process.)
- (2) Formulate, continually update, and annually review a CPP which will allow the appropriate approving (i.e., site management) or reviewing (e.g., a DOE Field Office) authorities to judge the comprehensiveness and effectiveness of the computer protection program. In cases where multiple computer installations, computer systems, or program-area applications exist, multiple plans may be appropriate. (See paragraph 11d, below, for a description of the required contents of a CPP.)
- (3) Develop and implement procedures establishing controls designed to prevent misuse and abuse of unclassified computer resources. (See paragraph 11e, below, for a description of controls.)
- (4) Develop and implement a process, as appropriate, for providing contingency planning and reasonable continuity of operations for unclassified computer systems and unclassified computer applications supporting mission-essential functions in the event of a disruption to normal operations. (See paragraph 11h, below, for a description of this process.)
- (5) Develop and implement procedures for reporting significant UCS incidents, as described in Attachment 3.
- (6) Ensure that plans are developed and implemented for conducting continuous computer

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security awareness and training to assure that DOE and DOE contractor personnel involved in managing, designing, developing, operating, maintaining unclassified computer applications processing sensitive information, and who use unclassified computer systems are aware of their security responsibilities, know how to fulfill them, are kept aware of vulnerabilities, and are trained in techniques to enhance security.

(7) Coordinate the requirements of this Order and related computer security matters with organizations/individuals having responsibilities for telecommunications security and classified computer security."

6.1.4

Training and Qualification

6.1.4.1

Selection and Qualification

6.1.4.2

Training and On-Shift Training

The Training and Qualification Subelement of the Safeguards and Security Program should develop, implement, and manage a comprehensive training program to ensure that individuals are qualified to perform the assigned S&S tasks and responsibilities. The level of training conducted should be commensurate with the complexity and scope of the S&S activity.

Programmatic measures should address the review of formal and on-shift training needs, the development of appropriate training materials, the evaluation of program and instructor effectiveness, the incorporation of lessons learned from S&S incidents or events, the documentation of training activities, and the maintenance of training records.

SITE REQUIREMENT SOURCE: DOE1360.2B Preamble, Section 11.b

"The CPPM shall:

(1) Implement and administer a management control process appropriate to the environment of the site to ensure that the sensitivity and/or essentiality of the information processed on a computer is determined by the owners of automated information and that appropriate administrative, technical, physical, and personnel protection measures and procedures are incorporated into all new and operational unclassified computer systems and unclassified computer applications processing sensitive information to achieve and sustain an acceptable level of security. (See paragraph 11c, below, for description of this management control process.)

(2) Formulate, continually update, and annually review a CPP which will allow the appropriate approving (i.e., site management) or reviewing (e.g., a DOE Field Office) authorities to judge the comprehensiveness and effectiveness of the computer protection program. In cases where multiple computer installations, computer systems, or program-area applications exist, multiple plans may be appropriate. (See paragraph 11d, below, for a description of the required contents of a CPP.)

(3) Develop and implement procedures establishing controls designed to prevent misuse and abuse of unclassified computer resources. (See paragraph 11e, below, for a description of controls.)

(4) Develop and implement a process, as appropriate, for providing contingency planning and

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reasonable continuity of operations for unclassified computer systems and unclassified computer applications supporting mission-essential functions in the event of a disruption to normal operations. (See paragraph 11h, below, for a description of this process.)

(5) Develop and implement procedures for reporting significant UCS incidents, as described in Attachment 3.

(6) Ensure that plans are developed and implemented for conducting continuous computer security awareness and training to assure that DOE and DOE contractor personnel involved in managing, designing, developing, operating, maintaining unclassified computer applications processing sensitive information, and who use unclassified computer systems are aware of their security responsibilities, know how to fulfill them, are kept aware of vulnerabilities, and are trained in techniques to enhance security.

(7) Coordinate the requirements of this Order and related computer security matters with organizations/individuals having responsibilities for telecommunications security and classified computer security."

6.2

PROTECTION PROGRAM SCOPE AND EVALUATION

6.2.1

Vulnerability Analyses and Assessments

The Protection Program Scope and Evaluation Element of the Safeguards and Security Program should include vulnerability analyses or assessments to evaluate the potential for theft, diversion, sabotage, unauthorized access, or any other hostile activity which might adversely impact national security or the health and safety of employees and the public.

In particular, vulnerability analyses and assessments should identify weaknesses which would otherwise make facility property, materials, and/or information vulnerable to exploitation by government adversaries.

Initial protection measures should consider the target at risk and the attractiveness level of the material involved, if appropriate. The vulnerability analysis should then define the type of facility threat to be expected, evaluate of the potential threat scenarios, and identify the associated vulnerabilities in the facility.

6.2.2

Security and Nuclear Material Surveys

The Protection Program Scope and Evaluation Element of the Safeguards and Security Program should ensure that security surveys are conducted initially and periodically thereafter to verify safeguards adequacy within a facility.

Programmatic controls should address survey frequency, scope, exceptions, methodology, resources to be used, qualification and training of survey team personnel, communications with involved parties, the review of applicable files, and related Master Safeguards and Security Agreement (MSSA) conditions.

A process for documenting and reporting survey results should also be developed. Survey documentation should include survey ratings, narrative text, program strengths and weaknesses, compliance segment results, performance segment results, deficiencies, concerns, and suggested program enhancements.

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The requirements associated with nuclear material surveys are not applicable

SITE REQUIREMENT SOURCE: DOE5634.1B Chapter IV, Section 7

"PERFORMANCE SEGMENT. Surveys of facilities shall include a performance evaluation to assess the capability of the safeguards and security system to meet performance objectives. The performance evaluation shall determine system performance against scenarios for applicable threats/targets."

SITE REQUIREMENT SOURCE: DOE5634.1B Chapter VI, Section 3

"USE OF THE "Marginally Satisfactory" RATING. A facility shall not be assigned

a survey rating of Marginally Satisfactory for consecutive survey periods unless the following conditions apply:

- a. The previous survey which resulted in a composite survey rating of Marginally Satisfactory identified different deficiencies and reasons for the rating.
- b. The deficiencies and reasons which were the basis for the previous Marginally Satisfactory composite survey rating were related to the completion of a major line-item construction project. In that case, acceptable interim measures must have been implemented and physically verified pending completion of the construction. These interim measures shall be documented in the survey report."

SITE REQUIREMENT SOURCE: DOE5634.1B Chapter VI, Section 4

"USE OF UNSATISFACTORY RATING. If either of the conditions cited in paragraphs 3a or b, above, are not met, an Unsatisfactory rating shall be assigned."

SITE REQUIREMENT SOURCE: DOE5634.1B Chapter VI, Section 5

"CORRECTIVE ACTIONS AND SURVEY RATINGS. A composite nuclear materials and/or security survey rating which must be based on conditions existing when the rating was assigned. Shall be stated in the survey report, ratings shall not be based upon future corrective actions. If corrective actions have been taken in the interval between the performance of the onsite survey and the assignment of the composite survey rating, the final rating should reflect these actions."

SITE REQUIREMENT SOURCE: DOE5634.1B Chapter VI, Section 8

"PERFORMANCE. The rating for the set of exercises, system studies, and technical evaluations, constituting the performance segment of the survey, shall be based on an evaluation of the degree to which the elements of the safeguards or security system meet protection objectives."

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6.2.3 **Control Facility Approvals**

6.2.4 **System Performance Tests**

The Protection Program Scope and Evaluation Element of the Safeguards and Security Program should utilize a performance testing program to initially and periodically confirm the adequacy and effectiveness of safeguards and/or security systems. The performance testing program should validate functional requirements of the total system, as well as individual system components.

In addition, the testing program should ensure that safeguards and/or security systems accomplish their intended purpose. Critical system elements, including S&S equipment, procedures, and/or personnel, should be tested to verify continued functionability, operability, effectiveness and/or performance.

Programmatic measures for the performance testing program should address the set of tests to be performed, the conduct of announced and/or unannounced tests, the frequency of testing, test methodology, evaluation and acceptance criteria, the reporting of test results, the review process for identified deficiencies having safeguards impact, corrective action requirements, and test program documentation.

SITE REQUIREMENT SOURCE: DOE5630.13A Preamble, Section 7.c

"The MSSA includes statements of the facility's safeguards and security performance levels based on the status of several complementary performance indicators such as the results of vulnerability assessments, system performance tests, surveys, inspections, evaluations, and training levels as well as the field element managers' judgment of the effectiveness of the protection system."

6.3 **PERSONNEL SECURITY**

An effective Safeguards and Security Program should grant individuals access to sensitive areas or information only after it has been determined that such access will not endanger national security or the health and safety of employees and the public. The qualification criteria used to grant such access, the degree of access provided, and the corresponding level of security training provided should be determined by a graded approach based on the individual's professional responsibilities and associated need-to-know principles.

To ensure these policies are specifically addressed, an effective Safeguards and Security Program should utilize a personnel security program which:

- Implements a detailed personnel clearance program,
- Incorporates comprehensive security education and awareness measures,
- Establishes appropriate controls for classified visits,
- Supports and monitors unclassified visits and assignments, and
- Maintains adequate personnel security assurance activities.

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6.3.1

Personnel Clearance Program

The Personnel Security Element of the Safeguards and Security Program should include a personnel clearance program which determines the qualification and continuing eligibility of individuals requiring access to facility areas, materials, and/or information.

The highest classification of facility area, materials, and/or information to which the individual will permitted access should determine the level of the security clearance issued. For operational purposes, the number and level of security clearances issued should be kept to a minimum.

Programmatic controls should address the issuance, usage, and termination of personnel security clearances. Specific measures should define processes relating to access authorization requests, personnel screening methods, interim access authorizations, the continuation of existing authorizations, essential security briefings, the release or transmittal of personnel security files, foreign travel situations, changes in marital status, and cases requiring reevaluation or reinvestigation.

SITE REQUIREMENT SOURCE: DOE5631.1B Preamble, Section 13

"FOREIGN TRAVEL BRIEFINGS.

- a. Purpose. These briefings are designed for all travelers who hold or have held a DOE access authorization within the last 5 years, and who are traveling to sensitive countries. The purpose of the briefings is to alert those travelers to potential intelligence threats and threats to personal safety and to inform them of defensive measures that can be used to counter these threats. The briefing also provides knowledge of laws, regulations, and other directives governing the activities of the traveler, along with background information and travel advisories applicable to the destination country(ies). While briefings are primarily for personnel with access authorizations traveling to sensitive countries, they should also be made available to other individuals such as uncleared personnel who may be traveling to sensitive countries, to or through countries where terrorism is a known threat, or to countries for which travel advisories exist.
- b. Scheduling. Individuals who hold or have held DOE access authorizations within the last 5 years and who plan to travel to sensitive countries, whether on official or unofficial travel, are responsible for notifying their local security office, which will conduct the foreign travel briefing, at least 45 days prior to the planned departure date. Local security officials shall schedule the foreign travel briefing as close to the departure date as possible to ensure the latest information is included. If such a briefing has been provided to the individual within the past 6 months another briefing is not required.
- c. Subjects. Travelers may be briefed on general security precautions by viewing the current foreign travel defensive briefing video. The following points should be communicated to the traveler:

(1) Travelers may be the target of hostile intelligence services while in sensitive countries. Possible methods and approaches should be discussed.

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- (2) Travelers should be circumspect in their activities to avoid situations which could be compromising.
- (3) Travelers should not carry pornographic materials, prohibited drugs, or, in some cases, religious materials.
- (4) Travelers should not engage in illegal black market activity or money exchanges.
- (5) Restrictions may apply to photography and religious dealings with local citizens.
- (6) Foreign travel exceeding 3 months, not involving official U.S. Government business, will result in the termination of access authorization.
- (7) Most current travel advisory.
- (8) If travelers are approached or contacted by anyone seeking access to classified or sensitive information or if they believe they have been targeted for attempted exploitation by a foreign entity, they should not overreact, but they should report the incident to the nearest accessible U.S. embassy or consulate and submit a report as detailed in paragraph 13d(1).
- (9) Country-related background information.
- (10) Laws, regulations, and directives governing visitors to the country(ies) in which they are traveling.

d. Debriefings.

- (1) The local DOE security office shall be informed as soon as the traveler returns to his or her duty station, or sooner if appropriate. If appropriate, a hostile contact report should be submitted under the provision of National Security Decision Directive 197 and SA-10 should be notified through security channels.
- (2) Travelers making reports under subparagraph d(1) above shall be thoroughly debriefed by the local security office as to any security or other concerns arising as a result of the foreign travel."

SITE REQUIREMENT SOURCE: DOE5631.2C Chapter I, Section 1.d

"The use of interim access authorizations shall be kept to the absolute minimum and considered only when properly requested in accordance with the requirements of Chapter IV."

6.4

PHYSICAL SECURITY SYSTEMS

6.5

PROTECTION PROGRAM OPERATIONS

6.5.1

Unclassified Facility and Property Protection

6.5.2

Security Badges and Passes

The Protection Program Operations Element of the Safeguards and Security Program should utilize a security badge system for personnel identification purposes. This system should also

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be used to indicate access approvals and/or limitations pertaining to facility entry and exit controls.

All facility security badges should adhere to standard badge format. In addition, programmatic controls should be established to govern the issuance, use, and termination of facility security badges.

SITE REQUIREMENT SOURCE: DOE5632.9A Attachment 2

*General. As set forth in DOE 5632.9A, Paragraph 7b, there shall be a standard badge format for all badges issued by DOE and DOE contractor organizations. The badge designs shall resemble the design provided in Figure 1. Other functional designs may be approved by the Head of Field Element or the Director of the Office of Safeguards and Security at DOE Headquarters. The intent is to provide some level of visual consistency within the DOE complex which will make it easier for protective personnel to locate the required information.

Each facility is given some flexibility in designing the badge. The front of the badge is divided into three zones. The required information must be somewhere in the appropriate zone. This will provide DOE with badges that are similar by having all of the required information on the badge front and rear, yet sufficiently different to distinguish badges issued by the various facilities. A prescribed area (the bottom zone and the area adjacent to the photograph) on the badge front is designated for the facilities to use for site-specific applications.

Specific locations for the information on the badge are not specified. However, zones are provided for where the information is to be located. The information should be on the badge within the area of that zone. Zone size and lettering height are specified in Figure 1.

II. Design Specifications

A. Front Design

The basic front design is shown in Figure 1. The upper zone (zone 1) shall contain the serial number, the issuing office, and a portion of the DOE seal. The middle zone (zone 2) shall contain the photograph, the clearance designation, the facility logo/ symbol, and a portion of the DOE seal over the photograph. The DOE seal shall be a hologram. The lower zone (zone 3) shall contain the badge holders affiliation (white - DOE Federal employees, yellow - contractor employees).

1. Dimensions

Figure 1 and Table 1 show the dimensions that are common to all badge types and their locations.

2. Photograph

The photograph shall measure no less than 1.250 inches x 1.500 inches. The photograph shall be located according to Figure 1. The photograph should not be located directly over the mag stripe on the rear of the badge.

3. DOE Seal

Figure 1 shows the location of the DOE seal. The seal shall be a light blue in color and

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semitransparent so as to be readily visible when laminated but not to obscure the details of the underlying information (i.e. photograph, printing, etc.). The seal shall be printed on the inside of the front overlamine.

4. Serial Number

A unique serial number shall be printed in black ink on the front of each badge for badge/insert accountability purposes. The minimum letter height is 0.0938 inches.

5. Site Issuing Office Name

The site issuing office name shall be located in the upper zone as shown in Figure 1.

6. Background Color

The background color for the front of the badge is based on the clearance level for the badge. Colors (referenced by the Pantone Matching System color number) for the clearance levels are:

Q - 367C (green)
L - 163U (orange)
TS - 291U (blue)
S - 465C (brown)
V - 485C (red)
bar - 128U (gold)

The background color for uncleared visitors is red.

7. Clearance Designator

The clearance designator is to be placed to the left of the photograph as shown in Figure 1. Valid designators are: Q, TS, L, and S. The minimum letter height is 0.5 inches.

8. Site Logo

The site logo should be located in zone 2 as shown in Figure 1.

9. Employee Name

The employee name may be located in either zone 2 or 3.

10. Expiration Date

Badges which require an expiration date shall have the expiration date shown in zone 3.

B. Rear Design

Information to be included is shown in Figure 2.

1. Rear Insert

The rear shall be white, except for the information message background, with all printing in

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black ink. The information background color shall correspond to the clearance level designation color defined in Section II A6. The rear of the badge shall have information dimensioned and located according to Figure 2. The information message should indicate that the badge, if found, be returned to the appropriate issuing office.

2. Bar Code

The rear of all badges shall have a minimum of one bar code printed on it. This bar code shall be located according to Figure 1 and shall use Code 39 symbology. The employee's social security number shall be encoded in the bar code. The bar code shall run parallel to the magnetic stripe.

III. Physical Standards

A. Dimensional Requirements

The finished laminated badge, complete with all inserts, shall meet the dimensional requirements set forth in Figure 1. The badge width shall be 2.125 inches and the badge length shall be between 3.375 inches minimum and 4.25 inches maximum. The hole for a badge clip shall be centered within 0.1875 inches from the end and no wider than 0.5625 inches to allow use of either a common insertion type reader or swipe type reader.

B. Thickness

The finished badge shall be between 0.030 inches minimum and 0.050 inches maximum.

C. Inner Core

The badge shall consist of an inner core containing the required printed information and shall have overlaminates on the front and rear to seal the assembled badge into a final, monolithic badge.

D. Materials Compatibility

All materials used in the construction of the badge shall be compatible so that when laminated, the badge shall bond into one monolithic unit for the life of the badge.

E. Durability

The security badge should be designed to have a functional life span of no less than 5 years.

F. Lamination

The finished badge should not have cracks, bubbles, or delaminations when assembled and laminated using the proper instructions and equipment.

G. Serial Number

Each security badge shall have a DOE complex wide, seven digit, unique serial number for badge and/or insert accountability. Serial numbers are to be controlled by the appropriate DOE Field Office and are prefixed (first digit) by that field office's designator. Field office designators are as follows:

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Headquarters, Forrestal A or B
Headquarters, Germantown C or D
Albuquerque Field Office E or F
Chicago Field Office G or H
Idaho Field Office I or J
Nevada Field Office K or L
Oak Ridge Field Office M or N
Richland Field Office O or P
San Francisco Field Office R or S
Savannah River Field Office T or U
Pittsburgh Naval Reactors V or W
Naval Reactors Office X or Y

Refer to Section IIA for the serial number printing standard and Figure 1 for location and size. Each DOE Field Office shall assign the second alphanumeric digit to each facility assigned to that office. Five digits would remain to be assigned to personnel.

H. Magnetic Stripe Standards

1. Density

The badge packet shall have a 4,000 oersted, three track magnetic stripe tape.

2. Size and Placement

The magnetic stripe tape is to be placed on the rear of the finished badge. The magnetic stripe shall be sized and located on the finished badge in accordance with ANSI X4.16-1983, paragraph 6.2 (see Figure 2 of this document for the DOE adaptation of ANSI X4.16-1983).

3. Signal Level

During the lifetime of the badge, the data signal level as specified in ANSI X4.16-1983, paragraph 5.1, shall not be degraded by more than ten percent by the repeated application (i.e. twenty times) of any magnetic field of less than 3000 oersted at the surface of the magnetic stripe.

I. Protective Coating

The magnetic stripe should have a protective coating to enhance its resistance to abrasion, wear, and delamination. This coating must be of a thickness such that the reading of the magnetic signal will not be impaired.

J. Electronic Data

Standards for the electronic data to be stored on the magnetic stripe are contained in the DOE Security Badge Implementation Manual Volume II, Electronic Data Specification for the DOE Security Badge. The general electronic data format is shown in Figure 2. The placement of the electronic data shall be referenced from the bottom edge of the badge as illustrated in Figure 2."

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6.5.3

Protective Force Communications and Activities

The Protection Program Operations Element of the Safeguards and Security Program should address protective force communications and activities to provide for the prevention or deterrence of potential S&S threats. These measures should also provide for the timely response to suspected or actual incidents.

Protection operations should ensure that protective forces have the capability to communicate effectively during normal and emergency conditions without adverse impact on facility operations or equipment.

Other protective force measures should address facility, building and room surveillance; personnel access and badge compliance; communications equipment evaluation and support; and investigation of abnormal situations and suspicious activities.

SITE REQUIREMENT SOURCE: DOE5480.16 Chapter II General

***CHAPTER II**

OPERATIONS

1. BASIC CONSIDERATIONS. Activities through which the Department defines, develops, and implements its responsibilities under the Atomic Energy Act of 1954, as amended, Federal statutes, Executive orders, and other directives, for the protection of Restricted Data and other classified information or matter, nuclear weapons and nuclear weapon components, and for the protection of Department and contractor facilities, property, and equipment require the arming of certain Departmental and contractor employees. These employees, who include protective force personnel, Transportation Safeguards Division (AL) couriers, and Departmental safeguards and security staff personnel, shall not be authorized to carry a firearm until they have received appropriate safety training in the use of the firearms to be carried and have demonstrated their technical and practical knowledge of the contents of the manuals governing the safe use of those firearms. In addition, authorization to remain in armed status shall continue only if the employee redemonstrates his or her technical and practical knowledge of firearms safety semi-annually.

2. REQUIREMENTS.

- a. Semiautomatic and automatic weapons shall not be carried with a live round in a firing chamber except under conditions specifically authorized by the Deputy Assistant Secretary for Security Affairs or when there is an imminent life-threatening situation.
- b. All duty weapons shall be carried in the manner specified in the appropriate DOE instruction manual. Unless otherwise stated, from check-in to check-out a handgun shall always be in a holster and a rifle, shotgun, or submachine gun shall always be carried on an appropriate sling with the muzzle pointed up or down except where the weapon is designed to be carried in a different manner or operational conditions dictate otherwise. At no time shall a weapon be carried with fingers on the trigger or inside the trigger guard.
- c. When firearms are carried in vehicles or aircraft they shall be mounted in an appropriate rack or container when not held by an individual.

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- d. All personnel covered by this Order shall be required to comply with the personnel protective and safety rules in effect at each workplace.
- e. The loading or clearing of weapons shall take place only in an approved area or when the barrel of the weapon is in or pointing toward a bullet containment device. Each site shall have an approved procedure for loading and clearing firearms under field conditions when no bullet containment device is available.
- f. The routine loading and clearing of all weapons shall be witnessed by a supervisor.
- g. In the event of an unscheduled security alarm, the exercise controller shall suspend the exercise and release the shadow force to respond to the alarm. The exercise will not resume until the members of the shadow force are out of the exercise area.
- h. If the presence of alcohol or drugs is detected on a person, it shall be grounds for denial of the issuance of a firearm or removal from a duty station.
- i. Departmental Elements and contractors performing security operations shall develop specific site policies and procedures covering the safe transportation, handling, use, and storage of live ammunition, blank ammunition, riot agents, orthochlorobenzolmalononitrile (CS) and chloracetophenone (CN) liquid grenades (tear gas), smoke, and other explosive or incendiary devices used in firearms operations.
- j. Each field element shall perform analyses to determine what weapons can be used safely in each site for which it has responsibility.

3. WEAPONS MAINTENANCE.

- a. All sites, including the Central Training Academy, shall have (onsite, under contract offsite, or in association with another DOE site) an armorer with the knowledge, capability, and responsibility for inspecting, maintaining, and repairing all weapons available for use. The armorer and all other personnel shall be prohibited from modifying the basic design of a weapon or any of the weapon's operating or safety components without written approval from the Manager of Operations Office or, as applicable, DP-34.
- b. Armorers shall successfully complete a factory-authorized or U.S. military-approved training course for each weapon available for use at a site. In addition, armorers shall demonstrate proficiency in the following:
 - (1) Conducting weapons safety inspections;
 - (2) Performing minor repair of basic weapons;
 - (3) Assembling/disassembling the weapons used at the various sites;
 - (4) Rendering weapons safe, including confiscated weapons;
 - (5) Knowing the minimum and maximum tolerances associated with safe operation of all weapons in inventory at each site; and
 - (6) Identifying unapproved modifications to weapons.

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- c. Certification procedures for armorers shall be established by the Central Training Academy, which shall certify all DOE armorers. Recertification shall be required at least every 2 years or whenever there is a major change in firearms policy.
- d. The armorer shall inspect and certify for use all firearms in accordance with the recommendations of the manufacturer or the Central Training Academy, but not less often than semiannually.
- e. The armorer shall maintain accurate individual records on all weapons, including the name of manufacturer, model, serial number of weapon, inspection dates, and nature and date of any repair, in accordance with prescribed authorized schedules.
- f. The armorer shall inspect, and conduct test firings of, a firearm following any unusual operation of, occurrence with, or repairs to that firearm. Any weapon that has experienced an unusual operation shall be tagged "out-of-service" and segregated from operational weapons until certified by the armorers as safe to operate. Records of any unusual occurrence and subsequent inspection/test firing shall be maintained in accordance with prescribed authorized schedules."

SITE REQUIREMENT SOURCE: DOE5632.7 Chapter II, Section 1

"GUARDS. Guards shall observe and physically check locked repositories containing classified matter, man designated fixed access control points as appropriate, respond to protective alarms, and report any incident involving classified matter or Government property to a supervisor.

- a. Vehicle Operation. Guards must be able to operate all vehicles reasonably expected to be employed within their duty assignment.
- b. Communication Equipment. Guards must be able to operate all communication equipment reasonably expected to be employed within their duty assignment. They must be proficient in the use of accepted communication terminology, acronyms and phonetics, methods for verifying operators, and signaling duress.
- c. Laws, Policies and Procedures. Guards must be knowledgeable of and able to apply those site and facility policies and procedures governing their role in site protection. They must also be knowledgeable of Federal- and state-granted authority applicable to their assigned activities and the relative responsibilities between the protective force and local law enforcement agencies (LLEA) in both normal and contingency operations.
- d. Post and Patrol Operations.
 - (1) Guards must be familiar with and be able to apply all search and identification requirements governing the granting of access to and egress from the area they are protecting.
 - (2) Guards must be familiar with prohibited articles and be adept at their recognition. They must be familiar with the proper packages and authorizations required to move restricted materials in and out of security areas.
 - (3) Guards must be able to properly operate all personnel, vehicle, and package screening devices employed at their duty posts.

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(4) Guards must be knowledgeable of the required visitor and employee credentials, badges, passes, visitor escort regulations, and visitor logging procedures.

(5) Guards must be able to identify the various types and appearances of sensitive material being protected and the normal location, routine uses, and movements of the material at their duty posts.

(6) Guards must be knowledgeable of the requirements for, and be able to perform as escorts for, sensitive materials, such as classified matter or Government property.

(7) Guards must be knowledgeable of the facility property they are to protect and routine patrol duty requirements and be able to perform the duties of: checking buildings, rooms, and classified repositories to ensure that all classified matter is secure; responding to alarms; and noting indications of suspicious activity.

(8) Guards must be knowledgeable of and able to implement plans and procedures to protect the security of the site during disruptive events, such as fire, industrial disorders, civil disturbances, espionage, and sabotage.

(9) Guards must be proficient in methods of self defense.

(10) Guards must be proficient in elementary first aid practices.

(11) Guards must be familiar with basic fire fighting equipment and agents and their use."

SITE REQUIREMENT SOURCE: DOE5632.7 Chapter II, Section 4

"SPECIAL SKILLS. Protection of some facilities shall require individuals with additional special skills, such as tactical aircraft pilots, rappellers, explosive demolitionists, alarm station operators, canine handlers, and barricaded suspect/hostage negotiators. While the scope of such duties will be locally determined based on site-specific needs, all personnel assigned such duties must be proficient in their performance. To assess the proficiency of these skills the DOE standards and criteria shall be used if applicable. If not applicable local standards must be developed and approved by the Head of the Field Element."

SITE REQUIREMENT SOURCE: DOE5632.7 Chapter II, Section 5

"SUPERVISORY RESPONSIBILITIES. Supervisors shall:

- a. Be knowledgeable of the duties and qualifications of all supervised personnel.
- b. Be familiar with the basic operating functions of facilities for which they have protection responsibilities.
- c. Assure that their subordinates and their equipment are ready for duty at the start of each duty shift and inspect each duty post at least twice per shift, personally or by other means.
- d. Assure that all duty logs and reports have been properly completed, distributed, and acted upon."

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SITE REQUIREMENT SOURCE: DOE5632.7 Chapter IV, Section 1.d

"Communications Equipment for Protective Personnel. Protective force communications equipment shall provide multichannel capability with clear transmissions. It shall also exhibit the necessary degree of reliability commensurate with the intended use. Communications equipment shall be readily available in sufficient numbers to equip protective forces.

(1) Class A Facilities and Class B Facilities Containing Category II Quantities of SNM. Security inspectors at fixed posts shall have both normal telephone service and two-way radio with central stations as well as points from which backup forces shall be dispatched. Administrative controls shall be established to assure proper use of this system in an emergency. Duress alarms shall be provided at security inspector posts.

(2) Class B Facilities. Class B facilities employing protective personnel to protect classified matter shall be provided with a system which shall afford both intra-plant and outside communication.

(3) Special Response Teams shall be equipped with voice privacy or digital encryption two-way radio communication.

(4) Tests. Daily tests of protective communications systems are required. If equipped with duress capabilities, a test of duress system is required weekly. Records of these tests shall be maintained."

SITE REQUIREMENT SOURCE: DOE6430.1A Division 13, Section 1300-10.2.7

"1300-10.2.7 Communication Systems

See also Section 0110-13.5, Communications Equipment.

Following assessment of the nature of the threat, the intrusion shall be communicated to response forces. Communications between the CAS and the response force security inspectors are generally by two-way radio, telephone, or other signaling system. Communication to local law enforcement agencies is by telephone or radio. Special response teams shall be equipped with voice privacy or digital equipment two-way radio operation.

The CAS and SAS shall be designed with substantial walls, ceilings and floors to provide protection for security personnel and communications equipment.

All communications systems shall be tested at the required frequency to assure readiness.

Security inspectors at fixed posts shall have both normal telephone services and two-way communications with CASs, and with alternate positions from which backup forces will be dispatched.

Security inspector at mobile and fixed posts shall be provided with duress systems. This requirement may be met with hand-held radios equipped with a duress feature.

A hardened CAS (and protective force communications center) shall be equipped with radio and telephone channels of communication with local law enforcement agencies. An emergency alternate communications capability from a secondary station shall be provided for use in the event the primary station is compromised. Radio communications equipment shall remain

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operable in the event of a loss of primary electric power.

Communications equipment shall allow rapid, reliable, and protected information exchange between on-site protective forces; between on-site protective forces and the CASs and secondary communications station; and between the CASs, secondary communications stations, and local law enforcement agencies."

6.5.4

Safeguards and Security Event Reporting

The Protection Program Operations Element of the Safeguards and Security Program should include measures to ensure that situations which pose a threat to facility activities or which lessen the established level of facility protection are handled in a manner conducive to immediate and long-term corrective actions.

Programmatic controls should identify the type of safeguards and security event and the associated reporting or notification requirements. Protection measures should also ensure an appropriate level of awareness regarding individual responsibilities associated with event reporting.

SITE REQUIREMENT SOURCE: DOE5480.16 Chapter III, Section 4

"REPORTING/INVESTIGATION REQUIREMENTS.

- a. All accident, injury, and unusual occurrence reporting and investigation requirements of DOE 5000.3A, DOE 5484.1, and DOE 5632.7 shall apply.
- b. All unauthorized firearms discharges and/or any significant associated equipment failures shall be reported immediately to the Emergency Operations Center, DOE Headquarters (FTS 896-8100) and within 24 hours to the appropriate safety and security managers at operations offices and to EH-32 and DP-34. DP-34 shall refer all such incidents to the Central Training Academy for analysis and recommendations."

6.5.5

Incident Response and Management

The Protection Program Operations Element of the Safeguards and Security Program should establish incident response and management controls which minimize the impact of actual S&S events and which deter the occurrence of future S&S events. Programmatic measures should be consistent with the graded safeguards philosophy and should be implemented in timely and professional manner.

Incident response and management controls should address the discovery process, the notification of the appropriate personnel and/or response forces, initial and detailed search activities, preliminary and detailed inquiries, incident investigation, review of event information, damage assessment, initial and subsequent communications, follow-up notifications and actions, and related operational determinations.

SITE REQUIREMENT SOURCE: DOE5639.3 Chapter I, Section 2

"REPORTING PROCEDURES. The method and sequence of the reporting of violations, losses, and incidents of security concern will depend upon the situation as well as the immediacy of action which may be required to mitigate the situation. Reports of violations,

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losses, and incidents of significant security concern to DOE which require immediate oral reporting shall be made in accordance with DOE 5000.3A. Appropriate security incident reports in the form of a memorandum, teletype, telefax, facsimile, or other electronic means shall be submitted to the appropriate authorities as soon as the required information becomes available."

6.6 MATERIAL CONTROL AND ACCOUNTABILITY

6.7 INFORMATION SECURITY

6.7.1 Document Classification and Marking

6.7.2 Classified Matter Protection and Control (CMPC)

The Information Security Element of the Safeguards and Security Program should include measures to ensure proper protection and control of classified matter which has been included in the safeguards process by virtue of its importance to national security or other applicable government interests.

Classified matter, including classified material and information, should be protected appropriately under all conditions. Specific measures for the physical protection of classified matter should be consistent with the level of classification determination and should ensure that only authorized personnel with the proper security clearance level are granted access to the classified matter.

In addition, protection measures should control classified information during its preparation and during its review and approval process. Similarly, measures should be provided to ensure proper protection and control of classified documents during their use and storage.

SITE REQUIREMENT SOURCE: DOE5635.1A Chapter II, Section 11

"CLASSIFIED INFORMATION NONDISCLOSURE AGREEMENTS. National Security Decision

Directive Number 84 (NSDD 84) and Information Security Oversight Office (ISOO) Final Rule, Title 32 CFR Part 2003, sets the requirements for safeguarding national security information and specifies that all persons with authorized access to classified information required to sign a nondisclosure agreement as a condition of access. To comply with this provision, nondisclosure agreements shall be executed as follows:

- a. Standard Form (SF) 189, "Classified Information Nondisclosure Agreement," (See Attachment II-3), shall be signed by all DOE employees who possess an access authorization. The witness and acceptance individual shall be a DOE employee.
- b. SF 189A, "Classified Information Nondisclosure Agreement (Industrial/Commercial/Non-Government)," (See Attachment II-4) shall be signed by all others not covered in "a" above.

(1) Contractor personnel or representatives of other Federal agencies may witness the SF 189A signature. In either case the signed and witnessed form must subsequently be signed by a DOE employee as the acceptance individual. In instances where the witness is from the cognizant

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DOE office, he or she may also sign as the acceptance official.

(2) The use of the Security Debriefing Acknowledgment section of the SF 189A is optional. The use of this section does not replace the Security Termination Statement (Attachment II-2), currently required by DOE 5631 series."

6.7.3

Violations to Laws, Losses, and Incidents (VOLL)

The Information Security Element of the Safeguards and Security Program should address methods for handling actual or suspected criminal violations, losses of classified matter, or incidents of security concern. Protection measures in this area should include employee education, administrative procedures for handling employees suspected of criminal violations, and VOLL reporting procedures.

SITE REQUIREMENT SOURCE: DOE5635.3 Preamble, Section 10

"LOST, COMPROMISED OR POSSIBLY COMPROMISED DOCUMENTS. DOE 5631.5, should be consulted for requirements in conjunction with losses of classified documents outside security areas or relative to incidents involving alleged or suspected violations of Federal laws. (See DOE 5635.1A for additional information and reporting procedures where documents have been compromised or possibly compromised)."

SITE REQUIREMENT SOURCE: DOE5639.3 Chapter I, Section 1.a

"DOE and DOE Contractor Employees.

(1) Representatives shall not conduct any investigations of criminal violations as defined in Attachment 2, paragraph 16. An exception to this is when DOE investigators are deputized agents of the State or local law enforcement agencies. Such deputized agents, however, shall consult with the FBI when investigating criminal violations involving DOE and DOE contractor activities, operations, or personnel.

(2) Employees with knowledge of, or information indicating possible fraud, waste, abuse, or other forms of wrong doing in the Department's programs or operations shall inform IG-1 immediately upon obtaining such knowledge or information as defined in DOE 2320.1C.

(3) DOE representatives may conduct preliminary internal investigations of unlawful disclosures of classified information consistent with paragraph 7, "Responsibilities and Authorities."

(4) IG-1 is responsible for conducting preliminary inquiries and investigations of fraud, waste, or abuse by DOE and DOE contractor employees, consistent with paragraph 7.

(5) Loss or compromise of documents and material, and violations of criminal laws relating to matters of security concern to DOE and DOE contractors shall be reported promptly to SA-10 and to the FBI."

6.7.4

Unclassified Controlled Nuclear Information (UCNI)

The Information Security Element of the Safeguards and Security Program should include security measures to ensure that Unclassified Controlled Nuclear Information (UCNI) is

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protected from unauthorized dissemination. Physical protection measures should specifically address information security during use or storage and related controls for the reproduction, destruction, transmission, and automated data processing of UNCI documents.

Measures should also be established to properly control UNCI classification, changes in classification, UNCI determination authority, and UNCI document markings. In addition, guidance should be provided for determining and authorizing access to UNCI and for handling potential UNCI violations.

Internal guidelines may be developed and issued by any organization to identify the UNCI information of interest to the issuing organization.

SITE REQUIREMENT SOURCE: DOE5635.4 Preamble, Section 9

***VIOLATIONS.**

- a. **Administrative Penalty.** Any DOE employee who violates this Order is subject to imposition of an administrative penalty by his or her supervisor. This penalty may range from counseling by the person's supervisor to termination of employment. The specific administrative penalty appropriate for violations of this Order shall be proportionate to the number and severity of the person's violations.
- b. **Civil Penalty.** Any person who violates this Order is subject to a civil penalty under section 148 of the Atomic Energy Act. DP-1 may recommend to the Secretary imposition of this civil penalty, which shall not exceed \$100,000 for each violation.

(1) Written Notification.

(a) Whenever DP-1 believes that a person is subject to imposition of a civil penalty under the provisions of section 148 b(1) of the Atomic Energy Act, DP-1 shall notify the person in writing by certified mail, return receipt requested, of:

1. The date, facts, and nature of each act or omission with which the person is charged;
2. The particular provision(s) of the Act that has/have been violated;
3. Each penalty which DP-1 proposes to recommend S-1 impose and its amount;
4. The right of the person to submit to DP-1 the person's written reply to each of the allegations in the notification letter. The person shall mail or deliver any reply letter within 20 days of receipt of the notification letter from DP-1.
5. The right of the person to submit to DP-1 a written request for a hearing under the provisions of paragraph 9b(2);
6. The fact that, upon failure of the person to pay any civil penalty imposed by S-1, the penalty may be collected by civil action under the provision of paragraph 9b(5); and
7. Copies of 10 CFR Part 1017 and this Order.

(b) DP-1 shall respond in writing within 10 days of the receipt of a reply or a hearing request letter.

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(c) DP-1, at the request of the person accused of a violation, may extend for a reasonable period the time limit for submitting a reply or a hearing request letter.

(2) Hearing. Any person who receives a notification letter, as described above, may request a hearing to answer under oath or affirmation the allegations contained in the notification letter. The person shall mail or deliver any hearing request letter to DP-1 within 20 days of receipt of the notification letter. Upon receipt from the person of a written request for a hearing, DP-1 shall request that S-1 appoint a hearing officer and, if necessary, a hearing counsel.

(a) The Hearing Counsel, if appointed, shall:

- 1 Represent the Department;
- 2 Consult with the person or the person's counsel prior to the hearing; and
- 3 Examine and cross-examine witnesses during the hearing.

(b) The Hearing Officer shall:

1. Be responsible for the administrative preparations for the hearing;
2. Convene the hearing as soon as is reasonable;
3. Conduct the hearing in a manner which is fair and impartial;
4. Arrange for the presence of witnesses and physical evidence at the hearing;
5. Make a recommendation that a violation of section 148 of the Atomic Energy Act or any regulation or order of the Secretary issued under section 148 of the Atomic Energy Act has occurred only if the DOE proves by the preponderance of the evidence that such a violation has occurred; and
6. Submit his or her recommendation, accompanied by a statement of the findings and reasons supporting them, to the Secretary for final determination on the imposition of a civil penalty.

(c) Rights of the Person. The person may:

1. Present evidence in his or her own behalf, through witnesses, or by documents;
2. Cross-examine witnesses and rebut records or other physical evidence (except as provided in paragraph 9b(2)(d)4);
3. Be present during the entire hearing (except as provided in paragraph 9b(2)(d)4);
4. Be accompanied, represented, and advised by counsel of his or her own choosing; and
5. Testify in his or her own behalf.

(d) Conduct of the Hearing.

1. A summarized record of the hearing shall be made.

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2. All relevant and material evidence is admissible (except as provided in paragraph 9b(2)(d)4); however, formal rules of evidence are not applicable.
 3. Witnesses shall testify under oath and are subject to cross-examination (except as provided in paragraph 9b(2)(d)4).
 4. If the hearing officer determines that the testimony of a witness or any documentary or physical evidence contains classified information or UCNI, such testimony or evidence will not be considered unless it is material. If it is material, a nonsensitive summary of the testimony or records or description of the physical evidence shall be made available to the person to the maximum extent possible, consistent with the requirements of national security or the public and health and safety. In all such cases, the hearing officer, in considering such testimony or evidence, shall take into account that the person did not have an opportunity to cross-examine the witness or review the actual document or evidence.
 5. The DOE bears the burden of proving that a violation of section 148 of the Atomic Energy Act or any regulation or Order of the Secretary issued under section 148 of the Atomic Energy Act, has occurred.
- (e) Failure to Request a Hearing. If the person fails to file a supporting material, to S-1 for final determination on the imposition of the civil penalty.
- (3) Final Determination. S-1 makes the final determination on the disposition of a violation and may uphold, compromise or mitigate, or remit any penalty recommended by DP-1.
- (4) Appeal. A person who violates this Order, as determined by S-1, may appeal the determination to an appropriate United States District Court.
- (5) Collection of Penalty. S-1 requests the Attorney General to institute a civil action to collect a penalty imposed under this Order.
- c. Criminal Penalty. Any person who violates this Order may be subject to a criminal penalty under section 223 of the Atomic Energy Act. In such case, S-1 refers the matter to the Attorney General for investigation and possible prosecution."

6.8

KEY PROGRAM INTERFACES

An effective Safeguards and Security Program should address key interfaces with other site and facility programs to ensure consistent and complimentary policies and practices. Key program interfaces for Safeguards and Security should include emergency planning and preparedness; packaging and transportation; and research and development or experimental activities.

6.8.1

Emergency Planning and Preparedness

The Safeguards and Security Program should interface with the Emergency Planning and Preparedness Program to identify and upgrade the process for reporting information related to suspected, attempted, or actual cases of theft, diversion, sabotage, unauthorized access, or any hostile activity involving classified matter and/or other government assets. This interface should also address the process of handling and reporting incidents involving firearms.

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6.8.2

Packaging and Transportation

The Safeguards and Security Program should interface with the Packaging and Transportation Program to address any relevant issues involving the shipment of nuclear materials.

6.8.3

Research and Development and Experimental Activities

The Safeguards and Security Program should interface with research and development or experimental activities to ensure proper classification, use, and distribution of classified information being generated by such activities.

WESTINGHOUSE HANFORD COMPANY

STANDARDS

REQUIREMENTS

IDENTIFICATION

DOCUMENT

FACILITY:

**HIGH LEVEL WASTE STORAGE
TANK FARMS/242-A
EVAPORATOR**

FUNCTIONAL AREA:

Engineering Design

Author: Tom Hutson

Reviewer: Don Koss

REVISION 1

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7.0 ENGINEERING DESIGN

INTRODUCTION

SCOPE

The Engineering Design functional area for the Tank Farm Facilities (TFF) is based on the element/subelement structure contained in Draft C of the ES&H guidelines for RID development. The Engineering Design functional area for the Tank Farm Facilities includes the design engineering process required to support design of additions and modifications to the existing facility. Modifications to the facility may arise from operational requests, operational experience, maintenance activities, or changes identified by the design organization.

The scope of the Engineering Design functional area for Tank Farm operations encompasses the design aspects for expense funded minor modifications of existing structures, systems, or components (SSCs) that will be performed as part of the maintenance activities. This document does not preclude the implementation of a major project or major modifications should they be reviewed in the future. This functional area also includes the design process from conceptual design through preparation of as-built documentation. It incorporates the programmatic and technical elements necessary for the conduct and control of Engineering Design Programs.

The definition of objectives for design modifications to the operating facility is a function within the scope of the Operations functional area and is considered an input to the design process. Activities such as environmental evaluation of the site (e.g., suitability of the site under the National Environmental Policy Act [NEPA]) are part of the Environmental Protection functional area. Preparation of the Safety Analysis Report (SAR) is covered in the Nuclear Safety functional area. The definition and control of the facility technical baseline and configuration are within the scope of the Configuration Management functional area. Definition of a facility's mission is considered as an input to the design process and is not an activity within the Engineering Design functional area.

The physical boundaries for the Engineering Program Functional Area include the Single-Shell Tank Farms, Double-Shell Tank Farms, 242-A Evaporator-Crystallizer, 242-S and T Evaporators, the Liquid Effluent Retention Facility (LERF), the Purgewater Storage Facility (PWSF), and associated components. It also includes systems and support facilities dedicated to the Tank Farm Facilities, but excludes general site facilities such as the site electric power system, site telecommunications systems, and roads serving the Hanford Reservation. The interface between the excluded structures, systems, and components is established at the point where the structure, system, or component is dedicated to the Tank Farm Facilities. Non-dedicated structures, systems, and components are outside the bounds of the Engineering Design functional area for the Tank Farm Facilities.

The Engineering Design RID identifies required activities based on laws, regulations, DOE Orders, and nuclear industry standards, methods, and practices. The Engineering RID does not prescribe how to perform the required activities. This emphasis on process related activities results in a discussion that does not address design criteria and functional or technical requirements that are contained in such

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documents as facility SARs, Technical Safety Requirements (TSRs), Operational Safety Requirements (OSRs), etc., or in generally applicable design criteria or technical codes and standards (e.g., ASME, IEEE, ISA, ASTM, etc.).

As stated in the paragraph above, this document identifies many laws, regulations, nuclear industry standards, methods and practices. These documents use terms and discuss specific systems or organizations that are specific to the commercial nuclear industry and may not be directly relatable to DOE Facilities. When these terms, specific systems or organizations are encountered when reviewing this RID, the user should substitute the appropriate term, system, organization, etc. for the subject facility. The important aspect is the basic requirement in which the terms, systems, or organizational names are stated and not the term, system or organization.

The Engineering Design RID consists of the following elements:

Program Management

Design Control

Key Program Interfaces

The requirements for each element and an identification of its component subelements is provided below.

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7.1

MANAGEMENT AND ORGANIZATION

This element addresses the key program management activities of an effective Engineering Design Program. These activities are a subset of the Management Systems Functional Area which discusses many of the activities that would be applicable to the Engineering Design Functional Area as well as the other functional areas. The following are the sub-elements for the Program Management element for engineering design:

- Program Policy and Procedures
- Planning and Scheduling
- Responsibility, Authority, and Accountability
- Organizational and Programmatic Interfaces

The requirements for each subelement are defined in the subelement. DOE4700.1 provides the guidance for the conduct of project management activities including development of project management plans, configuration management, engineering design criteria, baseline development, construction, progress and status reporting and project completion and closeout. The guidance in DOE4700.1 should be applied on a graded approach to all projects commensurate with the scope of the particular project.

7.1.1

Program Policy and Procedures

The requirements for program policies and procedures that are generally applicable to DOE facilities are covered in the Management Systems RID. Requirements for program policies and procedures specifically applicable to the Engineering Design functional area are contained in this subelement. Policies shall be established to recognize the professional nature of the engineering design process and the extensive teamwork needed for an effective program. Engineering design-related procedures shall exist to control the engineering design process and reflect generally applicable and engineering-specific policies. A policy shall exist to define the design authority that has responsibility for safe and reliable facility design. Procedures shall exist to control the delegation of that design authority. Policy and procedure requirements for configuration management are contained in the Configuration Management RID.

SITE REQUIREMENT SOURCE: ANSI-N45.2.11-1974 Section 2.2

"Procedures shall be employed to assure that design activities are carried out in a planned, controlled, orderly and correct manner. Program procedures shall cover the following as applicable:

1. Responsibilities of organizations involved in the program, such as owner, A-E, NSSS Supplier and other contractors.
2. Responsibilities within design organizations.
3. Technical information exchanges across external and internal interfaces.
4. Document control including review, approval, release, distribution, and revision.
5. Maintenance and retention of design documents.
6. Management review of status and adequacy of program.
7. Necessary training of personnel performing activities covered by this standard.
8. Identifying appropriate design input.
9. Preparation of design documents.
10. Specifying quality levels, acceptance standards, and record requirements.

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11. Performance of design verifications
12. Conducting audits of design activities, their reporting and follow-up.
13. Taking corrective action (see Section 9)
14. Making experience reports available to cognizant personnel.
15. Controlling design changes.
16. Other procedures as required by this standard."

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Appendix 3A-1, Section 1

"This Appendix provides nonmandatory guidance on design control as specified in Basic Requirement 3 and Supplement 3S-1. Some factors to be considered in establishing the design control measures may include (a) through (f) below:

- (a) nature of the organization, such as the facility owner(s), major equipment designer(s) or facility designer, and the design interfaces among them;
- (b) importance of design activity to safety;
- (c) state of the art such as experimental, developmental, or standard design;
- (d) nature of design activity, such as conceptual, preliminary, detailed design, field engineering, or modifications to operating facilities;
- (e) nature of interaction between design, operation, and construction activities;
- (f) the effect of design change implementation on the safe operation of the facility."

RELATED REFERENCES

1. ANSI-N45.2.11-1974 Section 2.3

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Appendix 3A-1, Section 3(a)

"Subjects normally covered by procedures for the preparation and control of drawings include the following:

- (1) drafting room standards
- (2) standardized symbols
- (3) identification system
- (4) indication of status
- (5) checking methods
- (6) review and approval requirements
- (7) issuance and distribution control
- (8) storage and control of originals or master copies
- (9) revisions
- (10) as-built drawings"

RELATED REFERENCES

1. ANSI-N45.2.11-1974 Section 4.1

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SITE REQUIREMENT SOURCE: DOE-RL6430.1C Section 4

***4. POLICY. It is RL policy to:**

- a. Design, construct and maintain facilities in accordance with: (1) all applicable Federal Laws and Departmental Orders, (2) existing health, safety, environmental, quality and security requirements, and (3) Departmental requirements for energy conservation.
- b. Provide uniform engineering and construction standards to account for conditions unique to the Hanford Site.
- c. Promote uniformity in the solution of repetitive engineering problems which contribute to safety, operability, quality control, and cost reduction.
- d. Establish the use of minimum sitewide criteria for the design, procurement, construction, and maintenance of facilities and equipment. (Reference "Hanford Plant Standards Index to the Design Criteria Book" for a listing of design criteria.)
- e. Cancel or revise Hanford Plant Standards when national standards become adequate for use at Hanford or when the General Design Criteria (GDC) provided in DOE 6430.1A adequately define criteria requirements.
- f. Originate new HPS, or revise existing HPS, when criteria provided in the GDC, HPS or national standards do not adequately define criteria requirements.
- g. Revise existing HPS to keep current with the latest editions DOE Orders.

SITE REQUIREMENT SOURCE: DOE5700.6C Attachment 1, Section B.3.f

"Purchased items and services should be accepted using specified methods (such as review of manufacturing process control data, source verification, receipt inspection, pre-installation and post-installation tests, certificates of conformance, or a combination of these methods)."

SITE REQUIREMENT SOURCE: DOE5700.6C Attachment 1, Section C.2.a

"Criterion 10 -- Independent Assessment

- a. A process of planned and periodic independent assessments should be established and implemented by an independent assessment organization. Independent assessments should focus on improving items and processes by emphasizing line organization's achievement of quality."

SITE REQUIREMENT SOURCE: DOE5900.2A Section 7 General

"7. POLICY AND OBJECTIVE.

- a. It is the policy of the Department to use the metric system in all activities, including procurement, consistent with statutory, operational, economic, technical, and health and safety considerations.

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b. It is the objective of the policy to pursue an orderly and coordinated transition to the use of the metric system in all the Department's activities, including procurement, in a manner consistent with Federal policy."

SITE REQUIREMENT SOURCE: DOE6430.1A Section 0101-1

"6430.1A
Division 1
General Requirements

0101 CRITERIA PURPOSE AND APPLICATION

0101-1 GENERAL

These criteria provide mandatory, minimally acceptable requirements for facility design. The predominant model building code in the region shall govern on issues not covered in these criteria.

State, municipal, county, and other local building and zoning codes and ordinances should be reviewed for possible conflicts with these criteria. While it is not mandatory that DOE projects comply with such local codes and regulations, the design professional is encouraged to cooperate with local officials and DOE personnel to accommodate the intent of local codes and regulations as much as possible.

These criteria apply to any building acquisition, new facility, facility addition and alteration, and leased facility that is required to comply with DOE 4300.1B. This includes on-site constructed buildings, pre-engineered buildings, plant-fabricated modular buildings, and temporary facilities. For existing facilities, original design criteria apply to the structure in general; however, additions or modifications shall comply with this Order and the associated latest editions of the references herein. Reactors and their safety systems shall be sited and designed according to DOE 5480.6.

These criteria shall be applied in the planning, design, and development of specifications for facilities, including the preparation of site-specific general design criteria and project-specific design criteria during the project planning phase.

If there are any conflicts between these criteria and DOE directives, these criteria shall govern. Any such conflicts shall be brought to the attention of the Headquarters OPFM.

Information cited in these criteria as being provided by the cognizant DOE authority shall be obtained by the design professional through the designated cognizant DOE authority."

FACILITY REQUIREMENT SOURCE: DOE6430.1A Section 0140

"Quality Assurance. Facility design shall be conducted under QA requirements to ensure that the established program and project quality objectives are satisfied. A QA program shall be developed and implemented in compliance with DOE 5700.6B and using the elements of DOE 4700.1 and ANS ANSI/ASME NQA-1."

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SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section I, Section A, Paragraph 1, Sentences 1-4

"The organization and administration of the design engineering organization should ensure that a high level of performance is achieved through effective implementation and control of department activities. Management should instill in personnel a conservative approach to activities and a sense of responsibility for reactor safety. Corporate and station policies should describe the standards expected for design engineering activities. Effective implementation and control of design engineering activities primarily are achieved by instituting high standards, using properly qualified personnel, monitoring and assessing performance, and holding personnel accountable for their performance."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section I, Section B, Paragraph 1

"Effective management and leadership are essential to the accomplishment of complex activities, such as those associated with the design and design changes of nuclear power plants. Design Engineering management must foster an environment that promotes excellence and professionalism. Management should encourage pursuit of the root cause(s) of problems and should provide the direction necessary to implement corrective actions. Engineers should be encouraged to develop and propose problem solutions to management."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section I, Section B, Paragraph 2

"Senior management should establish policies addressing the expectations for the design engineering organization. These policies should define design engineering goals and objectives, establish expected performance levels, and clearly define organizational responsibilities. They should be communicated to all personnel. Policies and procedures should support the goals and objectives and provide guidance to personnel so that they can accomplish assigned tasks at the expected levels of performance."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section I, Section C.1.a

"Goals and objectives for the design engineering organization should support both corporate and station goals and objectives. They should be defined in terms of measurable results and products."

Design engineering activities to achieve established goals and objectives should be clearly defined and should consider available engineering resources. Utility senior management goals and objectives should be integrated into departmental and individual goals and objectives.

Goals and objectives should be communicated clearly throughout the design engineering organization. Communication can be accomplished in various ways, including planning and scheduling meetings, department meetings, and individual discussions and publicizing organizational action plans.

Periodic status reports should be made to senior management as a means of monitoring and assessing progress towards goals and objectives."

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SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section I, Section C.1.b, Bullet 1, Paras. 1 and 2

"A Policy that identifies the utility's design authority should be established. For most utilities, the design engineering organization is the designated design authority. As such, the design engineering organization is responsible for safe and reliable plant design and should be given the authority to carry out all aspects of that responsibility. Authority to perform design activities, within clearly specified limits and controls, may be delegated to other organizations

both inside and outside the utility. Responsibility for ensuring that those specified activities are carried out in a manner conducive to high-quality design should remain with the designated design authority.

For example, the authority to implement temporary design changes to the plant may be delegated to the plant technical support organization. However, the design authority should remain responsible for ensuring that temporary design changes do not adversely affect plant safety, system design requirements, or equipment. This responsibility can be carried out by specifying the criteria for what changes can be made without prior design engineering review and approval and by timely technical review of such changes."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section I, Section C.1.b, Bullet 3, Paragraph 1

"Procedural guidance should be provided for the conduct of important technical and administrative activities. Technical activities typically controlled by procedures are listed in Appendix B and discussed in Sections II-IV. Administrative activities discussed in Section I and II also should be specified procedurally to convey management's expectations and enable personnel to perform their assignments effectively and efficiently."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section I, Section C.1.b, Paragraph 1

"Policies and procedures implemented in the design engineering organization should reflect high standards and expectations and should convey an attitude of trust that encourages teamwork at all levels. These policies also should promote and foster professionalism in all personnel. Policies should be reflected in procedures and other documentation, as appropriate. The design engineering organization's responsibilities and its relationships with other organizations (utility and non-utility) should be defined clearly. Procedures also should define necessary controls over changes to the plant design. Policies and procedures should be reviewed periodically and improved as necessary."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section I, Section C.2, Paragraphs 1-4

"The effectiveness of design engineering activities should be monitored and assessed periodically to identify areas where improvements are needed. Monitoring and assessment can be accomplished in a variety of ways, including use of internal self-assessments performed by utility personnel, quality assurance surveillances and audits, and assessments by qualified outside organizations. Assessment of identified performance problems to identify root causes should be performed. Some stations have found that managers and supervisors can be used

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effectively to assess departments other than their own. The use of the utility personnel in assessment of needed corrective actions has resulted in improved ownership of needed corrective actions.

Quantitative indicators should be established to provide early indication of performance problems. These indicators should monitor both the quality of design activities and the responsiveness of design engineering support. For example, the number of approved modification requests awaiting design, completed modifications awaiting closeout, outstanding requests for engineering assistance, the number and age of unincorporated drawing change requests, and designs completed on schedule and within budget can be useful indicators in monitoring responsiveness of engineering support activities. Similarly, the number of deficiencies identified by safety review or design verification and the number of field changes required to correct design error provide a means of monitoring the quality of design. In addition, critiques of the modification implementation activities are useful management tools for assessing and improving the process.

Established indicators reflecting departmental and station performance should be analyzed and trended, with results periodically provided to management. Criteria or performance goals should be established for each quantitative indicator so that desired performance levels are identified clearly. Management assessment should consider both current performance and the performance trends to identify areas warranting additional attention. Explanations for deviations of expected performance should be provided in the reports. The performance by contracted services should be assessed and the results provided to contractor management. These results should be considered when making decisions concerning contractor support.

Performance assessments should evaluate the achievement of desired results as well as the compliance with established standards and controls. Recurring problems may indicate that previous solutions have been ineffective and also may indicate problems with root cause analysis."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section I, Section C.5

"Management should assign sufficient resources to handle anticipated work loads based upon established goals and objectives. Management should further ensure that sufficient resources are available and effectively used to support short-term work while progressing with desired long-term activities. Adequate human resources, computers and software, records, drafting support, and facilities must be provided to support the design engineering organization's diverse activities.

Resource requirements change over time and should be monitored routinely to ensure continued availability to support current and projected work. Methods should be established to forecast resource needs based on the backlog of approved work and other anticipated activities. (See "Long-range Planning," Section II, Part C.1.) Where possible, modifications should be scheduled so that large short-term increases in resources can be avoided.

Situations requiring large short-term staff augmentation frequently can lead to design quality problems due to the temporary staff's lack of familiarity with plant design requirements and utility design control procedures. The amount of resources required to monitor and assess contracted work will vary, depending on the size of the contracted work force and the contractor's experience and familiarity with the specific station. Methods to improve contractor performance could include, for example, increased monitoring or incentive provisions to enhance contractor performance in areas that have been weak in the past."

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7.1.2

Planning and Scheduling

The engineering design function should have plans, schedules, and resource estimates as necessary to carry out its activities effectively and efficiently over the projected life of the facility. Schedules should identify major milestones and a system for measuring progress against those milestones should be established and used. Planning and scheduling should consider both short-term and long-range aspects. A system of prioritization for both long-term and near-term projects should be used and should be an integral part of the Issue Management element of the Management Systems Functional Area.

a. Long-range planning should cover several cycles of facility operation. The long-range planning process should account for the time necessary to obtain management screening and approval of each engineering design project, procurement lead times, and any other factors that impart uncertainty into the engineering design process. Long-range scheduling for design engineering should be integrated with the issue management and strategic planning processes and the scheduling performed within other functional areas. Long range plans should be updated, reviewed, and approved.

b. Short-term planning and scheduling should be performed to ensure sufficient engineering design support for planned and unscheduled facility outages. Near-term plans should ensure efficient and effective allocation of resources at all levels within the organizations responsible for implementation of engineering design requirements. Uncertainties should be accounted for in the short-term planning process.

SITE REQUIREMENT SOURCE: DOE5700.6C Attachment 1, Section B.4.a(3)

"Provisions to ensure inspection planning is properly accomplished should be established. Planning should identify item characteristics and processes to be inspected, inspection techniques, acceptance criteria, hold points, and the organization responsible for performing inspection."

FACILITY REQUIREMENT SOURCE: DOE6430.1A Section 0140[06]

"As part of the QA program, architectural and engineering portions of design should be closely coordinated and functionally analyzed during the conceptual, preliminary (Title I), and detailed (Title II) design phases to avoid conflicts that could result in costly changes during construction. Prior to initiating Title I and Title II design, QA requirements shall be established for the project systems, subsystems, and components."

SITE REQUIREMENT SOURCE: DOEN5480.5 Procedure Section 6.b

"6. Backfit Analyses by Contractors and Implementation Plans.

...

b. Preparation of Implementation Plans. Based on the results of the analysis conducted in accordance with Paragraph 6a, the contractor is to propose an implementation plan. For each requirement not categorized as invariant, this implementation plan shall:

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- (1) commit to implement the requirement without change,
- (2) propose a modified implementation of the requirement to accommodate facility-specific circumstances, or
- (3) justify not implementing the requirement based upon facility-specific reasons."

SITE REQUIREMENT SOURCE: DOEN5480.5 Procedure Section 7.a

"The contractors responsible for each facility on which a backfit is imposed shall propose a schedule for implementing each such backfit (except for excluded or invariant requirements for which fixed implementation schedules have been imposed). The proposed schedule is to take into consideration the relative safety priority of the backfit compared to other work planned for the facility and the available to support this work."

SITE REQUIREMENT SOURCE: DOEN5480.5 Procedure Section 7.b

"The proposed implementation schedule is to be submitted to the DOE for approval along with the implementation plan and analysis required by Para- graph 6 of this procedure. DOE approval of each such schedule shall be documented, describing the basis for the approval."

SITE REQUIREMENT SOURCE: INPO-85-013 Summary

"The objective of a good plant modification program is to provide controls to ensure that potential improvements in the plant are designed, reviewed, approved, installed, and operated in a safe and reliable manner. Since many groups are involved in the modification process, it is necessary to have a well-defined program that clearly identifies responsibilities and provides strong communications among the participants. An effective station program meeting the above objective should contain the following elements:

- o encouragement of ideas for improvements in plant design
- o careful review, approval, and establishment of priorities for modification requests to ensure the best use of limited resources
- o tracking and timely feedback on status of modification requests
- o close coordination among responsible parties to ensure timely use of resources
- o plant walkdowns by the designer during the design phase
- o development of a conceptual design early in the design process bases on engineering evaluation and root cause determination
- o operability, maintainability, constructibility, and ALARA reviews during the design process
- o careful evaluation of the expected costs and benefits of proposed modifications
- o adherence to the FSAR, regulatory requirements, technical specifications, applicable codes, standards, and design criteria of the plant in the design, installation, and testing of modifications

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- o thorough and documented technical reviews and safety evaluations with independent review, including review and revision of the impact on the design bases, criteria, specifications, and regulatory commitments
- o reviews by on-site and off-site safety review groups as required by technical specifications
- o quality reviews and field inspections of design, procurements, and installation activities
- o thorough testing to ensure design performance and system compatibility
- o updating of important documents used in plant operations prior to returning affected systems to service
- o positive control by plant management of the authorization and performance of field activities
- o training of key plant personnel prior to returning affected systems to service
- o timely formal revision of design and operation documents, including specifications, as-designed and as-built drawings, vendor manuals, setpoint documents, FSAR, and technical specifications
- o timely updating of supporting programs to reflect modifications - examples include spare parts, in-service inspection, equipment history, surveillance, preventive maintenance, and equipment qualification
- o incorporation of applicable plant modifications into the plant- referenced simulator and appropriate training programs The attached procedure is an example of a plant modification control program. While it addresses many of the above elements, some are not described fully. This approach is intentional to keep the good practice as straightforward as practicable and free from unnecessary detail. Users may find a need to develop more detailed guidance in certain aspects of their modification programs to address specific areas of concern."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter II, Section A, Paragraph 1

"Project controls should be established within the design engineering organization to provide effective planning of assigned tasks, efficient use of resources, and effective response to identified plant problems. Project controls should reflect station priorities for problem resolution and provide a means of communicating design engineering progress on planned activities. Project controls should be used to estimate and monitor the expenditure of resources to stay within budgetary constraints and to assist in projecting future needs. Effective project controls enable the design engineering organization to support plant maintenance and operational needs while continuing to prepare modification designs and conduct training and administrative activities."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter II, Section B, Paragraph 1

"Design engineering project controls should include the development of plans, schedules, and resource estimates necessary to carry out design engineering functions effectively and efficiently. Controls used for planning and scheduling major projects should be compatible with the planning and scheduling tools used by the station. Compatibility and consistency

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between the tools and systems used to plan and schedule major work items provide a means for direct communication of progress and problems with the station. In addition, coordinating the tracking tools between station and design engineering organization can strengthen communication between the two groups when determining the level of work planned, the need for station involvement, and the progress in completing work."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter II, Section B, Paragraph 2

"Project controls should track progress and resource expenditures for ongoing tasks. This tracking capability should assist those in design engineering management to identify scheduling problems and to assess organizational needs when planning and budgeting for future projects. Project controls should establish the appropriate priority and level of effort necessary for resolving engineering assistance requests. The priority for resolution of station requests should be established jointly with station management, taking into consideration those requests already being worked and the urgency for resolution of new requests."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter II, Section B, Paragraph 3

"Project controls should enable the development of periodic reports to corporate and station management regarding engineering activities, work progress, and the level of engineering support. The reports should identify the status and quantity of engineering resources expended for each planned design modification and major activity. Special attention should be given to upcoming project milestones and recently identified work that might impact on existing schedules or require a reallocation of engineering resources."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter II, Section C.1, Paragraph 1

"Methods should be established to guide the development of long-range plans for design engineering support of plant modifications and for other major design engineering activities including long-range program improvements. Long-range plans should include major projects to be completed over the next three to five years or several refueling cycles. Long-range plans for design engineering activities should support the station's long-term plans through the integration of station and design engineering organization activity schedules. Except in extremely urgent cases, all modification and activities requiring substantial design engineering resources should be included in the long-range planning process and be approved by station and design engineering management. Typical long-range projects include modifications to implement plant improvements or regulatory requirements and projects that involve the overhaul or replacement of major plant equipment. Long-range plans also should include large-scope engineering studies and the support or development of programs such as in-service inspection, equipment qualification, snubber reduction, and design bases reconstitution."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter II, Section C.1, Paragraph 2

"Each design engineering project should receive management screening and approval. Each approved project should be clearly defined and assigned a priority for implementation. It is important that station and design engineering management work together to establish and integrate the priorities for these projects that best support station needs and to integrate the

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projects with the station's priorities. Objective criteria should be developed to facilitate establishing priorities and ensuring consistent review of all proposed projects. Projects should be defined sufficiently in detail so that the required resources can be estimated, including what types of engineering resources are needed and whether these resources will be available in-house or contracted from outside sources."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter II, Section C.1, Paragraph 3

"A long-range schedule that reflects the results of the overall project planning and prioritization process should be developed. The long-range schedule should identify major milestones and long-lead items (e.g., parts, materials, engineering services) and clearly identify critical-path activities. The schedule should reflect future plant outages and other planned major station activities. The long-range scheduling techniques used to schedule and track design engineering activities should be compatible with the station's scheduling system to ensure consistency of information and to facilitate integration of schedules and information exchange. Long-range schedules should be resource-loaded (see "Resources," Section I, Part C.5) to provide both a clear assessment of additional resource needs and identification of times when resources are available for additional projects and tasks."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter II, Section C.1, Paragraph 4

"Long-range plans and schedules should be reviewed and approved by station and corporate management. On a periodic basis, long-range plans should be updated to reflect new and revised projects. Station and engineering management should examine the status of important projects and verify that priorities, resources, and scheduled implementation dates remain consistent with station needs. They also should be able to analyze quickly the effects of new and modified projects on the current schedule so that action can then be taken to adjust resources or modify the schedule."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter II, Section C.1, Paragraph 5

"The long-range and near-term planning processes (discussed in Part C.2) require careful coordination and integration so that the transition from long-range to near-term results in timely execution of activities. For example, a long-range project might be planned and implemented in phases over several years. However, specific portions of the project are included in the near-term schedule to ensure preparatory work or partial implementation during the next planned plant outage. A review of the planning process should be performed annually to assess program effectiveness and the accuracy of projections and to make improvements as needed."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter II, Section C.2, Paragraph 2

"Similar to projects identified in long-range plans, all approved near-term modifications and projects should be assigned a priority and scheduled for implementation. Station management ultimately should determine priorities and require completion dates to ensure station needs are met. Near-term projects should be monitored and tracked closely to identify needed adjustments in resources or completion dates. Frequent changes in priorities, scheduling, or

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work scope can have a negative impact on the accuracy and completeness of designs as well as on the efficient use of resources. Station and design engineering management should work together within the planning process to ensure that changes to established priorities, schedules, or work scope can be accomplished without unnecessary disruption of the orderly completion of design activities."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter II, Section C.2, Paragraph 3

"Near-term plans should clearly define major milestones and identify individuals responsible for each activity. Scheduled start dates, estimated duration, required completion dates, and relationships among various activities should be reflected in near-term plans. Activities that can be completed during plant operation, such as simulator modifications, prefabrication of pipe, cable pulling, and equipment placement, should be clearly identified. Completion dates for major milestones, such as release of conceptual and final designs, and the issuance of design output documents, such as installation or construction drawings, procurement specifications, and construction or installation specifications, also should be included. Dates for the completion of design activities should be established to allow sufficient time to complete other related work, such as station reviews, procurement, material staging, tagout planning, craft scheduling, and preparation of installation and test packages. Experience has shown that inadequate planning or implementation of initial project activities often impacts on timely completion of the remaining activities."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter II, Section C.2, Paragraph 5

"It is important that the entire modification design process be considered when planning a modification. For example, support of field installation activities and special tests, document updates, review of test results, and modification package closeouts should be included in near-term plans to provide timely support and avoid large backlogs of incomplete work."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter II, Section C.3, Paragraph 1

"The role of the design engineering organization in providing engineering support to the station also includes day-to-day station support as well as support for planned near and long-term activities. The design engineering organization should provide both direct and indirect support to station activities on a day-to-day basis. Direct support includes modification designs, analyses and calculations, and responses to questions. Indirect support includes functions such as responses to regulatory questions and reviews of industry information or events."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter II, Section C.3, Paragraphs 2-4

"As a support organization, design engineering should be responsive to station needs for operational and maintenance support. Engineering resources for day-to-day support should be assessed routinely to ensure engineering is not over committed and resources are effectively used. Day-to-day station support should be coordinated with other design engineering activities and integrated into the overall station engineering process as discussed in INPO 85-031, Guidelines for the Conduct of Technical Support Activities at Nuclear Power Stations.

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Station management should review and approve as appropriate requests for design engineering assistance to ensure that the requests are valid. Requests requiring significant resources should be documented and controlled to ensure station management received the requests for review. Informal requests, occurring daily between station and design engineering individuals, should be controlled to limit the impact on scheduled work. However, urgent station problems should receive immediate support. Station management should work with design engineering management in assigning realistic priorities and desired completion dates to approved requests for design engineering assistance, thereby ensuring that requests are worked in the order needed and do not unnecessarily disrupt modification design and major engineering support activities.

Providing effective support for the wide range of station requests often requires firsthand knowledge of the plant systems and operation and face-to-face communications with the station staff. As a result, design engineers normally should visit the station when investigating station engineering problems. In those cases where the distance between station and design offices makes face-to-face communications difficult, establishing an on-site design engineering contingent staffed with representative from each design discipline may be an appropriate alternative for day-to-day station support."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter III, Section C.5.e(1)

"Appendix B of 10CFR50 requires that changes to safety-related equipment or systems be verified adequate by methods such as design reviews, alternate calculations, or testing. This applies to all permanent or temporary modifications that could affect plant safety or reliability. A design verification is often the most effective process for identifying and correcting deficiencies in design assumptions and design details. The design verification is an in-depth review of all aspects of the design change and confirms that the proposed modification is technically adequate.

Design verifications should be performed by technically competent individuals who know the plant design and operational requirements and who were not involved in development of the design change. Individuals performing design verifications should be trained to perform the verification activities. They also should be provided sufficient time to perform required calculations or other activities.

The design verification should be systematic and well documented. It should be included in the modification's project plan because it can require significant time and resources. The method of verification should be established by procedure or other means and must be documented properly. As a minimum, the design verification should include the following:

- verification that all design requirements were addressed correctly in the design
- a detailed check of the calculations, analyses, and output documents to verify that the assumptions, methods, and conclusions reached are valid and reasonable
- verification that technical reviews, including safety reviews, address appropriate design considerations

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A checklist can be used during the design verification to promote consistency, identify the areas reviewed, and provide stimuli for additional questions during the review. However, reviewers should be careful not to allow the checklist to limit the scope of their critical analysis.

ANSIN45.2.11 (ANSI/ASME NQA-1) and NSAC-105 provide additional details regarding design verification, including the use of qualification tests and alternate calculations."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter IV, Section C.4, Paragraph 2

"Design engineering personnel should provide timely disposition (e.g., rejection, approval, alternate solutions) of field change requests. Delays in processing field change requests can result in delays in the installation schedule and increased installation labor costs. Therefore, the design engineering organization may authorize installation of field changes, in some cases, before the final design engineering review is completed. However, the field change request process should ensure that all field changes receive approval by the responsible design organization prior to post-modification testing. Depending on the complexity of the change, it may be necessary to assign cognizant design engineers to the field as direct support in installing the change."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter IV, Section C.7, Paragraph 4

"The closeout process should occur in a timely manner to ensure that up-to-date documents are available for use. A target date for closeout of all other drawings and documents should be established based on how important the system is to safe and reliable plant operation. This target date should ensure that the drawings and documents are current and available to support resolution of other station problems and for reference for later modifications. Some documents, such as operator requalification and maintenance training lesson plans, may not require updating prior to modification package closeout. Updates to these documents should be tracked and changes implemented as appropriate to support station needs."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section III, Section C.4, Paragraph 2

"The design output documents that will be developed and/or revised during the design process should be specified in the project plan. The project plan should specify the development of standard document distribution lists or a document distribution matrix to ensure that all appropriate design documents are received by affected organizations. Design documents received from equipment suppliers also should be included in the project plan. Reviewing, approving, and controlling organizations should be identified for each type of document."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section III, Section C.4, Paragraph 3

"The project schedule should identify major milestones. This permits the involved organizations to identify resources and the level of effort required to support the project. Section II, "Project Controls," provides additional discussion on planning and scheduling of plant modifications."

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7.1.3

Responsibility, Authority, and Accountability

The requirements for assignment of responsibility, authority, and accountability that are generally applicable to DOE facilities are covered in the Management Systems RID. Engineering design-specific requirements for responsibility, authority and accountability are contained in this subelement. Design authority shall be designated. The designated design authority shall have the responsibility for safe and reliable plant design and shall be given the authority to carry out all aspects of that responsibility. Delegation of that authority shall be made with controls and specific limits.

SITE REQUIREMENT SOURCE: ANSI-N45.2.11-1974 Section 1.3

"It is the responsibility of the plant owner to provide for the establishment and execution of a quality assurance program for the plant design consistent with the provisions of this standard. The plan owner may delegate to other organizations the work of establishing and executing the quality assurance program, or any part thereof, but shall retain responsibility for overall program effectiveness. It is the responsibility of the plant owner and other organizations invoking this standard to identify the structures, systems and components, and to specify the extent to which the provisions of this standard apply to such structures, systems and components. In no way shall the program operate to diminish the responsibility of any contractor for the quality of services furnished."

SITE REQUIREMENT SOURCE: INPO-85-033 Summary

"The primary objective of using system engineers is to improve overall plant performance and reliability. Effective implementation of a system engineer concept has the following additional benefits:

- o It improves the communication and coordination of efforts between departments. Successful system engineers can be a unifying force that draws the numerous diverse elements of a station organization together.
- o It enhances job satisfaction through increased responsibility, accountability, and plant knowledge. Engineers can be assigned and periodically rotated through systems of increasing difficulty as a part of their career development program.
- o It creates a foundation of technical expertise for each system and provides an effective method of retaining a historical records of system problems and performance.

Station system engineer programs that have been effective include the following elements:

- o Selected plant systems are assigned to suitably qualified personnel (engineer or person with appropriate technical background).
- o The duties and responsibilities of system engineers are clearly defined and understood by support groups.
- o Interfaces and lines of communication with other departments are clearly understood and positive.
- o Each engineer is involved in numerous aspects of activities on his systems, including the following:

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- evaluating system performance, trending important system parameters, and initiating action to correct equipment problems
- reviewing surveillance and special test results and recommending corrective actions for out-of-specification or questionable data
- providing assistance in determining system readiness for start-up
- developing and documenting system modifications
- providing assistance in operating and maintenance procedure development

The attachment example has been developed to assist in the development of a program for using system engineers."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section I, Section C.1.b, Bullet 1, Paras. 1 and 2

"A Policy that identifies the utility's design authority should be established. For most utilities, the design engineering organization is the designated design authority. As such, the design engineering organization is responsible for safe and reliable plant design and should be given the authority to carry out all aspects of that responsibility. Authority to perform design activities, within clearly specified limits and controls, may be delegated to other organizations both inside and outside the utility. Responsibility for ensuring that those specified activities are carried out in a manner conducive to high-quality design should remain with the designated design authority.

For example, the authority to implement temporary design changes to the plant may be delegated to the plant technical support organization. However, the design authority should remain responsible for ensuring that temporary design changes do not adversely affect plant safety, system design requirements, or equipment. This responsibility can be carried out by specifying the criteria for what changes can be made without prior design engineering review and approval and by timely technical review of such changes."

7.1.4

Organizational and Programmatic Interfaces

Engineering design-related interfaces exist with other functional areas as described in Section 7.4, Key Interfaces. Within the Engineering Design functional area there are significant interfaces that must be controlled. The Organizational and Programmatic Interfaces element provides the requirements for the interfaces that are controlled by the Engineering Design functional area. This element consists of two subelements:

- Internal Design Interfaces
- External Design Interfaces

Internal design interfaces are those within the design authority's organization. Internal design interface requirements are those interface requirements for which the design authority has implementation responsibility. These interface requirements are typically those within the design authority's own organization and may include, for example, interfaces between

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engineering disciplines and interfaces between line and staff functions within the design authority. Internal interfaces shall be well-defined and procedural controls established for design information passed across the interfaces.

External design interfaces are all other design-related interfaces such as those that exist between the design authority and others to whom the design authority has delegated authority to perform design activities such as contractors. External design interfaces also exist between the design authority and other functional areas where the design authority has the responsibility for implementation of the requirement. For example, the design authority may be required to obtain and validate design input from other organizations. Likewise, the design authority may be required to provide technical requirements or input to other organizations. In this case the design authority may need to control the supplied design information so that it can provide updated information should changes occur.

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Chapter II, Section 3

"3 DESIGN CONTROL

The design shall be defined, controlled, and verified. Applicable design inputs shall be appropriately specified on a timely basis and correctly translated into design documents. Design interfaces shall be identified and controlled. Design adequacy shall be verified by persons other than those who designed the item. Design changes, including field changes, shall be governed by control measures commensurate with those applied to the original design."

RELATED REFERENCES

1. 10CFR50 Appendix A, Criterion 1

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Supplement 3S-1, Section 6

"6 Interface Control

Design interfaces shall be identified and controlled and the design efforts shall be coordinated among the participating organizations. Interface controls shall include the assignment of responsibility and the establishment of procedures among participating design organizations for the review, approval, release distribution, and revision of documents involving design interfaces.

Design information transmitted across interfaces shall be documented and controlled. Transmittals shall identify the status of the design information or document provided and, where necessary, identify incomplete items which require further evaluation, review, or approval. Where it is necessary to initially transmit design information orally or by other informal means, the transmittal shall be confirmed promptly by a controlled document."

SITE REQUIREMENT SOURCE: DOE5700.6C Attachment 1, Section B.2.a

"Criterion 6 -- Design

- a. A process should be established and implemented for design using sound engineering/scientific principles and appropriate standards, such as the General Design Criteria

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(DOE 6430.1A). Provisions should include control of design requirements, inputs, processes, outputs, changes, records, and organizational interfaces."

SITE REQUIREMENT SOURCE: DOE5700.6C Attachment 1, Section B.2.d

"Design interfaces should be identified and controlled and design efforts should be coordinated among and within participating organizations. Interface controls should include the assignment of responsibility and establishment of procedures among participating design organizations."

SITE REQUIREMENT SOURCE: DOE5700.6C Section 9.b(2)(b)

"Criterion 6 - Design Items and processes shall be designed using sound engineering/scientific principles and appropriate standards. Design work, including changes, shall incorporate applicable requirements and design bases. Design interfaces shall be identified and controlled. The adequacy of design products shall be verified or validated by individuals or groups other than those who performed the work. Verification and validation work shall be completed before approval and implementation of the design."

FACILITY REQUIREMENT SOURCE: DOE6430.1A Section 0140[02]

"Control mechanisms shall be established to ensure that: (1) design inputs are correctly translated into design documents in a timely manner; (2) organizational and physical interfaces are identified and controlled; (3) changes to design are controlled in a manner commensurate with the original design; (4) the design is independently verified to be adequate; (5) documentation and records of the design and design verification processes are maintained in accordance with the QA program."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter III, Section C.5.d, Paragraph 3

"Design interface control procedures should establish responsibilities for review, approval, release, distribution, and revision of documents. When design output documents are distributed, the transmittals should identify the status of the information being distributed and whether the document has been issued for review or approval."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section I, Section C.1.b, Paragraph 1

"Policies and procedures implemented in the design engineering organization should reflect high standards and expectations and should convey an attitude of trust that encourages teamwork at all levels. These policies also should promote and foster professionalism in all personnel. Policies should be reflected in procedures and other documentation, as appropriate. The design engineering organization's responsibilities and its relationships with other organizations (utility and non-utility) should be defined clearly. Procedures also should define necessary controls over changes to the plant design. Policies and procedures should be reviewed periodically and improved as necessary."

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SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section I, Section C.3, Paragraph 1

"Teamwork in the conduct of design engineering activities should be encouraged through design engineering practices and policies. For example, to improve teamwork, a document addressing the balance between design engineering and operational considerations in the development of design change packages can be useful. The balance specified should be consistent with operating goals and personnel, environmental concerns, and safety concerns. Additionally, interface agreements (see C.4 below) the design engineering organization and contractor engineering organizations and other groups can enhance teamwork. These interface agreements typically identify the support to be provided and typical methods for requesting and providing that support. Conversely, while the need for formally defined interfaces is important, informal interfaces among members of the design engineering staff and other organizations also should be encouraged. The successful completion of complex activities such as modifications requires a team effort. Modification teams that monitor and help coordinate modifications from initiation to closure have proved successful at some utilities. These teams usually are composed of representatives from each affected organization who meet at predetermined milestones throughout the development and implementation of the modification. Managers and supervisors should promote improved communications as a method for improving teamwork."

RELATED REFERENCES

1. NSAC-105

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section I, Section C.4, Paragraph 1

"The utility's design engineering organization has many interfaces with both internal and external organizations that should be well defined and function effectively to accomplish assigned tasks. The transfer of information across interfaces should be controlled and feedback mechanisms provided to ensure that the information has been received correctly. Ready access to station data is necessary for utility and contract design engineering organizations to provide effective and timely engineering support. The process for transferring information to contract design organizations should not be too restrictive and should include documentation of data received as well as documentation of information sources in the work product."

7.1.4.1

Internal Design Interfaces

Internal design interfaces are those between organizational units within the design authority. Interfaces shall be well-defined. Procedural controls shall exist for design information passed across interfaces.

SITE REQUIREMENT SOURCE: ANSI-N45.2.11-1974 Section 5.2.4

"Documentation. Procedures shall be established to control the flow of design information between organizational units. Design information transmitted from one organizational unit to another shall be documented and controlled. Transmittals shall identify the status of the design information or document provided and, where necessary, identify incomplete items which require further evaluation, review of approval. Where it is necessary to initially transmit design information orally or by other informal means, the transmittal shall be confirmed promptly by a controlled document."

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SITE REQUIREMENT SOURCE: DOE5700.6C Attachment 1, Section B.2.j

"Design verification should be completed before design output is used by other organizations or to support other work, such as procurement, manufacture, construction, or experiment. When this timing cannot be achieved, the unverified portion of the design should be identified and controlled. In all cases, design verifications should be completed before relying on the item to perform its function and before installation becomes irreversible (requiring extensive demolition or rework)."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section III, Section C.4, Paragraph 2

"The design output documents that will be developed and/or revised during the design process should be specified in the project plan. The project plan should specify the development of standard document distribution lists or a document distribution matrix to ensure that all appropriate design documents are received by affected organizations. Design documents received from equipment suppliers also should be included in the project plan. Reviewing, approving, and controlling organizations should be identified for each type of document."

7.1.4.2

External Design Interfaces

External design interfaces are those between the design authority organization and other organizations. Such interfaces shall be well-defined. Procedural controls shall exist for design information passed across interfaces. Interfaces with external organizations performing design-related activities shall be structured to enable design engineering personnel to monitor and assess the quality and timeliness of contracted activities.

Procedurally-controlled interfaces shall exist between the design authority and the facility operating organization. The design authority shall retain full responsibility for all technical work related to the design authority's responsibilities that is done by external organizations regardless of the contractual basis for the work.

SITE REQUIREMENT SOURCE: ANSI-N45.2.11-1974 Section 5.1.1

"Identification of Interface. The external interfaces between organizations performing work affecting quality of design shall be identified in writing and shall include those organizations providing criteria, designs, specifications and technical direction."

SITE REQUIREMENT SOURCE: ANSI-N45.2.11-1974 Section 5.1.4

"Documentation. Procedures shall be established to control the flow of design information between organizations. Design information transmitted from one organization to another shall be documented in specifications, drawings or other controlled documents which are uniquely identified and issued by authorized persons. The procedures shall provide that design interface information be transmitted to affected organizations and that any information requested in the design interface transmittal be transmitted back to the originator. Documentation requesting information or action shall be controlled by a system which assures that the response and the request can be related. Where it is necessary to initially transmit design information orally or by other informal means, the transmittal shall be confirmed promptly by a controlled document."

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SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Appendix 3A-1, Section 6

"During the construction and operational phases, attention should be given to defining and controlling the design interfaces between organizations participating in design changes/modifications and to defining the responsibility for the overall control of the design. The responsibility for the design of the facility should be divided in a way which is suited to the individual capabilities of the participating organizations and the status of construction or operations. Participating organizations may include:

- (a) owner's design organization
- (b) construction engineering group
- (c) operating organization
- (d) architect engineer
- (e) reactor manufacturer (NSSS)
- (f) equipment design
- (g) other design contractor

The documentation of the assignment of design responsibilities may be accomplished in procedures, internal or external correspondence, contracts or other suitable documents."

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Supplement 7S-1, Section 5.0

"SUPPLIER PERFORMANCE EVALUATION

The Purchaser of items and services shall establish measures to interface with the Supplier and to verify Supplier's performance as deemed necessary by the Purchaser. The measures shall include (a) through (f) below:

- (a) establishing an understanding between Purchaser and Supplier of the provisions and specifications of the procurement documents;
- (b) requiring the Supplier to identify planning techniques and processes to be utilized in fulfilling procurement document requirements;
- (c) reviewing Supplier documents which are generated or processed during activities fulfilling procurement requirements;
- (d) identifying and processing necessary change information;
- (e) establishing method of document information exchange between Purchaser and Supplier;
- (f) establishing the extent of source surveillance and inspection activities.

These verification activities shall be conducted as early as practicable. The Purchaser's verification activities, however, shall not relieve the Supplier of his responsibilities for verification of quality achievement."

SITE REQUIREMENT SOURCE: DOE5700.6C Attachment 1, Section B.2.j

"Design verification should be completed before design output is used by other organizations or to support other work, such as procurement, manufacture, construction, or experiment. When this timing cannot be achieved, the unverified portion of the design should be identified and controlled. In all cases, design verifications should be completed before relying on the item to perform its function and before installation becomes irreversible (requiring extensive demolition or rework)."

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SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter II, Section C.3, Paragraphs 2-4

"As a support organization, design engineering should be responsive to station needs for operational and maintenance support. Engineering resources for day- to-day support should be assessed routinely to ensure engineering is not over committed and resources are effectively used. Day-to-day station support should be coordinated with other design engineering activities and integrated into the overall station engineering process as discussed in INPO 85-031, Guidelines for the Conduct of Technical Support Activities at Nuclear Power Stations.

Station management should review and approve as appropriate requests for design engineering assistance to ensure that the requests are valid. Requests requiring significant resources should be documented and controlled to ensure station management received the requests for review. Informal requests, occurring daily between station and design engineering individuals, should be controlled to limit the impact on scheduled work. However, urgent station problems should receive immediate support. Station management should work with design engineering management in assigning realistic priorities and desired completion dates to approved requests for design engineering assistance, thereby ensuring that requests are worked in the order needed and do not unnecessarily disrupt modification design and major engineering support activities.

Providing effective support for the wide range of station requests often requires firsthand knowledge of the plant systems and operation and face-to-face communications with the station staff. As a result, design engineers normally should visit the station when investigating station engineering problems. In those cases where the distance between station and design offices makes face-to-face communications difficult, establishing an on-site design engineering contingent staffed with representative from each design discipline may be an appropriate alternative for day-to-day station support."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter III, Section C.5.b, Paragraph 6

"When design activities are to be conducted by a contractor, the utility design engineering organization should specify the necessary design requirements and verify that any design requirements identified by the contractor are maintained in a usable and retrievable form. Design engineering should review the results of contracted design activities to verify that the appropriate design requirements are considered and are updated as necessary."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section I, Section C.1.b, Bullet 1, Paragraph 3

"The degree of reliance on outside engineering services varies among utilities. In all instances; however, the design engineering organization should monitor and assess design engineering activities delegated to outside contractors to verify conformance to utility standards. Monitoring the technical adequacy of the design can be accomplished in several ways. For example, the utility's engineers can participate directly in the design or the design engineering organization can review contractor-prepared design output documents. The utility design engineering organization should provide clear information to outside engineering organizations regarding the planned monitoring and approval process as well as the expected quality and format of all documents, drawings, calculations, and other design products."

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SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section I, Section C.4, Paragraph 2

"Special attention should be given to interfaces between design engineering and outside organizations contracted to perform design activities. These interfaces must enable design engineering personnel to monitor and assess properly the quality and timeliness of delegated contract activities. Typically this requires direct interface among engineering personnel. Some utilities have found it useful to define these interfaces and special project requirements (e.g., organizational interface controls, package format, drafting standards, document retention, and turnover) in a design manual used for all project activities contracted to outside organizations. Regardless of contractual arrangements with a contracted design agent, the utility must assume full responsibility for all the agent's technical work."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section I, Section C.4, Paragraph 3

"Formal interfaces also should be established between design engineering and station groups. For example, conceptual designs for plant modifications should be reviewed formally by experienced station personnel to ensure that the proposed designs will correct the identified problems and are acceptable to the station from a constructibility, operability, maintainability, and radiological standpoint."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section III, Section B, Paragraph 10

"Responsibilities and interfaces should be clearly defined when an outside engineering firm is contracted to perform design activities. These responsibilities can be defined in specifications, the project plan, or both. Responsibilities and interfaces should be approved by the utility and agreed to by the contracted engineering management. The utility design engineering organization, as the design authority, retains responsibility for safe and reliable plant design."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section III, Section C.4, Paragraph 2

"The design output documents that will be developed and/or revised during the design process should be specified in the project plan. The project plan should specify the development of standard document distribution lists or a document distribution matrix to ensure that all appropriate design documents are received by affected organizations. Design documents received from equipment suppliers also should be included in the project plan. Reviewing, approving, and controlling organizations should be identified for each type of document."

7.1.5

Staffing and Training

The staffing and training element consists of three subelements:

- Staffing - defines the requirements for size of the staff to perform the engineering design function, planning related to the personnel resources assigned to implement the requirements assigned to the design authority, and the availability of the other resources necessary for the staff to function effectively.

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- Selection and Qualification - defines the requirements for selection of personnel and qualification of personnel to perform assigned tasks to implement the engineering design function.

- Training - defines training requirements that are specifically applicable to personnel assigned

For all three subelements, the identified requirements are those that apply to the engineering design function other than those that are generally applicable to all Tank Farms Facility personnel. Staffing and training requirements that are generally applicable to the Tank Farms Facility are defined in the Training RID.

7.1.5.1

Staffing

Sufficient personnel shall be available to perform anticipated engineering design work. Staffing shall be sufficient to perform short-term work and to make progress on long-term goals. Staffing needs determinations shall take into account the staffing needed to monitor and assess work delegated to external organizations. Sufficient non-human resources shall also be provided to the personnel assigned to accomplish engineering design requirements.

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter II, Section C.3, Paragraph 5

"The design engineering organization should arrange to support urgent station requests after normal working hours and on holidays or weekends. A design engineering point of contact with authority to mobilize the necessary resources to respond to urgent requests should be identified."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section I, Section B, Paragraph 3

"Sufficient resources, including staff, training, equipment, and funding, must be available to effectively accomplish assigned responsibilities. Corporate and station management periodically should assess the effectiveness of the design engineering organization to correct problems and improve performance by establishing and periodically reviewing objective indicators of performance in key areas."

7.1.5.2

Selection and Qualification

Personnel selected to implement engineering design function requirements shall meet at least the minimum entry qualifications of the assigned position. Controls shall be applied to ensure that personnel are qualified to perform their assigned tasks. Specific qualification requirements that address the experience and judgement necessary for personnel performing critical tasks shall exist.

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Supplement 2S-4, Section 3

"INDOCTRINATION

Personnel shall be indoctrinated in the following subjects as they relate to a particular function:

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- (a) general criteria, including applicable codes, standards, and company procedures;
- (b) applicable quality assurance program elements; and
- (c) job responsibilities and authority."

SITE REQUIREMENT SOURCE: DOE5700.6C Attachment 1, Section A.2.a

"Criterion 2 -- Personnel Training and Qualification

a. Personnel performing work should be capable of performing their assigned tasks. Qualification requirements should be established for specific job categories, such as operators, designers, managers, supervisors, inspectors, welders, engineers, scientists, and independent assessment personnel. Training includes both education in principles and enhancement of skills and practices. Training should ensure the worker understands the processes and tools he/she is using, the extent and sources of variability in those processes and tools, and the degree to which he/she does and does not have control over that variability."

SITE REQUIREMENT SOURCE: DOE5700.6C Attachment 1, Section A.2.d

"Personnel performing work that requires special skills or abilities should be qualified prior to performing work. Qualification should include demonstrated proficiency of each candidate and updated periodically thereafter to maintain skills to meet current practices."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter III, Section C.5.e(1)

"Appendix B of 10CFR50 requires that changes to safety-related equipment or systems be verified adequate by methods such as design reviews, alternate calculations, or testing. This applies to all permanent or temporary modifications that could affect plant safety or reliability. A design verification is often the most effective process for identifying and correcting

deficiencies in design assumptions and design details. The design verification is an in-depth review of all aspects of the design change and confirms that the proposed modification is technically adequate.

Design verifications should be performed by technically competent individuals who know the plant design and operational requirements and who were not involved in development of the design change. Individuals performing design verifications should be trained to perform the verification activities. They also should be provided sufficient time to perform required calculations or other activities.

The design verification should be systematic and well documented. It should be included in the modification's project plan because it can require significant time and resources. The method of verification should be established by procedure or other means and must be documented properly. As a minimum, the design verification should include the following:

- verification that all design requirements were addressed correctly in the design
- a detailed check of the calculations, analyses, and output documents to verify that the assumptions, methods, and conclusions reached are valid and reasonable
- verification that technical reviews, including safety reviews, address appropriate design considerations

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A checklist can be used during the design verification to promote consistency, identify the areas reviewed, and provide stimuli for additional questions during the review. However, reviewers should be careful not to allow the checklist to limit the scope of their critical analysis.

ANSI/ASME NQA-1 and NSAC-105 provide additional details regarding design verification, including the use of qualification tests and alternate calculations."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter III, Section C.5.e(2)

"Safety reviews should be performed for all permanent and temporary modifications that could affect plant safety or reliability. The reviews should be performed when the modification is proposed to ensure safety requirements are "built-in" to the design change. A safety review involves a safety analysis and a safety evaluation. The safety analysis verifies the change will be safe. The safety evaluation determines whether technical specifications should be amended or if an unreviewed safety question exists (either of which conditions requires Nuclear Regulatory Commission approval prior to implementation).

Safety reviews should be performed by technically competent individuals who know the plant design and operational requirements. Individuals performing safety reviews should have been trained in how to conduct them. They also should be provided sufficient time to give the change adequate consideration."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter III, Section C.5.e(3)

"As noted above, both design verifications and safety reviews should be performed by individuals who are technically competent and knowledgeable about the proposed design change. The design reviewer should not be involved in the development of the design. The independent reviewer should be able to confirm the technical adequacy of the design change without consulting the people who developed it. The reviewer may use alternate calculations or other means to arrive separately at conclusions. Conclusions that do not agree with those of the modification designer should be discussed and rectified."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter III, Section C.5.e, Paragraphs 3 and 4

"Safety reviews consist of two elements. The first element is the safety analysis, which analyzes the potential effects of the modification on plant safety. It considers factors such as plant design requirements, intended or unintended operation of affected equipment, potential component failures, human errors, and plant conditions. The second element is the safety evaluation, which determines whether an unreviewed safety question might exist. (See NSAC-125, Guidelines for 10CFR50.59 Safety Evaluations.) Although the two safety reviews often are combined, they are not synonymous and can differ in both form and function.

Safety reviews and design verifications should be performed by technically competent individuals who know the plant design and operational requirements and are capable of designing that portion of the modification they are verifying or reviewing. The design verifier

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and safety reviewer can be the same individual; however, the design verifier should not be involved in development of the design change. Safety reviews and design changes should be reviewed independently before the design is released for implementation."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section I, Section C.6, Paragraph 1

"Management should ensure that personnel are qualified to perform their assigned tasks. Selection of personnel with the knowledge and skills required to meet entry requirements for the jobs for which they are being hired is an essential first step in the process."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section I, Section C.6, Paragraph 2

"Training programs, based on specific needs of the organization and individual, should be established to develop and maintain the knowledge and skills of design engineering personnel to support safe and reliable plant operation. These programs should include systems-oriented training to broaden the perspectives of discipline-oriented personnel and training on policies and procedures affecting design engineering activities. Consideration also should be given to the training needs of contracted personnel to ensure that utility requirements are met. Qualification requirements for personnel performing critical tasks, such as design verification or safety reviews, should address the addition experience and judgement necessary to ensure that these tasks are completed correctly."

7.1.5.3

Training

Training for personnel in the engineering design function shall develop and maintain the knowledge and skills needed to support safe and reliable operation of the facility. Systems-oriented training shall be provided. Training shall be provided to personnel of external organizations performing engineering design tasks. Training shall be provided in root cause analysis for appropriate personnel. Management of the engineering design function shall review lesson plans, shall monitor the effectiveness of the training program, and shall provide

feedback to the management of the organization providing the training function. Further guidance is contained in the Management Systems and Training and Qualification Functional Areas.

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Supplement 2S-4, Section 4

"TRAINING

Training shall be provided, if needed, to:

- (a) achieve initial proficiency;
- (b) maintain proficiency; and
- (c) adapt to changes in technology, methods, or job responsibilities."

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SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Supplement 2S-4, Sections 1 & 2

***1.0 GENERAL**

This Supplement provides amplified requirements for the indoctrination and training of personnel performing or managing activities affecting quality. It supplements the requirements of Basic Requirement 2 of this Standard and shall be used in conjunction with that Basic Requirement when and to the extent specified by the organization invoking this Standard.

2.0 APPLICABILITY

This Supplement applies to personnel performing or managing activities affecting quality. Personnel to be indoctrinated or trained shall be identified. The extent of indoctrination and training shall be commensurate with the following:

- (a) the scope, complexity, and nature of the activity; and
- (b) the education, experience, and proficiency of the person.

Activities affecting quality include designing, purchasing, fabricating, handling, shipping, storing, cleaning, erecting, installing, inspecting, testing, operating, maintaining, repairing, refueling, and modifying."

SITE REQUIREMENT SOURCE: DOE5700.6C Attachment 1, Section A.2.a

"Criterion 2 -- Personnel Training and Qualification

a. Personnel performing work should be capable of performing their assigned tasks.

Qualification requirements should be established for specific job categories, such as operators, designers, managers, supervisors, inspectors, welders, engineers, scientists, and independent assessment personnel. Training includes both education in principles and enhancement of skills and practices. Training should ensure the worker understands the processes and tools he/she is using, the extent and sources of variability in those processes and tools, and the degree to which he/she does and does not have control over that variability."

SITE REQUIREMENT SOURCE: DOE5700.6C Attachment 1, Section A.2.b

"Training should emphasize correct performance of work and provide understanding of why quality requirements exist. In addition, training should provide an understanding of the fundamentals of the work and its context. Training instruction should address potential consequences of improper work and focus attention on "doing it right the first time."

SITE REQUIREMENT SOURCE: DOE5700.6C Attachment 1, Section A.2.c

"Training plans should address and stimulate professional development. Training plans should provide for maintenance of proficiency and progressive improvement, and should not be limited to attainment of initial qualification. Training plans for management personnel should include professional managerial, communication, and interpersonal skills."

SITE REQUIREMENT SOURCE: DOE5700.6C Attachment 1, Section A.2.e

"Training should provide curricula that address specific needs, and it should be presented by qualified instructors."

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SITE REQUIREMENT SOURCE: DOE5700.6C Attachment 1, Section A.2.f

"Training should be subject to on-going review to determine program and instruction effectiveness. Training and qualification should be upgraded whenever needed improvements or other enhancements are identified."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter III, Section C.5.e(1)

"Appendix B of 10CFR50 requires that changes to safety-related equipment or systems be verified adequate by methods such as design reviews, alternate calculations, or testing. This applies to all permanent or temporary modifications that could affect plant safety or reliability. A design verification is often the most effective process for identifying and correcting deficiencies in design assumptions and design details. The design verification is an in-depth review of all aspects of the design change and confirms that the proposed modification is technically adequate.

Design verifications should be performed by technically competent individuals who know the plant design and operational requirements and who were not involved in development of the design change. Individuals performing design verifications should be trained to perform the verification activities. They also should be provided sufficient time to perform required calculations or other activities.

The design verification should be systematic and well documented. It should be included in the modification's project plan because it can require significant time and resources. The method of verification should be established by procedure or other means and must be documented properly. As a minimum, the design verification should include the following:

- verification that all design requirements were addressed correctly in the design
- a detailed check of the calculations, analyses, and output documents to verify that the assumptions, methods, and conclusions reached are valid and reasonable
- verification that technical reviews, including safety reviews, address appropriate design considerations

A checklist can be used during the design verification to promote consistency, identify the areas reviewed, and provide stimuli for additional questions during the review. However, reviewers should be careful not to allow the checklist to limit the scope of their critical analysis.

ANSI/ASME NQA-1 and NSAC-105 provide additional details regarding design verification, including the use of qualification tests and alternate calculations."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section I, Section C.6, Paragraph 2

"Training programs, based on specific needs of the organization and individual, should be established to develop and maintain the knowledge and skills of design engineering personnel to support safe and reliable plant operation. These programs should include systems-oriented training to broaden the perspectives of discipline-oriented personnel and training on policies

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and procedures affecting design engineering activities. Consideration also should be given to the training needs of contracted personnel to ensure that utility requirements are met. Qualification requirements for personnel performing critical tasks, such as design verification or safety reviews, should address the addition experience and judgement necessary to ensure that these tasks are completed correctly."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section I, Section C.6, Paragraphs 3 and 4

"In addition to technical training, appropriate training in other areas, such as management and supervisory skills, root cause analysis, and communication skills, should be provided. ACAD 91-017, Guidelines for Training and Qualification of Engineering Support Personnel; and INPO 88-006, The Development of Prospective Nuclear Plant Managers and Middle Managers, could be of assistance in developing appropriate training program content.

Design engineering management should review the lesson plans for adequacy of scope, level of detail, etc. Management also should monitor training and its results to ensure effectiveness and should provide feedback to enhance the training program based on the observed performance of trained personnel."

7.2

DESIGN CONTROL

This element includes the controls applied to the engineering design activities to ensure that applicable design requirements (e.g., design bases or technical baseline, DOE Orders, regulatory requirements, codes, standards, etc.) are correctly translated into associated design output documents (such as design analyses, calculations, drawings, specifications, installation procedures, test procedures, etc.). Design Control should be one part of the overall configuration management process.

The subelements that form the design control element are:

- Design Input
- Design Process
- Design Output
- Design Review and Verification
- Design Change Control
- Standards and Guides
- Engineering Assistance Request Process

The design input subelement deals with the requirements for the sources of engineering design input requirements. The design process subelement defines the requirements for the control of the process of converting design inputs into design outputs. Design outputs are defined as the drawings and specifications to which a facility or a modification to a facility is built. This definition includes both procurement specifications and construction specifications. Requirements for documents, such as calculations, that are internal to the engineering design process, but are not directly used in the construction, operation, maintenance, or modification

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of a facility, are considered with the requirements for design process rather than being subject to the requirements for design output. The design review and verification subelement specifies the requirements for independent verification of engineering design work products. Design change control requirements apply to changes initiated within the engineering design functional area as well as to design-related changes made through the construction, operations, and maintenance processes. Standards and guides are standard engineering practices that are used to ensure consistent and correct design outputs are produced. These may include, for example, standard design details, standard procurement specifications, and technical guides for preparation of calculations. The requirements for standards and guides are specified in the standards and guides subelement. The engineering design function is required to support the operations and maintenance functions in ways other than producing new or revised designs. For example, engineering design function may be requested to provide trouble-shooting services that do not lead to a design modification. The engineering assistance request subelement defines the requirements applicable to providing this function.

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Appendix 3A-1, Section 5

"Design documents should be maintained current to ensure their availability to support facility design, construction, and operation. However, design changes may be approved without revision to the affected document(s). When this occurs, procedures should be established to ensure that a determination of the final design or as-built condition can be made, consistent with the user's needs. Since not all affected documents require revision, procedures should identify those design documents which are subject to revision. Measures may include, but are not limited to, imposing a time limit for updating the affected document(s), limiting the number of design changes allowed to accumulate prior to revising the affected document, or providing for a process that continually updates the affected document(s).

During the operational phase, attention should be given to system modifications, mechanical and electrical temporary alterations and instrument setpoint changes to ensure that design changes are processed in accordance with design control requirements. Proposed modifications, alterations, and changes may overlap and may not be installed in the sequence that they were designed; therefore, it is incumbent upon the design organization and plant/facility owner to control approved (but not installed) design changes to ensure that changes do not conflict with each other. Where modifications, alterations, or changes must be installed in a particular sequence, the sequence should be specified. Partial installation of design changes should be approved by the design organization. Controls should ensure that documents that are required to support operation reflect the as-built condition of the facility. Temporary and permanent repair work and parts replacement should be reviewed to determine if these activities constitute design changes."

SITE REQUIREMENT SOURCE: DOE5700.6C Attachment 1, Section B.2.a

"Criterion 6 -- Design

a. A process should be established and implemented for design using sound engineering/scientific principles and appropriate standards, such as the General Design Criteria (DOE 6430.1A). Provisions should include control of design requirements, inputs, processes, outputs, changes, records, and organizational interfaces."

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SITE REQUIREMENT SOURCE: DOE5700.6C Section 9.b(2)(b)

"Criterion 6 - Design Items and processes shall be designed using sound engineering/scientific principles and appropriate standards. Design work, including changes, shall incorporate applicable requirements and design bases. Design interfaces shall be identified and controlled. The adequacy of design products shall be verified or validated by individuals or groups other than those who performed the work. Verification and validation work shall be completed before approval and implementation of the design."

SITE REQUIREMENT SOURCE: DOE6430.1A Section 0101-2

"0101.2 CRITERIA DEVIATIONS

[. . .]

The contractor and/or DOE organizations responsible for facility projects shall review these criteria early in the planning phase and at later phases during the project construction process to determine if any of these criteria are not applicable or are not appropriate. The contractor shall document the criteria being used for each project in the project's SAR (per Section 0110-5.2, Safety Analysis) such that compliance with these criteria can be verified during design, construction, and facility operation. Site-specific criteria shall be included in this documentation.

[. . .]

Deviations may be granted by DOE organizations responsible for facility projects or granted by the DOE programmatic office responsible for the design of facilities when any of the following apply:

- o A specific portion of the general design criteria is determined to be inadequate or inappropriate for the facility under design.
- o Minor deviations are necessary or advantageous in the design professional's professional judgment.
- o A criterion does not reflect currently applicable codes, standards, regulations, or architectural or engineering principles and practices.
- o A criterion affecting environmental protection or safety is less stringent than local or State codes or regulations.
- o Deviations will achieve economies in facility construction, operation, or maintenance without significant adverse effects on programmatic or operating needs or DOE design policy and objectives.
- o Deviations will not affect DOE design policy and objectives and are determined to be necessary in the acquisition of buildings by lease or purchase.
- o Deviations will not affect DOE design policy and objectives, are necessary, and are allowable under existing exemption or variance provisions of another DOE directive.

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Headquarters-level review and approval are not required for deviations from local or State codes or regulations that do not affect compliance with DOE policies or objectives.

When a deviation is granted without Headquarters-level review and approval, the project file or other files as appropriate shall include full documentation of the deviation, including an analysis and justification for giving the deviation.

[. . .]

Headquarters-level review and approval shall be required for the following deviations from these criteria:

- o Deviations proposed for safety-class items (as defined in Section 1300-3.2, Safety Class Items, and determined by DOE 5481.1B) when such deviation will or may constitute an adverse impact on environmental protection, safety or health or other DOE design policies or objectives

- o Deviations from requirements in Federal laws or regulations or Executive Orders; such deviations cannot be approved unless such laws, regulations, or Executive Orders provide for deviations or waivers

OPFM shall, where responsibility is not otherwise prescribed by Executive Order or statute:

- o Be notified of any deficiencies in these criteria or conflicts that exist between them and other DOE directives

- o Determine the need for formal submittal of a proposed deviation

- o Coordinate with and determine appropriate Headquarters organizations necessary to review and approve any deviations

- o Review design project files or other files as appropriate containing documentation of deviations

Requests for deviations requiring Headquarters level approval shall be prepared by the responsible field organization and submitted with justification to OPFM, the Headquarters outlay program organization(s) involved, and any other Headquarters organization as determined appropriate by OPFM.

Nothing in these criteria shall preempt the specific requirements contained in other DOE directives relative to their processes and procedures for requesting exemptions, variances, or deviations. "

FACILITY REQUIREMENT SOURCE: DOE6430.1A Section 0140[02]

"Control mechanisms shall be established to ensure that: (1) design inputs are correctly translated into design documents in a timely manner; (2) organizational and physical interfaces are identified and controlled; (3) changes to design are controlled in a manner commensurate with the original design; (4) the design is independently verified to be adequate; (5) documentation and records of the design and design verification processes are maintained in accordance with the QA program. "

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FACILITY REQUIREMENT SOURCE: DOE6430.1A Section 0140[09]

"Deviations from specified standards shall be identified and procedures established to ensure their control."

SITE REQUIREMENT SOURCE: DOEN5480.5 Procedure Attachment 2

"FACTORS TO CONSIDER IN BACKFIT ANALYSES

Analyses conducted pursuant to this procedure shall consider information available concerning any of the following factors as may be appropriate and any other information relevant and material to the proposed backfit:

1. the specific objectives that the proposed backfit is designed to achieve;
2. the specific activities that will be required to implement the proposed backfit;
3. the potential change in risk to the public or to facility staff from the accidental release of radioactive or hazardous materials;
4. the potential impact on exposure of facility employees to radiation, radioactivity, hazardous materials, or occupational safety hazards;
5. the installation and continuing costs associated with the proposed backfit;
6. the potential impact of facility downtime associated with implementing the backfit, including potential impact on programmatic missions;
7. the potential safety impact of changes in facility or operational complexity, including the relationship to proposed and existing regulatory requirements; and
8. the potential impact of differences in facility type, design, or remaining operational lifetime on the relevancy and practicality of the proposed backfit."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter II, Section C.3, Paragraph 7

"Effective station engineering support involves the application of some aspects of the design process to more activities than just design modifications. For example, a station request for assistance in determining system operability may require review of the plant design basis and preparation of new calculations. Calculations would be handled in the same manner as those performed in support of plant modifications and should be summarized and transmitted in a form that answers the identified need. Similarly, elements of the design process may be used to perform studies and analyses and to disposition questions. The guidelines for modification design process activities in Sections III and IV generally are applicable to these situations. Judgement should be used in determining which steps or activities in the design process are appropriate for the given situation."

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7.2.1

Design Input

Design input consists of the requirements for each design and any other parameters or limitations that must be specified to allow the engineering design function to carry out its responsibilities with respect to producing a design that meets the needs of the facility. Design inputs shall be assembled, documented, controlled, and maintained to provide a basis for verifying that the installed design meets design requirements. Inputs shall be identified as to their source and any limitations on the validity of the inputs. The engineering design function shall obtain required information on the objectives or mission of a design change or facility addition from the appropriate source. Design inputs that require validation during the design process shall be identified and controlled to ensure that validation is performed. Applicable codes and standards shall be identified and the appropriateness of their use shall be demonstrated.

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Appendix 3A-1, Section 2(1)

"Design inputs include many characteristics and functions of an item or system. These inputs vary depending on the application; however, the nuclear industry has found it desirable to consider at least the following listed inputs as they apply to specific items or systems:

(1) basic functions of each structure, system, and component;"

RELATED REFERENCES

1. ANSI-N45.2.11-1974 Section 3.2

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Appendix 3A-1, Section 2(2)

"Design inputs include many characteristics and functions of an item or system. These inputs vary depending on the application; however, the nuclear industry has found it desirable to consider at least the following listed inputs as they apply to specific items or systems:

(2) performance requirements such as capacity, rating, and system output;"

RELATED REFERENCES

1. ANSI-N45.2.11-1974 Section 3.2

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Appendix 3A-1, Section 2(3)

"Design inputs include many characteristics and functions of an item or system. These inputs vary depending on the application; however, the nuclear industry has found it desirable to consider at least the following listed inputs as they apply to specific items or systems:

(3) codes and standards, regulatory requirements and commitments or responses to Federal, State, and Local Regulations. For example, these may include, but not be limited to:

- (a) Safety Analysis Report
- (b) NRC's Safety Evaluation Report and supplements thereto
- (c) Environmental Report
- (d) NRC's environmental statement and supplements thereto

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- (e) Technical Specifications
- (f) Regulatory Guides
- (g) Code of Federal Regulations
- (h) NRC bulletins, circulars, notices, and generic letters
- (i) commitments in correspondence with NRC"

RELATED REFERENCES

1. ANSI-N45.2.11-1974 Section 3.2

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Appendix 3A-1, Section 2(7)

"Design inputs include many characteristics and functions of an item or system. These inputs vary depending on the application; however, the nuclear industry has found it desirable to consider at least the following listed inputs as they apply to specific items or systems:

(7) Interface requirements including definition of the functional and physical interfaces involving structures, systems, and components:

- (a) the effect on existing plant equipment capability, such as DC battery loads, AC bus capacity, available stored water inventory, service instrument air capacity, water systems capability (intake, service, and component cooling water), and HVAC capability;
- (b) the effect of cumulative tolerances in the design;
- (c) the effect on design and safety analyses to ensure the analytical bases remain valid;
- (d) the compatibility with unimplemented design changes to specify any required sequence for implementation;
- (e) compatibility with Technical Specification requirements."

RELATED REFERENCES

1. ANSI-N45.2.11-1974 Section 3.2

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Chapter II, Section 3

"3 DESIGN CONTROL

The design shall be defined, controlled, and verified. Applicable design inputs shall be appropriately specified on a timely basis and correctly translated into design documents. Design interfaces shall be identified and controlled. Design adequacy shall be verified by persons other than those who designed the item. Design changes, including field changes, shall be governed by control measures commensurate with those applied to the original design."

RELATED REFERENCES

1. 10CFR50 Appendix A, Criterion 1

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SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Supplement 3S-1, Section 2

"2 Design Input

Applicable design inputs such as design bases, performance requirements, regulatory requirements, codes, and standards, shall be identified and documented and their selection reviewed and approved on a timely basis by the responsible design organization. The design input shall be specified and approved on a timely basis and to the level of detail necessary to permit the design activity to be carried out in a correct manner and to provide a consistent basis for making design decisions, accomplishing design verification, and evaluating design changes. Changes from approved design inputs, including the reason for the changes, shall be identified, approved, documented, and controlled."

RELATED REFERENCES

1. 10CFR50 Appendix A, Criterion 4
2. ANSI-N45.2.11-1974 Section 3.1
3. 10CFR50 Appendix A, Criterion 1
4. 10CFR50 Appendix A, Criterion 2

SITE REQUIREMENT SOURCE: ASME-NQA-2-1989 Part 2.1, Section 2.1.0

"Cleaning and cleanness control activities for each phase (manufacturing, construction, modification, repair, etc.) shall be planned in accordance with the requirements of the Introduction to this Standard. The plan(s) shall define the cleaning and inspection operations to be used, the system, the responsibilities of the parties concerned for each operation, and the measures to be employed to preserve the cleanness of cleaned surfaces. In addition, planning shall consider the following factors, as appropriate, recognizing that this list may not be complete nor applicable to each phase covered by this Standard:

- (a) adequacy of vents, drains, inspection access points, and bypass or recirculation lines;
- (b) facilities for filters and flushing and drain connections in locations where dead legs are unavoidable;
- (c) design and installation of piping in a manner that minimizes the necessity for installing temporary piping during the cleaning operations, such as dividing the system into a number of separate cleaning circuits to facilitate cleanability;
- (d) sequencing of installation operations to provide for visual inspection of inside surfaces of large diameter piping;
- (e) control of installation operations so that piping and components that have already been installed are not subject to contamination when subsequent installation operations are performed;
- (f) adequacy of pumping and heating capacities when these are important factors in the cleaning operations;
- (g) disposal of cleaning solutions and waste water;
- (h) safety, fire protection, and other hazards."

SITE REQUIREMENT SOURCE: ASME-NQA-2-1989 Part 2.15, Section 4.0

"Design Requirements. Due to the wide range of equipment normally used in the handling of items for nuclear plants, it is appropriate that different criteria be used for designing different types of handling equipment. This Section describes specific design criteria which are

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appropriate for most applications and which are recommended for general use. If it can be shown that these criteria are not appropriate for specific application, the engineer responsible shall select compatible criteria and document the justification. It is recognized that some items are also covered by other standards, which may be more stringent than this Part, and items must meet requirement of both. Hoisting, rigging, and transporting equipment which is to be used exclusively during the construction phase shall be designed in accordance with paras. 4.1, 4.2, and 4.3. Permanent plant handling equipment is designed and selected in accordance with other standards.

The organization responsible for the design shall establish a program for assuring that the handling equipment conforms to the design requirements of the applicable portions of this Part."

SITE REQUIREMENT SOURCE: ASME-NQA-2-1989 Part 2.15, Section 4.1

"Standard Manufactured Components. Standard manufactured components shall be selected to safely perform the intended operations structurally, mechanically, and electrically. They shall have been designed to conform to accepted industry standards."

SITE REQUIREMENT SOURCE: ASME-NQA-2-1989 Part 2.15, Section 4.2

"Commercial Standard Design. Commercial standard design equipment shall be selected to safely perform the intended operations structurally, mechanically, and electrically. They shall have been designed to conform to consensus standards, or when a consensus standard is not totally adequate, to accepted standards."

SITE REQUIREMENT SOURCE: ASME-NQA-2-1989 Part 2.15, Section 4.3.0

"Special Designed Equipment. Special designed equipment shall be designed to safely perform the intended operations structurally, mechanically, and electrically. Standard manufactured components or commercial standard design equipment, or elements thereof, incorporated into the total system, shall meet the requirement of paras. 4.1 and 4.2, respectively, with safety factors as recommended by the manufacturer of the components and equipment."

SITE REQUIREMENT SOURCE: ASME-NQA-2-1989 Part 2.20, Section 2.1

"Planning. A plan shall be developed for outlining project specific tasks for which procedures or work instructions will be required in accordance with the requirements of the Introduction to this Standard.

In addition, planning shall include the following:

- (a) identification of engineering data required for design;
- (b) specification of suitable field and laboratory testing equipment;
- (c) specification of approved standard methods or procedures for field, laboratory, and engineering sampling, testing, and analysis activities;
- (d) definition of required records and documentation;
- (e) the preparation of exploratory work plans.

The plan shall include provision for control and documentation of any changes."

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FACILITY REQUIREMENT SOURCE: DOE5480.11 Section 9.j(1)(d)

"Maintenance, Decontamination, and Decommissioning. Ease of maintenance and decontamination and decommissioning is to be considered in facility design and selection of materials."

FACILITY REQUIREMENT SOURCE: DOE6430.1A Section 0140[08]

"Wherever possible, design shall reflect experience gained on similar projects or similar types of construction. Provisions shall be made for review and checking design calculations, drawings, and construction specifications by qualified personnel other than those responsible for the original design."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter III, Section C.5.b, Paragraph 5

"Some portions of the design requirements can be maintained by engineering contractors, architect/engineers, or equipment manufacturers. Utility's design engineering organization and design contractors should have access to this information and, preferably, should maintain readily available copies of the documentation. In some cases, design requirements may not be documented or retrievable. In these situations, design requirements must be reestablished based on original design considerations and applicable regulatory requirements to support the proposed design and to integrate changes into the overall plant design. When design requirements are reestablished, an explanation of why the requirements were established should be documented to support the review and independent verification of the final design. In addition, when design requirements are reestablished, interfacing systems should be reviewed to determine any impact on these systems by the reestablished design requirements."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter III, Section C.5.b, Paragraph 8

"The design requirements should be assembled in a manner that allows them to be clearly communicated to station personnel. The identification and documentation of design requirements should include consideration of the possible uses by station personnel, including the need to ensure that plant configuration, station procedures, and training materials reflect current design requirements. Controls should be in place to ensure that approved revisions to the design requirements are distributed to users and that superseded design requirements are identified and prohibited from use."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter III, Section C.5.b, Paragraphs 1-3

"Design requirements are the original design bases for the plant updated to reflect all approved changes to the plant design bases. Design requirements should address the design input requirements described in American National Standards Institute report ANSI N45.2.11, Quality Assurance Requirements for the Design of Nuclear Power Plants. All planned modifications, including temporary modifications, should be reviewed to verify that the modifications are consistent with the design requirements and to evaluate any changes in design margins. Design requirement information sources should be readily accessible for the user, and the user should know where this information resides. Sources for design requirements should be identified. Additionally, design requirement should be consolidated into a limited number of

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documents, computer data bases, or source documents appropriately identified for retrievability.

Design requirements may be found in the following sources:

- design requirements document
- system descriptions
- design and procurement specifications
- vendor manuals and drawings
- plant drawings
- fire hazard analysis
- calculations and transient analyses, including documented assumptions and limitations.
- equipment environmental qualification data packages
- licensing documents and commitments
- codes and standards
- approved modifications not currently installed or reflected on design drawings, calculations, or analyses
- final (or updated) safety analysis report
- technical specifications

Additional sources for design requirements are identified in INPO 87-006, Report on Configuration Management in the Nuclear Utility Industry."

7.2.2

Design Process

The design process converts the inputs into design output documents that are used to implement the design in the facility. A key aspect of the design process is the preparation of calculations that demonstrate compliance of the design with acceptance criteria that are part of the design input. This subelement consists of three sub-subelements:

- General Design Process Requirements — requirements that apply generally to the design process.
- Design Analysis — requirements that apply to calculations and other analytical activities.
- Computer Programs Used in Design — requirements that apply to computer programs used in the design process. The Management Systems functional area addresses the general requirements for computer and software usage.

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The specific requirements for each of these sub-subelements are presented below.

7.2.2.1

General Design Process Controls

The design process shall be planned so that the organization performing the design work produces the required output documentation in a timely fashion to support the overall project plan. The design process shall be controlled. The design process shall produce the design outputs required for construction, operation, and maintenance of the facility.

Programmatic controls may include:

- Administrative controls to identify, manage and track design related information, modification packages, exceptions and deviations, etc.
- Process controls to ensure that field input including actual installed configurations are defined and captured through walkdowns or other means and that these are reflected in the design documents.
- Design modification process controls that ensure the use of existing technical baseline information or if not available the appropriate reconstitution.
- Design and design modification closeout controls that ensure verification of appropriate records, preparation of as-built drawings, resolution of any non-conformances, review of post-modification installation and functional testing results and required training.
- Process controls to ensure that the interface between the Engineering Design Functional Area and the Nuclear Safety Functional Area are defined and that the appropriate safety criteria, analysis and technical safety requirements are reflected in the proper design documents.

SITE REQUIREMENT SOURCE: ANSI-N45.2.11-1974 Section 9.0

"Corrective Action.

In addition to correcting a deficiency (or error), corrective action also includes, for significant or recurring deficiencies (or errors), determining the cause and instituting appropriate changes in the design process and the quality assurance program to prevent similar types of deficiencies (or errors) from recurring. A procedure shall be employed for providing such corrective action. This procedure shall also contain provisions for reporting the deficiency and corrective action to appropriate levels of supervision and management. The procedure shall also include follow-up actions that cannot be immediately completed to assure timely resolution and/or completion of the corrective action."

SITE REQUIREMENT SOURCE: ANSI-N45.2.11-1974 Section 9.1

"Detection of Errors. Deficiencies or error in the design or the design quality assurance program may be detected by:

1. Design verification measures.
2. Personnel using the design documents.
3. Audits.
4. Tests conducted.
5. Actual failure during operation.

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6. Other means."

SITE REQUIREMENT SOURCE: ANSI-N45.2.11-1974 Section 9.2

"Review of Procedure. Where a significant design change is necessary because of an incorrect design, the design process and verification procedure shall be reviewed and modified as necessary."

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Supplement 3S-1, Section 3

"3 Design Process

The responsible design organization shall prescribe and document the design activities on a timely basis and to the level of detail necessary to permit the design process to be carried out in a correct manner, and to permit verification that the design meets requirements. Design documents shall be adequate to support facility design, construction, and operation. Appropriate quality standards shall be identified and documented, and their selection reviewed and approved.

Changes from specified quality standards, including the reasons for the changes, shall be identified, approved, documented, and controlled. Design methods, materials, parts, equipment, and processes that are essential to the function of the structure, system, or component shall be selected and reviewed for suitability of application. Application information derived from experience, as set forth in reports or other documentation, shall be made available to cognizant design personnel. The final design (approved design output documents and approved changes thereto) shall:

(a) be relatable to the design input by documentation in sufficient detail to permit design verification; and

(b) identify assemblies and/or components that are part of the item being designed. When such an assembly or component part is a commercial grade item that, prior to its installation, is modified or selected by special inspection and /or testing to requirements that are more restrictive than the Supplier's published product description, the component part shall be represented as different from the commercial grade item in a manner traceable to a documented definition of the difference."

RELATED REFERENCES

1. ANSI-N45.2.11-1974 Section 4.1
2. 10CFR50 Appendix A, Criterion 1

SITE REQUIREMENT SOURCE: DOE5700.6C Attachment 1, Section B.2.b

"Design input, such as the design bases, reliability requirements, and fire protection requirements, should be correctly translated into design output, such as specifications, drawings, procedures, and instructions."

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SITE REQUIREMENT SOURCE: DOE5700.6C Attachment 1, Section B.3.c

"Appropriate controls for the selection, determination of suitability, evaluation, and receipt of all purchased items, including commercial-grade items, should be imposed to ensure that they perform as expected."

SITE REQUIREMENT SOURCE: INPO-85-013 Summary

"The objective of a good plant modification program is to provide controls to ensure that potential improvements in the plant are designed, reviewed, approved, installed, and operated in a safe and reliable manner. Since many groups are involved in the modification process, it is necessary to have a well-defined program that clearly identifies responsibilities and provides strong communications among the participants. An effective station program meeting the above objective should contain the following elements:

- o encouragement of ideas for improvements in plant design
- o careful review, approval, and establishment of priorities for modification requests to ensure the best use of limited resources
- o tracking and timely feedback on status of modification requests
- o close coordination among responsible parties to ensure timely use of resources
- o plant walkdowns by the designer during the design phase
- o development of a conceptual design early in the design process based on engineering evaluation and root cause determination
- o operability, maintainability, constructibility, and ALARA reviews during the design process
- o careful evaluation of the expected costs and benefits of proposed modifications
- o adherence to the FSAR, regulatory requirements, technical specifications, applicable codes, standards, and design criteria of the plant in the design, installation, and testing of modifications
- o thorough and documented technical reviews and safety evaluations with independent review, including review and revision of the impact on the design bases, criteria, specifications, and regulatory commitments
- o reviews by on-site and off-site safety review groups as required by technical specifications
- o quality reviews and field inspections of design, procurements, and installation activities
- o thorough testing to ensure design performance and system compatibility
- o updating of important documents used in plant operations prior to returning affected systems to service
- o positive control by plant management of the authorization and performance of field activities

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- o training of key plant personnel prior to returning affected systems to service
- o timely formal revision of design and operation documents, including specifications, as-designed and as-built drawings, vendor manuals, setpoint documents, FSAR, and technical specifications
- o timely updating of supporting programs to reflect modifications - examples include spare parts, in-service inspection, equipment history, surveillance, preventive maintenance, and equipment qualification
- o incorporation of applicable plant modifications into the plant- referenced simulator and appropriate training programs

The attached procedure is an example of a plant modification control program. While it addresses many of the above elements, some are not described fully. This approach is intentional to keep the good practice as straightforward as practicable and free from unnecessary detail. Users may find a need to develop more detailed guidance in certain aspects of their modification programs to address specific areas of concern."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter III, Section C.5, Paragraph 2

"In most cases, the as-built plant configuration should be verified against existing drawings and documents prior to the start of detailed design. The extent of verification depends on the accuracy and quality of the existing drawings and documents and the complexity of the modification. Verifying drawings prior to the start of detailed design development activities should minimize errors caused by drawing inaccuracies or deficiencies and should identify installed temporary modifications that can affect the design. Verification also many identify existing configuration problems. Throughout the design process, the designer should communicate progress and plans to the station staff. Joint walkdowns, with particular emphasis on design details impacting constructibility, operability, maintainability, and radiological protection, should be performed at specific milestones during the design process. Access to walkdown areas may not be possible due to plant operating or radiological conditions. In such cases, detailed design development should continue based on the available information and walkdowns rescheduled when plant condition allow access to the required area. Other information sources, such as design requirements documents, maintenance records, and post-modification records, also should be considered."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter III, Section C.5.b, Paragraph 4

"Once the needed design requirements are identified, they should be reviewed to ensure they are consistent with the current plant configuration. This review should include physical walkdowns where appropriate. In some cases where design requirements, such as calculations and analyses, may not be up to date with respect to current methods, the requirements should be evaluated prior to use. Particular attention should be given to original design inputs, assumptions, conclusions supported by engineering judgement, and compatibility of original and current methods. Experience has shown that errors in design changes often result from misunderstandings of original requirements in these areas."

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SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter III, Section C.5.b, Paragraph 8

"The design requirements should be assembled in a manner that allows them to be clearly communicated to station personnel. The identification and documentation of design requirements should include consideration of the possible uses by station personnel, including the need to ensure that plant configuration, station procedures, and training materials reflect current design requirements. Controls should be in place to ensure that approved revisions to the design requirements are distributed to users and that superseded design requirements are identified and prohibited from use."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter IV, Section A, Paragraph 1

"The engineering personnel who design a modification should be involved in processing the modification through closeout. Design engineering organization involvement should begin at the problem identification stage and continue throughout post-modification testing, acceptance, and initial operation of the modified system. For temporary modifications designed by station engineering personnel, design engineering personnel generally should be cognizant of the modifications as long as they are in effect. For both permanent and temporary modifications, the design engineer should be responsive to station requests for assistance and be accountable for the quality and integrity of the modification design throughout the design change process."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter IV, Section B, Paragraph 1

"The design engineering organization should be involved in all aspects of the design change implementation process. Design engineering involvement should be sufficient to ensure that any change is implemented according to the design requirements. The design engineering organization's role in the modification installation process should be clearly established, communicated to the station organization responsible for the modification installation, and maintained throughout the installation and testing phases of the design change implementation. The organization should provide feedback to the station staff on important information, such as design change package status, material procurement status, and the results of engineering analyses. Feedback and be provided informally through oral communications or formal methods such as meetings, documented responses, and project and engineering activities status reports."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter IV, Section C.1

"Once the design change package is released, the design engineer should be prepared to respond to questions and comments generated during the processing and review of the package by the station. Design engineering personnel should be available to interpret design output documents and respond to requests for changes identified during final station reviews and planning for modification implementation. Design engineering personnel should be prepared to participate in meetings of the on-site safety review committee to ensure that safety reviews are clear and properly documented. Design engineering procedures should ensure design changes are incorporated into the safety reviews in a timely manner so that the reviews are accurate and address pertinent concerns."

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SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter IV, Section C.3, Paragraph 2

"To minimize installation delays, design engineering personnel should address problems expeditiously. Because problems or deviations cannot always be resolved immediately, controls should be established that permit installation or testing to proceed with certain types of prespecified and identified problems or deviations prior to final engineering resolution. If installation or testing is allowed to continue under these conditions, controls should ensure that the problem or deviation is resolved and the final configuration approved by design engineering personnel. It is important that the design engineering organization be assigned full responsibility for installation and fabrication specifications and for specifying all quality control

requirements, inspection attributes, and acceptance criteria during modification development. This responsibility ensures that design requirements, installation tolerances, and critical installation tasks are clearly identified for the installation and inspection organizations."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section III, Section A, Paragraphs 1 and 2

"The modification design process for both permanent and temporary modifications should provide confidence in the technical adequacy of the design. This is provided by ensuring that the modification design satisfies established design requirements and includes additional design input considerations such as constructibility, operability, maintainability, radiological protection, and operating experience. The modification design process should ensure effective resolution of plant problems and enhancement of plant safety and reliability. This section discusses the modification design process, including problem identification, root cause analysis, development of alternative solutions, project plan development, detailed design development, and design change package issuance. Section IV, "Design Change Implementation," provides guidance on activities that occur after the release of the design change package. Some installation activities are a continuation of the design process, such as the processing of field change requests requiring review or revision of calculations to verify the acceptability of changes."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section III, Section B, Paragraph 5

"The modification design process begins with a clear statement of the problem or need for the modification. Problem identification can originate from the station or from external sources, such as a review of industry operating experience or new industry technical information or studies. All information pertinent to the problem or need for the modification should be assembled. This information aids in performing the root cause analysis and provides justification for pursuing a change."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section III, Section B, Paragraph 7

"Once the root causes of the problem are identified, methods to correct the causes should be considered. Alternative solutions frequently are possible. When possible, and with consideration of the magnitude or complexity of the problem potential alternative solutions should be developed and the advantages and disadvantages of each alternative identified.

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Solutions involving significant physical permanent plant change should be minimized. For alternatives involving significant permanent plant changes, conceptual designs and estimates of total cost for viable alternatives should be developed to provide sufficient information to support the selection of the best alternative. Simple or temporary modifications generally do not require conceptual designs. Complete information for each alternative solution will assist engineering and station management in evaluating the various alternatives and in selecting the optimum solution. Design engineering should recommend the most desirable solutions, and station management should approve the selected concept."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section III, Section B, Paragraph 8

"Once the design concept is approved, a project plan for the design and implementation of the plant modification should be developed for modification requiring significant design resources. The identification of project personnel, assigned tasks, major milestones, schedule constraints, interfaces, and required interactions are essential elements of the plan. Inadequate planning frequently results in not having sufficient time to produce a complete, high-quality design, including thorough design reviews and verifications. Elements of the project plan should be used as inputs to long- range or near-term planning as discussed in Section II."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section III, Section B, Paragraph 9

"Detailed design development begins with the identification of the design requirements and any additional design inputs. The design requirements should be assembled, controlled, and maintained to provide a basis for verifying the implemented design meets design requirements. Calculations required to support the modification should be performed, and design output documents, such as drawings, specifications, and requirements for installation, inspection, and testing, should be prepared. For temporary modifications, design output document preparation often involves "redlining" existing drawings and procedures. Design reviews should be performed to ensure that the design change accomplishes its intended function and meets the established design requirements. Independent verification should be performed prior to release of design output documents."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section III, Section B, Paragraphs 1 and 2

"A modification is any physical or functional change in the design or design basis of a plant structure, system, or component. A planned design change should be accomplished within the requirements and limitations of applicable procedures, codes, standards, specifications, licenses, and predetermined safety restrictions. Functional changes, such as altered software or setpoints, may not involve an apparent physical change but nonetheless must be controlled. However, the control of functional changes may not include all of the steps outlined in this section.

The modification design process should ensure that the desired level of quality is achieved and the needs of the station are addressed. Whether performed by the utility or a contractor, certain design change process elements are essential to both permanent and temporary modifications. Other elements are essential to permanent modifications but not temporary modifications. This section describes these essential elements for permanent modifications and notes exceptions for temporary modifications."

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SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section III, Section B, Paragraphs 3 and 4

"Design activities often are performed by station personnel for temporary or simple permanent modifications or by contracted architect-engineering firms for significant major modifications. The overall modification design process, however, should remain essentially as described in this section. The design engineering organization should see that the integrity of the plant design is maintained, regardless of which organization designs the modification.

At many stations, the controls used in designing temporary modifications omit steps normally in place to ensure design integrity for permanent modifications. For this reason, it is important that the design authority monitor the temporary modifications and also ensure that the temporary modification process is not used for permanent modifications. Additional guidance can be found in INPO 85-031, Guidelines for the Conduct of Technical Support Activities at Nuclear Power Stations."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section III, Section C.2

"When the proposed modification is in response to an identified problem, root cause analysis is one of the most important elements in the design process. Without properly identifying the root cause, the problem can recur, and modifications may only mask or compound the symptoms. Root cause analysis is the process used to identify the fundamental causes of the problem. A root cause analysis should be performed for significant, repetitive, or generic problems to ensure that the fundamental causes are fully understood.

The root cause analysis should begin with a thorough review of the problem statement. The review should include examination of the results of interviews with operations and maintenance personnel and the review and evaluation of procedural controls, station records, computer records, and other historical information. Additional joint walkdowns by experienced representatives from the station and design engineering may be appropriate. The representatives should focus their efforts on gathering information and understanding the problem.

As previously noted, industry operating experience can be helpful in determining root cause(s). The information should be assembled into groups of related facts and reviewed to identify possible root causes. The possible root causes should then be subject to critical independent review, verification by analysis, or physical testing. The results of the review, testing, or analysis should be evaluated, and a final report should be prepared documenting the method used to perform the root causes analysis, the conclusion reached, potential implications (if any) to other equipment or activities, and how the possible causes were validated or eliminated. INPO 90-004 (Good Practice OE-907), Root Cause Analysis, may be useful for this analysis."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section III, Section C.3, Paragraph 1, Sentences 1-3

"Once the root causes of the problem have been identified, the design engineer should consider alternative solutions to correct the problem and eliminate the causes. Cost benefit should be a consideration in evaluating alternative solutions. Although a formal evaluation may not be required for some simple or temporary changes, such as setpoint changes, in most instances it

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is important for the design engineer to identify technically feasible alternative solutions, providing the station staff with options that offer operational flexibility and latitude in schedule and budget."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section III, Section C.3, Paragraph 2

"Station input relating to operability, maintainability, constructibility, and radiological considerations should be obtained and factored into each viable alternative. When required to support choosing among alternatives, station and design engineering management should review a more detailed conceptual design developed for each viable alternative. A description of each alternative should be considered together with conceptual design documents, preliminary safety reviews, special installation or testing requirement, proposed schedules, and cost estimates. Alternatives that do not require a plant modification, such as procedural changes or additional training, should be considered and may be preferable to plant modifications. The design engineer should recommend the most desirable alternative and justify the recommendation. Station management should review the alternatives, provide any additional input, and concur with the alternative chosen. Selection of an alternative that does not address all of the root causes should require review and approval by senior management."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section III, Section C.4, Paragraph 1

"For major modifications, a project plan describing the development and implementation of the modification should be developed. A project plan is necessary to ensure every involved organization understands the design change and the scope of each organization's involvement. For temporary or simple modifications, a project plan may not be needed. Project plans should accomplish the following:

- Enhance communications among organizations, including outside contractors.
- Establish design responsibilities.
- Identify key personnel.
- Identify design information being developed within each organization or required from other organizations.
- Establish a schedule for the overall project effort."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section III, Section C.4, Paragraph 2

"The design output documents that will be developed and/or revised during the design process should be specified in the project plan. The project plan should specify the development of standard document distribution lists or a document distribution matrix to ensure that all appropriate design documents are received by affected organizations. Design documents received from equipment suppliers also should be included in the project plan. Reviewing, approving, and controlling organizations should be identified for each type of document."

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7.2.2.2

Design Analysis

Design analyses shall be performed to demonstrate compliance of the design to specified acceptance criteria. Design analyses shall be performed in a controlled manner and documented. Documentation shall be legible and shall be sufficiently detailed to permit a technically qualified person to review the analyses without recourse to the originator. Analyses shall be identified in a manner that allows the documentation to be retrieved.

SITE REQUIREMENT SOURCE: ANSI-N45.2.11-1974 Section 4.2

"Design analyses such as physics, stress, thermal, hydraulic and accident, shall be performed in a planned, controlled and correct manner.

Design analyses shall be legible and be in a form suitable for reproduction, filing and retrieving. Analyses shall be sufficiently detailed as to purpose, method, assumptions, design input, references and units such that a person technically qualified in the subject can review and understand the analyses and verify the adequacy of the results without recourse to the originator. Calculations shall be identifiable by subject (including structure, system, or component to which the calculation applies), originator, reviewer and date; or by other data such that the calculations are retrievable. Procedures shall include requirements for:

1. Identifying documents to permit ready reference and retrieval.
2. Defining the objective of the analyses.
3. Definition of design inputs and their sources.
4. Documenting the results of literature searches or other applicable background data.
5. Documenting assumptions, and identifying those assumptions that must be verified as the design proceeds.
6. Identification of computer calculations, including computer type, code or programming, inputs and outputs.
7. Review and approval."

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Supplement 3S-1, Section 3.1

"3.1 Design Analyses

Design analyses shall be performed in a planned, controlled, and documented manner. Design analysis documents shall be legible and in a form suitable for reproduction, filing, and retrieval. They shall be sufficiently detailed as to purpose, method, assumptions, design input, references, and units such that a person technically qualified in the subject can review and understand the analyses without recourse to the originator. Calculations shall be identifiable by subject (including structure, system, or component to which the calculation applies), originator, reviewer, and date; or by other data such that the calculations are retrievable."

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RELATED REFERENCES

1. 10CFR50 Appendix A, Criterion 2 dupe - to be deleted
2. 10CFR50 Appendix A, Criterion 4

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Supplement 3S-1, Section 3.1(b)

"(b) Documentation of design analyses shall include (1) through (6) below:

- (1) definition of the objective of the analyses;
- (2) definition of design inputs and their sources;
- (3) results of literature searches or other applicable background data;
- (4) identification of assumptions and indication of those that must be verified as the design proceeds;
- (5) identification of any computer calculation, including computer type, computer program (e.g., name), revision identification, inputs, outputs, evidence of or reference to computer program verification, and the bases (or references thereto) supporting application of the computer program to the specific physical problem;
- (6) review and approval."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter III, Section C.5.c, Paragraph 1

"Appropriate calculations and analyses should be prepared and verified to support design changes. For permanent modifications, original design calculations, if available, should be revised or superseded, with clear notations of the scope and intent of the change. For temporary modifications, revising original design calculations or annotating changes may not be needed. All calculations required to support modifications should be identified, indexed, and cross-referenced to the modification. The calculation index should identify the calculation number, title, revision, approval status, and the organization maintaining the calculation. The calculations should accurately reflect the as-built configuration of the plant."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter III, Section C.5.c, Paragraph 3

"Calculations should be documented in a format that easily can be reviewed for completeness during verification, revision, and retrieval efforts. The utility design engineering organization should establish guidance for calculation content and ensure conformance by all organizations, either internal or external, performing design calculations. All calculations would include the following:

- a unique calculation identification number and revision level
- statement of the objective of the calculation

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- safety classification
- identification of applicable unit, system, program, and/or building
- list of applicable codes and standards, including issue dates and addenda
- list of design requirements, additional design inputs, and references
- calculation method used
- any engineering judgements, including the justification for the engineering judgement
- identification of incomplete information or assumptions requiring verification
- references to applicable station documents such as procedures, the final (or updated) safety analysis report, or technical specifications."

7.2.2.3

Computer Programs Used in Design

Computer programs used in the design process shall be verified to demonstrate that they produce correct solutions for the encoded models. The models used within computer programs shall be demonstrated to be valid for the use to which they are being applied. Documentation of verification and validation activities shall be developed.

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Supplement 11S-2, Section 2.0

"TEST REQUIREMENTS

Test requirements and acceptance criteria shall be provided or approved by the organization responsible for the design or use of the program to be tested unless otherwise designated. Required tests including (as appropriate) verification tests, hardware integration tests, and in-use tests shall be controlled. Test requirements and acceptance criteria shall be based upon applicable design or other pertinent technical documents."

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Supplement 11S-2, Section 2.1

"Verification Tests

Verification tests shall demonstrate the capability of the computer program to produce valid results for tests problems encompassing the range of permitted usage defined by the program documentation. Acceptable test problem solutions are as follows:

- (a) hand calculations;
- (b) calculations using comparable proven programs; or
- (c) empirical data and information from technical literature.

For programs used for operational control, testing shall demonstrate required performance over the range of operation of the controlled function or process.

Depending on the complexity of the computer program being tested, testing may range from a single test of the completed computer program to a series of tests performed at various stages

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of computer program development to verify correct translation between stages and proper working of individual modules, followed by an overall computer program test. Regardless of the number of stages of testing performed, verification testing shall be sufficient to establish that test requirements are satisfied and that the computer program produces a valid result for its intended function."

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Supplement 11S-2, Section 2.2

"In-Use Tests

Test problems shall be developed and documented to permit confirmation of acceptable performance of the computer program in the operating system. Test problems shall be run whenever the computer problem is installed on a different computer, or when significant hardware or operating system configuration changes are made. Periodic in-use manual or automatic self-check routines shall be prescribed and performed for those applications where computer failures or drift can affect required performance."

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Supplement 11S-2, Section 3

"TEST PROCEDURES

Test procedures or plans shall specify the following, as applicable:

- (a) required tests and test sequence
- (b) required ranges of input parameters
- (c) identification of the stages at which testing is required
- (d) criteria for establishing test cases
- (f) requirements for hardware integration
- (g) anticipated output values
- (h) acceptance criteria
- (i) reports, records, standard formatting, and conventions"

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Supplement 11S-2, Section 4

"TEST RESULTS

Test results shall be documented. Verification test results shall be evaluated by a responsible authority to assure that test requirements have been satisfied."

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Supplement 3S-1, Section 3.1(a)

"(a) Computer programs may be utilized for design analysis without individual verification for each application provided:

- (1) the computer program has been verified to show that it produces correct solutions for the encoded mathematical model within defined limits for each parameter employed; and

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(2) the encoded mathematical model has been shown to produce a valid solution to the physical problem associated with the particular application.

Computer programs shall be controlled to assure that changes are documented and approved by authorized personnel. Where changes to previously verified computer programs are made, verification shall be required for the change, including evaluation of the effects of these changes on (1) and (2) above."

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Supplement 3S-1, Section 3.1(b)

"(b) Documentation of design analyses shall include (1) through (6) below:

(1) definition of the objective of the analyses;

(2) definition of design inputs and their sources;

(3) results of literature searches or other applicable background data;

(4) identification of assumptions and indication of those that must be verified as the design proceeds;

(5) identification of any computer calculation, including computer type, computer program (e.g., name), revision identification, inputs, outputs, evidence of or reference to computer program verification, and the bases (or references thereto) supporting application of the computer program to the specific physical problem;

(6) review and approval."

SITE REQUIREMENT SOURCE: ASME-NQA-2A-1990 Part 2.7, Section 10.1

"Individuals or organizations developing and supplying software under contract shall be required to have policies and procedures that meet the applicable requirements of this Part as specified in procurement documents. The documentation that is required by this Part shall be delivered or made available by the supplier to the purchaser. The applicable requirements of this Part shall become the responsibility of the purchaser upon receipt of software. Typically this software enters the purchaser's organization at the start of the installation and checkout phase. The supplier shall report software errors, or failures, to the purchaser, and the purchaser shall report software errors to the supplier."

SITE REQUIREMENT SOURCE: ASME-NQA-2A-1990 Part 2.7, Section 10.3

"The organization providing software services shall have a plan(s) for software quality assurance that meets the requirements of Section 10. The user organization shall determine the adequacy of this plan."

SITE REQUIREMENT SOURCE: ASME-NQA-2A-1990 Part 2.7, Section 2.1

"The requirements set forth in Part 2.7 apply to the computer software used to produce or manipulate data which is used directly in the design, analysis, and operation of structures,

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systems, and components. The application of specific requirements shall be prescribed in plan(s) for software quality assurance and in written policies and procedures."

SITE REQUIREMENT SOURCE: ASME-NQA-2A-1990 Part 2.7, Section 3, Paragraph 2

"Software development shall proceed in a traceable, planned, and orderly manner. The number of phases and relative emphasis placed on each phase of software development will depend on the nature and complexity of the software. Software development may be performed in an iterative or sequential manner."

SITE REQUIREMENT SOURCE: ASME-NQA-2A-1990 Part 2.7, Section 3.5

"During this phase the software becomes part of a system incorporating applicable software components, hardware, and data. The process of integrating the software with applicable components may consist of installing hardware, installing the program, reformatting or creating databases, and verifying that all components have been included.

Installation and checkout phase software verification and validation activities shall consist of:

- (a) the execution of tests for installation and integration; and
- (b) the documentation of the approval of the software for operational use."

SITE REQUIREMENT SOURCE: ASME-NQA-2A-1990 Part 2.7, Section 3.6

"Prior to this phase the software has been approved for operational use. Further activity shall consist of maintenance of the software to remove latent errors (corrective maintenance), to respond to new or revised requirements (perfective maintenance), or to adapt the software to changes in the operating environment (adaptive maintenance). Software modifications shall be approved, documented, verified and validated, and controlled. In-use tests shall be performed in accordance with ASME NQA-1, 11S-2."

SITE REQUIREMENT SOURCE: ASME-NQA-2A-1990 Part 2.7, Section 4

"Software verification and validation activities shall:

- (a) ensure that the software adequately and correctly performs all intended functions; and
- (b) ensure that the software does not perform any unintended function that either by itself or in combination with other functions can degrade the entire system.

Software verification and validation activities shall be planned and performed for each system configuration which may impact the software. The results of software verification and validation activities shall be documented. Software verification and validation shall be performed by individuals other than those who designed the software."

SITE REQUIREMENT SOURCE: ASME-NQA-2A-1990 Part 2.7, Section 4.1

"Software verification shall be performed during the software development to ensure that the products of a given cycle phase fulfill the requirements of the previous phase or phases."

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SITE REQUIREMENT SOURCE: ASME-NQA-2A-1990 Part 2.7, Section 4.2

"Software validation is performed at the end of the implementation phase to ensure that the code satisfies the requirements. Software validation activities, such as the development of test plans and test cases shall be integrated into each phase of the software life cycle. Testing shall be the primary method of software validation. The validation of modifications all be subject to selective regression testing to detect errors introduced during the modification of system or system components, to verify that the modifications have not caused unintended adverse effects, or to verify that a modified system(s) or system components(s) still meets specified requirements."

SITE REQUIREMENT SOURCE: ASME-NQA-2A-1990 Part 2.7, Section 6.4

"Software verification and validation documentation shall describe the tasks, and criteria for accomplishing the verification of the software in each phase, and the validation of the software at the end of the development cycle. The documentation shall also specify the hardware and software configurations pertinent to the software verification and validation. The documentation shall be organized in a manner that allows traceability to both the software requirements and the software design. This documentation shall also contain the results for the execution of the software verification and validation activities, and shall include the results of reviews and tests, and a summary of the status of the software e.g., incomplete design performance and application requirements."

SITE REQUIREMENT SOURCE: ASME-NQA-2A-1990 Part 2.7, Section 7

"Verification reviews shall identify the participants and their specific responsibilities during the review and in the preparation and distribution of the review documentation. The reviewed documents shall be updated and placed under configuration control. Documentation of review comments and their disposition shall be retained until they are incorporated into the updated software. Comments and their disposition not incorporated shall be retained in accordance with established procedures."

SITE REQUIREMENT SOURCE: ASME-NQA-2A-1990 Part 2.7, Section 7.1

"The review of software requirements shall be performed at the completion of the software requirements documentation. This review shall assure that the requirements are complete, verifiable, consistent and technically feasible. The review shall also assure that the requirements will result in feasible and usable code."

SITE REQUIREMENT SOURCE: ASME-NQA-2A-1990 Part 2.7, Section 7.2

"The software design review shall be held at the completion of the software design documentation. This review shall meet the design verification requirements of ASME NQA-1, 3S-1. This review shall evaluate the technical adequacy for the design approach, and assure internal completeness, consistency, clarity, and correctness of the software design, and shall verify that the software design is traceable to the requirements."

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SITE REQUIREMENT SOURCE: ASME-NQA-2A-1990 Part 2.7, Section 8

"A formal procedure of software problem and corrective action shall be established for software errors, and failures. This problem reporting system shall assure that problems are promptly reported to affected organizations to assure formal processing of problem resolutions. Problems in software may be classified by the organization responsible for the evaluation. Any classification systems shall have defined criteria based on the impact of the software output. Corrective action by the responsible organization shall assure that:

- (a) problems are identified, evaluated, documented, and, if required corrected;
- (b) problems are assessed for impact on past and present applications of the software by the responsible organization;
- (c) corrections or changes shall be controlled in accordance with Section 5.2; and
- (d) preventive actions and corrective actions results are provided to affected organizations."

SITE REQUIREMENT SOURCE: ASME-NQA-2A-1990 Part 2.7, Section 9

"To the extent appropriate, controls shall be established to permit authorized and prevent unauthorized access to a computer system."

SITE REQUIREMENT SOURCE: DOE5700.6C Attachment 1, Section B.2.f

"The acceptability of design work and documents, including design inputs, processes, outputs and changes, should be verified. Computer programs should be proven through previous use, or validated through testing or simulation prior to use."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter III, Section C.5.c, Paragraph 5

"Computer programs used to perform analytical or repetitive calculations should be verified and validated before being used to support a design engineering task. Verification should be performed only by competent, experienced professionals. Computer programs should be verified using hand calculations, analytical results from test cases, or comparison of results from a similar program. Computer program verification should be specific as to code name, revision number and date, and any other identifiers unique to that program. Appropriate verification of computer programs should be repeated whenever any portion of the program is revised. Computer programs should be controlled to prevent inadvertent or unauthorized changes to the software. Computer programs should be verified periodically to determine the effectiveness of these controls. Computer programs used by contractors and vendors should be controlled in a similar manner. Errors in vendor-supplied software should be documented and a vendor-supplied software error notification provided to all software users. Software errors should be evaluated for the effect on previously performed calculations and analyses. INPO 85-031, Guidelines for the Conduct of Technical Support Activities at Nuclear Power Stations, provides specific guidance on software controls."

7.2.3

Design Output

Design outputs consist of drawings, procurement specifications, engineering specifications for construction, and other engineering documentation necessary to construct, operate, and maintain the facility. Design outputs shall be prepared in a planned and controlled manner. The engineering design function shall specify quality control inspection requirements and acceptance criteria for attributes important to design. Design outputs should be prepared in a

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planned and controlled manner. The engineering design function should specify quality control inspection requirements and acceptance criteria for attributes important to design. Design output documents provide specific limits, controls, and technical directions for structures, systems and components to the constructor, operator, modifier, or to the requestor of engineering services.

Programmatic controls shall be in place to ensure:

- Operability, maintainability, and constructability of the final design prior to issue and
- Control for the preparation, review, approval, issue, distribution, storage, and revision of design output documents.

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Appendix 3A-1, Section 3(b)

"Subjects normally covered by procedures for the preparation and control of specifications and other design documents include the following:

- (1) format requirements
- (2) identification system
- (3) review and approval requirements
- (4) issuance and distribution
- (5) revisions
- (6) indication of status
- (7) storage and control of originals or master copies"

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Appendix 3A-1, Section 3(c)

"Design documents should include information which may subsequently be needed to support facility operations such as:

- (1) control room operations
- (2) maintenance
- (3) spare and replacement parts
- (4) environmental qualification of equipment
- (5) outage planning and scheduling
- (6) safety evaluations
- (7) facility modifications
- (8) personnel training and qualification"

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Chapter II, Section 4

"PROCUREMENT DOCUMENT CONTROL

Applicable design bases and other requirements necessary to assure adequate quality shall be included or referenced in documents for procurement of items and services. To the extent necessary, procurement documents shall require Suppliers to have a quality assurance program consistent with the applicable requirements of this Standard."

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SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Supplement 4S-1, Section 2.0-2.2

"CONTENT OF THE PROCUREMENT DOCUMENTS

Procurement documents issued at all tiers of procurement shall include provisions for the following, as deemed necessary by the Purchaser.

2.1 Scope of Work

A statement of the scope of the work to be performed by the Supplier shall be in the procurement documents.

2.2 Technical Requirements

Technical requirements shall be specified in the procurement documents. Where necessary, these requirements shall be specified by reference to specific drawings, specifications, codes, standards, regulations, procedures, or instructions, including revisions thereto that describe the items or services to be furnished. The procurement documents shall provide for identification of test, inspection, and acceptance requirements of the Purchaser for monitoring and evaluating the Supplier's performance."

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Supplement 7S-1, Section 10

"COMMERCIAL GRADE ITEMS

Where the design utilizes commercial grade items, the following requirements are an acceptable alternate to other requirements of this Supplement, except as noted in (b) below and the requirements of Supplement 4S-1.

(a) The commercial grade item is identified in an approved design output document. An alternative commercial grade item may be applied, provided the cognizant design organization provides verification that the alternate commercial grade item will perform the intended function and will meet design requirements applicable to both the replaced item and its application.

(b) Source evaluation and selection, where determined necessary by the Purchaser based on complexity and importance to safety, shall be in accordance with para. 3.1 of this Supplement.

(c) Commercial grade items shall be identified in the purchase order by the manufacturer's published product description (for example, catalog number).

(d) After receipt of a commercial grade item, the Purchaser shall determine that:

- (1) damage was not sustained during shipment;
- (2) the item received was the item ordered;
- (3) inspection and/or testing is accomplished, as required by the Purchaser, to assure conformance with the manufacturer's published requirements;
- (4) documentation, as applicable to the item, was received and is acceptable."

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Supplement 7S-1, Section 4

"BID EVALUATION

Bid evaluation shall determine the extent of conformance to the procurement documents. This evaluation shall be performed by individuals or organizations designated to evaluate the following subjects, as applicable to the type of procurement:

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- (a) technical considerations
- (b) quality assurance requirements
- (c) Supplier's personnel
- (d) Supplier's production capability
- (e) Supplier's past performance
- (f) alternates
- (g) exceptions

Prior to the award of the contract, the Purchaser shall resolve or obtain commitments to resolve unacceptable quality conditions resulting from the bid evaluation. "

SITE REQUIREMENT SOURCE: DOE5700.6C Attachment 1, Section B.3.a

"Criterion 7 – Procurement

- a. A process should be established and implemented to ensure that purchased items and services meet established requirements and perform as expected."

SITE REQUIREMENT SOURCE: DOE5700.6C Attachment 1, Section B.3.b

"Applicable technical and administrative requirements, such as specifications, codes, standards, tests, and inspections should be invoked for procurement of items and services. Procurement documents should include acceptance criteria."

SITE REQUIREMENT SOURCE: DOE5700.6C Attachment 1, Section B.4.b(3)

"Item and process test requirements and acceptance criteria should be provided by or approved by the organization responsible for design. Administrative controls and status indicators should be used to preclude inadvertent bypassing of required tests or operation of the item or process."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter III, Section C.5.a

"A design specification for use in the development of the design change should be prepared prior to the start of detailed design activities. The design specification should provide sufficient information to enable the design engineer or contracted engineering firm to proceed with the detailed design development in a timely and efficient manner.

The design specification should include pertinent design development guidance such as the following:

- objective of the design change
- design requirements the proposed change must satisfy, such as system flow rates or heat removal requirements
- conceptual design information for reference
- inspecting and testing requirements
- acceptance criteria for determining that the objective of the change has been met

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The level of detail in the design specification should be consistent with the scope and complexity of the design change. For temporary or simple modifications, a design specification may not be necessary. A more detailed discussion of the design specification is contained in NSAC-105, Guidelines for Design and Procedure Changes in Nuclear Power Plants."

RELATED REFERENCES

1. NSAC-105

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter III, Section C.5.d, Paragraph 1

"Design output documents (e.g., drawings, procurement specifications, installation and testing requirements, design reviews, and safety reviews) are produced during the design process to support the implementation of the modification. Drawings should be prepared in accordance with approved design procedures; they should be complete, accurate, and clear and reflect the design requirements. Specifications for equipment procurement should identify important design requirements such as performance and construction details; seismic and environmental conditions that affect component design; and other installation, operating, and maintenance requirements. Materials specifications should ensure the appropriateness of the materials for the application and emphasize the use of standard stocked materials, where possible."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter III, Section C.5.d, Paragraph 2

"Requirements for modification installation should be clearly specified. Installation requirements should identify applicable procedures and required inspection hold points. Inspection and test requirements should clearly identify testing methodology, operational parameters, and system and/or component conditions. Inspection and test requirements also should provide quantitative acceptance criteria that demonstrate the change meets the physical and functional design requirements."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter III, Section C.5.d, Paragraph 3

"Design interface control procedures should establish responsibilities for review, approval, release, distribution, and revision of documents. When design output documents are distributed, the transmittals should identify the status of the information being distributed and whether the document has been issued for review or approval."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter III, Section C.6, Paragraph 1

"A design change package should be developed for all modifications. The package content, format, and level of detail may vary depending on modification complexity, equipment, or system safety significance. However constructed, the design change package should provide necessary information to support final review of the design change and preparation of the installation and test package. Pertinent descriptive information, such as safety reviews, testing methods, and design requirements, should be maintained up to date and should be provided in the design change package. Other pertinent design information, such as the results of calculations and analyses, should be made available to reviewers if questions arise about the

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modification design. All aspect of the design change that should be completed prior to declaring the modified system operational (e.g., drawing revisions or markups, test verifications) should be clearly identified in the design change package.

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter IV, Section C.2, Paragraph 1

"An installation, inspection, and test package should be developed based on the information contained in the design change package. The design change package should include specific engineering requirements in installation and testing for use in preparing detailed installation instructions, inspection plans, and test procedures. Installation, inspection, and test package development can be performed in parallel with development of the design change package and must be consistent with the information in the final approved design change package before being implemented. This package should include specific directions to the craftsmen on installing the change. It should further provide appropriate work and quality controls to ensure the conduct of inspections and surveillances of installation will not present conflicts with station maintenance, operations, or radiological controls. The installation, inspection, and test package may be developed by station or design engineering personnel. Engineering personnel who design the modification or other engineering personnel who have been specifically trained to produce this document should review the installation, inspection, and test procedures to ensure that the procedures are consistent with the design requirements, the system will be properly tested, proper inspection attributes and acceptance criteria are specified, and the component or system performance will be compared to valid acceptance criteria."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter IV, Section C.3, Paragraph 2

"To minimize installation delays, design engineering personnel should address problems expeditiously. Because problems or deviations cannot always be resolved immediately, controls should be established that permit installation or testing to proceed with certain types of prespecified and identified problems or deviations prior to final engineering resolution. If installation or testing is allowed to continue under these condition, controls should ensure that the problem or deviation is resolved and the final configuration approved by design engineering personnel. It is important that the design engineering organization be assigned full responsibility for installation and fabrication specifications and for specifying all quality control requirements, inspection attributes, and acceptance criteria during modification development. This responsibility ensures that design requirements, installation tolerances, and critical installation tasks are clearly identified for the installation and inspection organizations."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section III, Section C.6, Paragraphs 2 and 3

"A design change package for a permanent modification should, as a minimum, include the following items: (For temporary modifications, some items, such as recommended spare parts lists, may not be required.)

- a description of the problem necessitating the change
- alternatives considered, and the bases for the selection of the chosen alternative

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- a detailed description of the change; its effects on plant operation in all operational modes; and, when applicable, a discussion of the effect of implementation (and removal for temporary modifications) of the modification
- records of design and station reviews for constructibility, maintainability operability, and radiological protection, including how the comments were resolved.
- a summary of the design requirements addressed during the design of the change, including appropriate codes, standards, regulatory commitments, calculations prepared or referenced, special analyses, the final (or updated) safety analysis report, technical specifications, and system interaction considerations
- a listing of design documents impacted by the change
- controlled drawings and sketches - For temporary modifications, these drawings or sketches may be permanent drawings redlined or annotated under the station's temporary modification procedure.
- a listing of the material required to install the change, especially long-lead-time items.
- equipment list updates to identify the component tag numbers for labeling components added or deleted as a result of the change - Temporary annotations of the equipment list may be used for temporary modifications.
- installation specifications identifying construction precautions, limitations, and tolerances; installation testing requirements such as flushing, resistance testing, cleaning, and hydrostatic testing, including appropriate acceptance criteria; and plant conditions required for installation such as system or plant outages, operating conditions or limits, and technical specification restrictions - The installation specifications should identify other modifications that must be implemented prior to the installation of the modification. The installation specifications also should identify those portions of the modification that can be performed without a plant or system outage such as prefabrication, conduit-routing, or cable-pulling. Installation tolerances should be supported by calculations or analyses. Existing construction specifications can be referenced to establish installation testing requirements and acceptance criteria.
- operational considerations, including aspects of modification that may affect plant or system operation - This section should identify plant parameters that can be affected, such as flow rates or bus loadings. It also should identify alarms that can be generated during installation, testing, and operation.
- specifications necessary for receipt inspection of new components, including storage requirements and any maintenance to be performed on a component prior to installation.
- functional (or operational) testing requirements, test prerequisites, operating conditions or limits (including the effects of off-normal operations on interfacing systems), and clear acceptance criteria for those parameters to be verified for comparison with design requirements (e.g., system flow rates, pump head versus flow curves, motor-starting and steady-state currents, logic system actuation times, and heat transfer capability)

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- a listing of applicable vendor documentation, such as vendor manuals or vendor drawings for major components
- a list of spare parts and stocking levels recommended to support component installation, testing, and long-term preventive and corrective maintenance
- safety reviews to provide the necessary information to on-site review committees to ensure that the change addresses the appropriate engineering requirements and does not introduce an unreviewed safety question - This information should be updated to reflect the current plant configuration if there has been a significant delay between the time design was completed and installation commenced
- special requirements for sequencing or coordinating implementation with other approved modifications
- identification of potential impact on the plant-referenced simulator and other training equipment

The format of design change packages and drawings should be standardized to facilitate reviews and assist in future retrieval of information necessary to support design or testing for later modifications or evaluation. Each section in the design change package should be uniquely identified with sequentially numbered pages and included in a table of contents for the design change package. This allows clear control of the package and permits reference to the specific sections of the package when preparing procedure revisions or field change requests."

7.2.4

Design Review and Verification

Designs shall be verified by methods such as design reviews, alternate calculations, or testing. Requirements for testing activities conducted to achieve verification of design significant parameters are specified in the Testing Programs subelement of the Engineering Design RID. Design verification shall be applied to both permanent and temporary design changes. Design verifications shall be performed by technically competent individuals who were not involved in the development of the design being verified. Verifications shall be controlled and documented. Verification shall be performed in a timely manner. The process of resolution of issues raised during this activity shall be defined and may be part of the Issue Management element of the Management Systems functional area. The Nuclear Safety and Management Systems functional

areas describe additional controls associated with the interface with the design process, SAR/OSR development and control, Unreviewed Safety Question determinations, and independent safety review.

SITE REQUIREMENT SOURCE: ANSI-N45.2.11-1974 Section 6.3.1

"Design Reviews. Design reviews are critical reviews to provide assurance that design documents such as drawings, calculations, analyses or specifications are correct and satisfactory. Design reviews can range from multi- organization reviews to single-person reviews. The depth of review can range from a detailed check of the complete design to a limited check of such things as the design approach and the results obtained. The results of the review shall be documented and measures taken to ensure that the findings are implemented. Whether the review is conducted by one individual or a multi- organization there are a number of basic questions that shall be addressed such as:

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1. Were the inputs correctly selected and incorporated into design? (See paragraph 3.2).
2. Are assumptions necessary to perform the design activity adequately described and reasonable? Where necessary, are the assumptions identified for subsequent re-verifications when the detailed design activities are completed?
3. Are the appropriate quality and quality assurance requirements specified?
4. Are the applicable codes, standards and regulatory requirements including issue and addenda properly identified and are their requirements for design met?
5. Have applicable construction and operating experience been considered?
6. Have the design interface requirements been satisfied?
7. Was an appropriate design method used?
8. Is the output reasonable compared to inputs?
9. Are the specified parts, equipment, and processes suitable for the required application?
10. Are the specified materials compatible with each other and the design environmental conditions to which the material will be exposed?
11. Have adequate maintenance features and requirements been specified?
12. Are accessibility and other design provisions adequate for performance of needed maintenance and repair?
13. Has adequate accessibility been provided to perform the in-service inspection expected to be required during the plant life?
14. Has the design properly considered radiation exposure to the public and plant personnel?
15. Are the acceptance criteria incorporated in the design documents sufficient to allow verification that design requirements have been satisfactorily accomplished?
16. Have adequate pre-operational and subsequent periodic test requirements been appropriately specified?
17. Are adequate handling, storage, cleaning and shipping requirements specified.
18. Are adequate identification requirements specified?
19. Are requirements for record preparation review, approval, retention, etc., adequately specified?"

SITE REQUIREMENT SOURCE: ANSI-N45.2.11-1974 Section 6.3.2

"Alternate Calculations. Verification of some types of calculations or analyses may be achieved by comparison with alternate methods of calculation or analyses. This shall be performed by a person or persons other than those who performed the original calculation. Where alternate calculations are performed to verify the correctness of the original calculation a review shall also be performed to address the appropriateness of assumptions, input data, and the code or other calculation method used.

The alternate method used for comparison may be a more simplified approach or less rigorous, such as when a hand calculation is used to check the computer code output. Although the simplified or less rigorous method may not exactly check the original calculation or analysis, it must provide results consistent with the original calculation or analyses.

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Appendix 3A-1, Section 4

"Design verification for some designs or specific design features may be achieved by suitable qualification testing of a prototype or initial production unit. Qualification testing may be used in combination with other verification methods. For example, it may be most effective to verify that an instrumentation cabinet is designed to withstand the maximum earthquake-caused vibratory motions by actually subjecting the cabinet and its associated components to shaker tests which correspond to these vibratory motions. The shaker tests will not, however, verify that the circuitry is designed correctly or that the component in the cabinet will perform its

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intended function. Other tests or verification means are required to confirm that remaining design functions are adequately performed by the instrumentation and that those components perform the intended functions for the varying conditions to which they are subjected."

RELATED REFERENCES

1. ANSI-N45.2.11-1974 Section 6.3.3

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Chapter II, Section 3

"3 DESIGN CONTROL

The design shall be defined, controlled, and verified. Applicable design inputs shall be appropriately specified on a timely basis and correctly translated into design documents. Design interfaces shall be identified and controlled. Design adequacy shall be verified by persons other than those who designed the item. Design changes, including field changes, shall be governed by control measures commensurate with those applied to the original design."

RELATED REFERENCES

1. 10CFR50 Appendix A, Criterion 1

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Supplement 3S-1, Section 4

"4 Design Verification

Design control measures shall be applied to verify the adequacy of design, such as by one or more of the following: the performance of design reviews, the use of alternate calculations, or the performance of qualification tests. Verification of computer programs shall include appropriate testing. The responsible design organization shall identify and document the particular design verification method(s) used. The results of design verification shall be clearly documented with the identification of the verifier clearly indicated. Design verification shall be performed by any competent individual(s) or group(s) other than those who performed the original design but who may be from the same organization. This verification may be performed by the originator's supervisor, provided the supervisor did not specify a singular design approach or rule out certain design considerations and did not establish the design

inputs used in the design or, provided the supervisor is the only individual in the organization competent to perform the verification. cursory supervisory review do not satisfy the intent of this Standard.

Verification shall be performed in a timely manner. Design verification, for the level of design activity accomplished, shall be performed prior to release for procurement, manufacture, construction, or release to another organization for use in other design activities except in those cases where this timing cannot be met, such as when insufficient data exist. In those cases, the unverified portion of the design shall be identified and controlled. In all cases the design verification shall be completed prior to relying upon the component, system, structure, or computer program to perform its function."

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RELATED REFERENCES

1. ANSI-N45.2.11-1974 Section 6.1

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Supplement 3S-1, Section 4.1

"4.1 Extent of Design Verification

The extent of the design verification required is a function of the importance to safety, the complexity of the design, the degree of standardization, the state of the art, and the similarity with previously proven designs. Where the design has been subject to a verification process in accordance with this Standard, the verification process need not be duplicated for identical designs. However, the applicability of standardized or previously proven designs, with respect to meeting pertinent design inputs, shall be verified for each application. Known problems affecting the standard or previously proven designs and their effects on other features shall be considered. The original design and associated verification measures shall be adequately documented and referenced in the files of subsequent application of the design.

Where changes to previously verified design have been made, design verification shall be required for the changes, including evaluation of the effects of those changes on the overall design and on any design analyses upon which the overall design and on any design analyses upon which the design is based that are affected by the change to previously verified design."

RELATED REFERENCES

1. ANSI-N45.2.11-1974 Section 6.2

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Supplement 3S-1, Section 4.2.1

"4.2 Methods

Acceptable verification methods include, but are not limited to, any one or a combination of the following: design reviews, alternate calculations, and qualification testing.

4.2.1 Design Reviews. These are critical reviews to provide assurance that the final design is correct and satisfactory. Where applicable, (a) through (f) below shall be addresses:

- (a) Were the design inputs correctly selected?
- (b) Are assumptions necessary to perform the design activity adequately described and reasonable? Where necessary, are the assumptions identified for subsequent reverifications when the detailed design activities are completed?
- (c) Was an appropriate design method used?
- (d) Were the design inputs correctly incorporated into the design?
- (e) Is the design output reasonable compared to the design inputs?

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(f) Are the necessary design input and verification requirements for interfacing organizations specified in the design documents or in supporting procedures or instructions?"

RELATED REFERENCES

1. ANSI-N45.2.11-1974 Section 6.3
2. ANSI-N45.2.11-1974 Section 6.3.1

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Supplement 3S-1, Section 4.2.2

"4.2 Methods

Acceptable verification methods include, but are not limited to, any one or a combination of the following: design reviews, alternate calculations, and qualification testing.

[. . .]

4.2.2 Alternate Calculations. These are calculations or analyses that are made with alternate methods to verify correctness of the original calculations or analyses. The appropriateness of assumptions, input data used, and the computer program or other calculation method used shall also be reviewed."

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Supplement 3S-1, Section 4.2.3

"4.2 Methods

Acceptable verification methods include, but are not limited to, any one or a combination of the following: design reviews, alternate calculations, and qualification testing.

[. . .]

4.2.3 Qualification Tests. Where design adequacy is to be verified by qualification tests, the tests shall be identified. The test configuration shall be clearly defined and documented. Testing shall demonstrate adequacy of performance under conditions that simulate the most adverse design conditions. Operating modes and environmental conditions in which the item must perform satisfactorily shall be considered in determining the most adverse conditions. where the test is intended to verify only specific design features, the other features of the design shall be verified by other means. Test results shall be documented and evaluated by the responsible design organization to assure that the test requirements have been met.

If qualification testing indicates that modifications to the item are necessary to obtain acceptable performance, the modification shall be documented and the item modified and retested or otherwise verified to assure satisfactory performance. When tests are being performed on models or mockups, scaling laws shall be established and verified. The results of model test work shall be subject to error analysis, where applicable, prior to use in final design work."

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RELATED REFERENCES

1. ANSI-N45.2.11-1974 Section 6.3.3

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Supplement 4S-1, Section 3

"PROCUREMENT DOCUMENT REVIEW

A review of the procurement documents and changes thereto shall be made to assure that documents transmitted to the prospective Supplier(s) include appropriate provisions to assure that items or services will meet the specified requirements.

Reviews shall be performed and documented to provide objective evidence of satisfactory accomplishment of such review prior to contract award.

Changes made as a result of the bid evaluations or precontract negotiations shall be incorporated into the procurement documents. The review of such changes and their effects shall be completed prior to contract award.

This review shall include the following considerations:

- (a) appropriate requirements specified in Section 2 of this Supplement;
- (b) determination of any additional or modified design criteria;
- (c) analysis of exceptions or changes requested or specified by the Supplier and determination of the effects such changes may have on the intent of the procurement documents or quality of the item or service to be furnished.

Reviews required by this Section shall be performed by personnel who have access to pertinent information and who have an adequate understanding of the requirements and intent of the procurement documents."

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Supplement 7S-1, Section 8.3

"Acceptance of Services Only

In certain cases involving procurement of services only, such as third party inspection; engineering and consulting services; and installation, repair, overhaul, or maintenance work, the Purchaser shall accept the service by any or all of the following methods:

- (a) technical verification of data produced;
- (b) surveillance and/or audit of the activity;
- (c) review of objective evidence for conformance to the procurement document requirements such as certifications, stress reports, etc."

SITE REQUIREMENT SOURCE: ASME-NQA-2-1989 Part 2.20, Section 3.5

"Engineering Activities Verification. During the performance of engineering evaluation and analysis of the results of the field and laboratory operations, in-process (not necessarily continuous) surveillance shall be performed to assure that the engineering activities are being conducted by qualified personnel according to procedures. Checks of engineering evaluation and analysis activities shall be made in accordance with approved procedures to assure conformance to the requirements of Sections 2 and 6.

Checks shall be made to verify that the elements of the evaluation and analysis program are in compliance with applicable technical and quality standards, specifications, and requirements. The elements to be checked and verified shall include, but are not limited to, the following:

- (a) organization of the Quality Assurance Program;
- (b) qualification of personnel;

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- (c) identification, control, and storage of project documents;
- (d) use of procedure conforming to applicable specifications and requirements;
- (e) documentation and verification of field and laboratory data and results, engineering calculations and analyses, conclusions, and recommendations;
- (f) preparation and preparation of reports of data, calculations, analyses, conclusions, and recommendations.

Records of the verification of the engineering evaluation and analysis activities shall be verified as complete prior to presentation of the final subsurface investigation report."

SITE REQUIREMENT SOURCE: DOE5700.6C Attachment 1, Section B.2.f

"The acceptability of design work and documents, including design inputs, processes, outputs and changes, should be verified. Computer programs should be proven through previous use, or validated through testing or simulation prior to use."

SITE REQUIREMENT SOURCE: DOE5700.6C Attachment 1, Section B.2.g

"Design verification should be performed by qualified individual(s) or group(s) other than those who performed the original design - but who may be from the same organization. The extent of verification should be based on the complexity, risk, and uniqueness of the design."

SITE REQUIREMENT SOURCE: DOE5700.6C Attachment 1, Section B.2.h

"Verification methods include, but are not limited to, design reviews, alternate calculations, and qualification testing. Separate verification may not be needed for multiple uses of identical or previously proven designs, unless they are intended for different applications or different performance criteria."

SITE REQUIREMENT SOURCE: DOE5700.6C Attachment 1, Section B.2.i

"Testing to verify or validate acceptability of a specific design feature should demonstrate acceptable performance under conditions that simulate the most adverse design conditions. Operating or test modes and environmental conditions in which items must perform satisfactorily should be considered in determining the most adverse conditions."

SITE REQUIREMENT SOURCE: DOE5700.6C Attachment 1, Section B.2.j

"Design verification should be completed before design output is used by other organizations or to support other work, such as procurement, manufacture, construction, or experiment. When this timing cannot be achieved, the unverified portion of the design should be identified and controlled. In all cases, design verifications should be completed before relying on the item to perform its function and before installation becomes irreversible (requiring extensive demolition or rework)."

SITE REQUIREMENT SOURCE: DOE5700.6C Attachment 1, Section C.2.a

"Criterion 10 -- Independent Assessment

a. A process of planned and periodic independent assessments should be established and implemented by an independent assessment organization. Independent assessments should focus on improving items and processes by emphasizing line organization's achievement of quality."

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FACILITY REQUIREMENT SOURCE: DOE6430.1A Section 0140[08]

"Wherever possible, design shall reflect experience gained on similar projects or similar types of construction. Provisions shall be made for review and checking design calculations, drawings, and construction specifications by qualified personnel other than those responsible for the original design."

FACILITY REQUIREMENT SOURCE: DOE6430.1A Section 0140[10]

"To the extent practicable, and particularly in the case of innovative design, the design should be independently reviewed by competent consultants in construction or manufacturing techniques to confirm the practicability of construction or manufacture."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter III, Section C.5.b, Paragraph 6

"When design activities are to be conducted by a contractor, the utility design engineering organization should specify the necessary design requirements and verify that any design requirements identified by the contractor are maintained in a usable and retrievable form. Design engineering should review the results of contracted design activities to verify that the appropriate design requirements are considered and are updated as necessary."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter III, Section C.5.b, Paragraphs 1-3

"Design requirements are the original design bases for the plant updated to reflect all approved changes to the plant design bases. Design requirements should address the design input requirements described in American National Standards Institute report ANSI N45.2.11, Quality Assurance Requirements for the Design of Nuclear Power Plants. All planned modifications, including temporary modifications, should be reviewed to verify that the modifications are consistent with the design requirements and to evaluate any changes in design margins. Design requirement information sources should be readily accessible for the user, and the user should know where this information resides. Sources for design requirements should be identified. Additionally, design requirement should be consolidated into a limited number of documents, computer data bases, or source documents appropriately identified for retrievability.

Design requirements may be found in the following sources:

- design requirements document
- system descriptions
- design and procurement specifications
- vendor manuals and drawings
- plant drawings
- fire hazard analysis

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- calculations and transient analyses, including documented assumptions and limitations.
- equipment environmental qualification data packages
- licensing documents and commitments
- codes and standards
- approved modifications not currently installed or reflected on design drawings, calculations, or analyses
- final (or updated) safety analysis report
- technical specifications

Additional sources for design requirements are identified in INPO 87-006, Report on Configuration Management in the Nuclear Utility Industry."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter III, Section C.5.c, Paragraph 4

"Revisions and pending revisions to calculations should be clearly identified in the index, on the affected page, and on the cover sheet. The reason for the revision and which pages are affected also should be identified. Minor revisions may be made on the original calculation, with the original computation clearly deleted but not obliterated; revisions should be initialed and dated. Major revisions that supersede or revise a large portion of the calculation should clearly void the old calculation. Pending revisions should be annotated or posted on the original calculation. The review of a revised calculation should include a review of all the information contained in the calculation to ensure that each revision is compatible."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter III, Section C.5.c, Paragraph 6

"Design calculations and analyses should be verified and approved prior to releasing associated design output documents for fabrication or installation. Calculations should be verified by performing a step-by-step review of the calculation; reviewing inputs, methods, and results; or repeating the calculation using the identical, different, or approximating technique."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter III, Section C.5.d, Paragraph 4

"Preinstallation walkdowns of the modification should be performed when practicable with representatives of plant operations, maintenance, radiological protection groups (if applicable), and the installer to provide a final review of the design before the design output documents are issued for implementation. The walkdowns should confirm the operability, maintainability, and constructibility of the final design and consider the design's impact from an ALARA (as low as is reasonably achievable) standpoint".

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SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter III, Section C.5.e(1)

"Appendix B of 10CFR50 requires that changes to safety-related equipment or systems be verified adequate by methods such as design reviews, alternate calculations, or testing. This applies to all permanent or temporary modifications that could affect plant safety or reliability. A design verification is often the most effective process for identifying and correcting deficiencies in design assumptions and design details. The design verification is an in-depth review of all aspects of the design change and confirms that the proposed modification is technically adequate.

Design verifications should be performed by technically competent individuals who know the plant design and operational requirements and who were not involved in development of the design change. Individuals performing design verifications should be trained to perform the verification activities. They also should be provided sufficient time to perform required calculations or other activities.

The design verification should be systematic and well documented. It should be included in the modification's project plan because it can require significant time and resources. The method of verification should be established by procedure or other means and must be documented properly. As a minimum, the design verification should include the following:

- verification that all design requirements were addressed correctly in the design
- a detailed check of the calculations, analyses, and output documents to verify that the assumptions, methods, and conclusions reached are valid and reasonable
- verification that technical reviews, including safety reviews, address appropriate design considerations

A checklist can be used during the design verification to promote consistency, identify the areas reviewed, and provide stimuli for additional questions during the review. However, reviewers should be careful not to allow the checklist to limit the scope of their critical analysis.

ANSI/ASME NQA-1 and NSAC-105 provide additional details regarding design verification, including the use of qualification tests and alternate calculations."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter III, Section C.5.e(2)

"Safety reviews should be performed for all permanent and temporary modifications that could affect plant safety or reliability. The reviews should be performed when the modification is proposed to ensure safety requirements are "built-in" to the design change. A safety review involves a safety analysis and a safety evaluation. The safety analysis verifies the change will be safe. The safety evaluation determines whether technical specifications should be amended or if an unreviewed safety question exists (either of which conditions requires Nuclear Regulatory Commission approval prior to implementation).

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Safety reviews should be performed by technically competent individuals who know the plant design and operational requirements. Individuals performing safety reviews should have been trained in how to conduct them. They also should be provided sufficient time to give the change adequate consideration."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter III, Section C.5.e(3)

"As noted above, both design verifications and safety reviews should be performed by individuals who are technically competent and knowledgeable about the proposed design change. The design reviewer should not be involved in the development of the design. The independent reviewer should be able to confirm the technical adequacy of the design change without consulting the people who developed it. The reviewer may use alternate calculations or other means to arrive separately at conclusions. Conclusions that do not agree with those of the modification designer should be discussed and rectified."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter III, Section C.5.e(4)

"All reviews and design verifications should be sufficiently documented to allow other technically competent individuals to understand the basis of conclusions reached without having to consult the reviewer. The independent reviewer should document the conclusions, their bases, and any missing or unclear information. Assumptions, analyses, alternate calculations, and conclusions should be documented. Documentation also should include approval signatures clearly indicating management concurrence.

A checklist may be used to ensure consistent depth of review and to stimulate additional questions. When a checklist is used, the bases for drawn conclusions should be documented in appropriate detail to support design verification."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter III, Section C.5.e, Paragraphs 1 and 2

"Design verification and safety reviews confirm that a proposed modification will not unacceptably increase the probability or consequences of potential events. Events of concern include those affecting public and personnel safety and equipment operability or reliability. Design verifications and safety analyses performed as part of the safety reviews are intended to address the technical adequacy of the design change

The design engineering organization most often performs design verifications and safety reviews for permanent modifications as part of the modification process. It also can perform design verifications and safety reviews for designs by other organizations, including contractors and the plant technical support organization, for either permanent or temporary modifications. These reviews should satisfy the same technical, administrative, and documentation requirements as those performed for modifications designed by the design engineering organization. However, the utility design engineering organization should establish the level and extent of these review for designs by contractors, taking into consideration the contractor's experience, quality of previous design products, and reviews such as ANSI N45.2.11 reviews performed by the contractor. Additional discussion of design verifications and safety reviews is found in NSAC-105, Guidelines for Design and Procedure Changes in Nuclear Power Plants."

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SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter III, Section C.5.e, Paragraphs 3 and 4

"Safety reviews consist of two elements. The first element is the safety analysis, which analyzes the potential effects of the modification on plant safety. It considers factors such as plant design requirements, intended or unintended operation of affected equipment, potential component failures, human errors, and plant conditions. The second element is the safety evaluation, which determines whether an unreviewed safety question might exist. (See NSAC-125, Guidelines for 10CFR50.59 Safety Evaluations.) Although the two safety reviews often are combined, they are not synonymous and can differ in both form and function.

Safety reviews and design verifications should be performed by technically competent individuals who know the plant design and operational requirements and are capable of designing that portion of the modification they are verifying or reviewing. The design verifier and safety reviewer can be the same individual; however, the design verifier should not be involved in development of the design change. Safety reviews and design changes should be reviewed independently before the design is released for implementation."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter IV, Section B, Paragraph 2

"Design engineering personnel should periodically review permanent modification installation activities with the installing organization and with station personnel who will be responsible for operating, testing, and monitoring of system performance once the change is installed. These interactions should identify problems with installing, testing, or maintaining the design change to minimize recurrence of similar problems in future changes. Prior to installation, all design change packages should be reviewed and approved by the plant operations safety review committee. This review should ensure that the appropriate reviews and evaluations were performed and the design change does not constitute an unreviewed safety issue."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter IV, Section B, Paragraph 5

"As-built documents should be reviewed to ensure the modification was installed as designed. Any deviations not approved by a previous field change should be resolved prior to placing the system in service. As-built drawings should provide adequate information to enable design reverification, if required, and to provide detailed input for any future modifications. This process allows design engineering personnel to verify that the application of installation tolerances is consistent with the design requirements."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter IV, Section C.4, Paragraph 4

"Design engineering personnel should review appropriate design documents for impact before the field change request is approved. Reviews should be made by the same individuals and/or organization who were involved in review of the original modification. Documents such as calculations, safety reviews, drawings, sketches, equipment or spare parts lists, bills of material, installation and procurement specifications, installation and testing procedures, and acceptance criteria should be updated to reflect field changes prior to package closeout."

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SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter IV, Section C.4, Paragraph 5

"Field change requests should be monitored and causes for field changes should be identified and analyzed to provide a basis for improving the design change process. Implementing appropriate corrective actions should decrease the number of field changes needed for future modifications. Experience has shown that large numbers of field changes frequently are caused by inadequate walkdowns, inaccurate or incomplete as-built drawings, or incomplete designs caused by tight scheduling or insufficient planning."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter IV, Section C.6, Paragraphs 2-3

"Design engineering personnel should review documents that reflect the as-built condition of the affected systems to verify that the design change is accurately documented and consistent with the applicable design requirements. (For temporary modifications, the documentation often consists of temporary changes such as the redlining of drawings and procedures.) The following documents should be included in the review:

- as-built drawings or sketches showing the actual dimensions for installed equipment and components-These drawings allow the engineer to verify the tolerances are applied appropriately and to ensure analyses reflect the actual plant configuration. As-built drawings should include previously approved changes to allow verification acceptability of the final design.
- all nonconformances identified during the installation and testing of the modification-This final review should ensure nonconformances have been dispositioned properly and the appropriate documents have been updated.
- post-modification installation and functional testing results, including the values for critical parameters such as system flow rates, motor amperage reading, and thermal performance of modified heat exchangers- Actual test results should be compared to expected values based on the design analyses, and design information should be updated to reflect the resolution of identified problems.

These documents should be reviewed and problems corrected and documented before the equipment or system is placed into service."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section III, Section B, Paragraph 6

"Root cause analysis should be performed on significant, repetitive, or generic problems. Identification of the fundamental cause(s) of a problem ensures that the proposed solution will correct the problem and prevent recurrence of that situation in the future. Industry operating experience can be used to assist in identifying root causes of problems applicable to the station.

7.2.5

Design Change Controls

Controls shall be applied to changes to the design of the facility. Design changes include those changes that are initiated by the design authority and those that are the result of requests or actions of other organizational units including the operations and maintenance functional areas.

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Design changes may also arise from the installation process. Controls should be provided to ensure that design changes do not conflict with each other due to their installation configuration or sequence and that their operation is not different from that for which they were designed and to ensure approval of partial implementation of design changes. The design change control process is an integral part of the overall configuration management function.

This subelement consists of four subelements:

- **Engineering-Driven Changes** -- design changes that are initiated by the design authority either during the initial design process or as a result of engineering work after the design is released for construction. Engineering-driven changes include improvements or enhancements identified by the design authority during the operating lifetime of the facility.
- **Construction/Major Modification Changes** -- design changes that are the result of requests for design change made by the construction organization and major modifications that extend or change the facility's mission. Construction/major modification changes occur after release of the design for construction and are initiated by organizations other than the design authority.
- **Operations/Maintenance Changes** -- operations and maintenance activities that affect the approved design. Temporary modifications, parts substitutions (replacement parts not identical to the original part), and requests for changes to enhance operations or maintenance activities are design changes.
- **Non-Conforming Item Design Changes** -- conditions that are identified through quality control inspections, surveillance testing, or other means as not conforming to design requirements and that are dispositioned as "use-as-is" or "repair" are design changes.

The requirements applicable to each of the design change types are identified in the subelements.

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Chapter II, Section 3

"3 DESIGN CONTROL

The design shall be defined, controlled, and verified. Applicable design inputs shall be appropriately specified on a timely basis and correctly translated into design documents. Design interfaces shall be identified and controlled. Design adequacy shall be verified by persons other than those who designed the item. Design changes, including field changes, shall be governed by control measures commensurate with those applied to the original design."

RELATED REFERENCES

1. 10CFR50 Appendix A, Criterion 1

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Supplement 3S-1, Section 5

"5 Change Control

Changes to final designs, field changes, modifications to operating facilities, and nonconforming items dispositioned as use-as-is or repair shall be justified and subject to design

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control measures commensurate with those applied to the original design. These measures shall include assurance that the design analyses for the structure, system, or component are still valid. Changes shall be approved by the same affected groups or organizations which reviewed and approved the original design documents; except where an organization which originally was responsible for approving a particular design document is no longer responsible, then the Owner or his designee shall designate a new responsible organization which could be the Owner's engineering organization. The designated organization shall have demonstrated competence in the specific design area of interest and have an adequate understanding of the requirements and intent of the original design.

When a design change is approved other than by revision to the affected design documents, measures shall be established to incorporate the change into these documents, where such incorporation is appropriate.

Where significant design change is necessary because of an incorrect design, the design process and verification procedure shall be reviewed and modified as necessary."

SITE REQUIREMENT SOURCE: DOE5480.19 Chapter VIII, Section C.9

"Temporary Modification Control

Administrative control systems should be established for installation of temporary modifications such as electrical jumpers, lifted leads, pulled circuit boards, disabled annunciators/alarms, mechanical jumpers/bypasses, temporary setpoint changes, installed or removed block flanges, disabled relief or safety valves, installed or removed filters or strainers, plugged floor drains, and temporary pipe supports. Prior to modification, these controls should provide for communicating the installation of temporary modifications to the design authority to allow for technical oversight and an evaluation of the impact on current design activities, and approval of the design modification. These control systems should make provisions for safety reviews, installation approval, independent verification of correct installation and removal, documentation of the modification, update of operating procedures and documents, training, marking of installed modifications, and periodic audits of outstanding modifications."

SITE REQUIREMENT SOURCE: DOE5700.6C Attachment 1, Section B.2.c

"Changes to final designs, field changes, modifications, and nonconforming items dispositioned "use as is" or "repair" should be justified and subject to design control measures commensurate with the original design. This work should include assurance that the design analyses for the items are still valid. Changes should be approved by the original design organization or a technically qualified designee."

SITE REQUIREMENT SOURCE: DOEN5480.5 Procedure Section 6.c(3)

"Once approved, a backfit implementation plan may not be changed unless factors considered in the original analysis conducted pursuant to this Notice have changed sufficiently to change the conclusions of that analysis. In such cases, a revised implementation plan and revised analysis shall be submitted to the DOE for approval and shall be reviewed and approved in the same manner as an original analysis and plan."

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SITE REQUIREMENT SOURCE: INPO-85-016-1988 Summary

"Temporary modifications are controlled to ensure that necessary personnel are aware of all changes and that temporary alterations made to plant equipment do not unacceptably alter or degrade the original design, plant safety, or reliability. The number and duration of temporary modifications should be minimized. Use of this procedure will control temporary modifications by requiring them to be adequately identified, reviewed, approved, documented, and periodically reassessed for continued applicability.

A temporary modification is any short-term alteration made to plant systems, structures, or equipment that does not conform with approved drawings or other design documents. The following are examples of temporary modifications:

- o lifted leads
- o electrical jumpers
- o pulled circuit boards
- o disabled annunciators/alarms
- o mechanical jumpers/bypasses
- o temporary setpoint changes
- o installed or removed blank flanges
- o disabled relief or safety valves
- o installed or removed filters or strainers
- o plugged floor drains
- o temporary pipe supports

A station program to control temporary modifications should include the following elements:

- o Shift supervisor approval of temporary modifications before installation or removal
- o positive identification of electrical temporary modifications with independent verification prior to installation
- o independent verification or functional test of all temporary modifications after they are installed or removed
- o record of all installed temporary modifications
- o assurance that operators and supervisors are trained on installed temporary modifications and their impact on system/component operation prior to returning the system to service
- o safety reviews of temporary modifications installed on in-service (operable) equipment to ensure that the modified equipment will continue to perform as intended and will not adversely affect plant or personnel safety
- o assurance of the quality of work and suitability of materials used for temporary modifications. (For example, this procedure requires that temporary modifications be installed or removed using an approved work order.)
- o method to review the temporary modifications periodically for errors and continued need
- o method of clearly identifying installed temporary modifications

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o method to provide operators with instructions for operating temporarily modified equipment and/or guidance regarding the periodic monitoring of its operation (e.g., drawings and procedures must be marked up or annotated to reflect the new configuration prior to returning the system to operation)

An example program that addresses the major elements of a good program has been attached for consideration."

RELATED REFERENCES

1. INPO-85-031

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter III, Section C.5.b, Paragraph 7

"Controls should be provided to ensure that design requirements are retrievable and proposed design changes are reviewed and approved by the utility's design authority. This review and approval should provide verification that changes to design requirements include the necessary supporting calculations, analyses, or tests. In addition, the effects of these changes on other requirements, such as licensing commitments, should be fully documented and reviewed. It is important to carefully coordinate changes to licensing commitment with modification installation schedules."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter III, Section C.5.c, Paragraph 2

"Expected or calculated operating conditions should be evaluated with respect to system and equipment operational or safety limits to determine the allowable limits or margins for operation. Margins for operation should be clearly identified in the calculations and communicated to station operating personnel. Additional calculations or revisions made to support filed changes should be incorporated into or supersede the original calculations."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter IV, Section B, Paragraphs 3-4

"The design engineering organization should provide timely support of modification installation and testing activities and be responsive to field change requests. Design engineering personnel should be responsible for the review and approval or rejection of field change requests to ensure any proposed changes are consistent with the design requirements. Design engineers familiar with applicable analyses performed to establish the design can best identify those analyses that need to be reviewed and updated to address approved field change requests. The design engineering organization should provide alternative solutions for rejected field change requests to ensure that installation and testing problems are resolved.

Engineering personnel designing a modification should specify the test parameters, acceptance criteria, and preferred method for post-modification testing. The definition of test requirements and acceptance criteria should be based on the system and component design requirements, including any specific assumptions or constraints applied to the design. Post-modification tests should include the appropriate physical tests to verify the components are installed properly (e.g., hydrostatic testing, meggering, continuity checks, and nondestructive examinations). In addition, function tests should be performed to verify the correct operation of the system over

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the full range of design conditions, such as system flow testing, flow balancing, system pressure drip testing, and system logic testing to prove automatic transfer, startup, or shutoff functions. Prior to closeout of the modification package, the responsible design engineer should perform a final review of test results to verify that the modified system performs in accordance with design assumptions and requirements."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter IV, Section C.4, Paragraph 1, Sentences 1-2

"Field changes to approved design change, installation, inspection, and testing packages should be controlled. Field change notices or design change revisions should be processed after a modification has been reviewed by the plant operations safety review committee and authorized for installation or when a modification cannot be completed in accordance with the design change, installation, inspection, or testing package."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter IV, Section C.4, Paragraph 2

"Design engineering personnel should provide timely disposition (e.g., rejection, approval, alternate solutions) of field change requests. Delays in processing field change requests can result in delays in the installation schedule and increased installation labor costs. Therefore, the design engineering organization may authorize installation of field changes, in some cases, before the final design engineering review is completed. However, the field change request process should ensure that all field changes receive approval by the responsible design organization prior to post-modification testing. Depending on the complexity of the change, it may be necessary to assign cognizant design engineers to the field as direct support in installing the change."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter IV, Section C.5

"The design engineering organization should determine the acceptability of partial implementation of a design change. Design engineering personnel should identify those aspects of the change that must be completed to allow the system to be declared operable without the change itself being completely implemented. If a design change has been partially implemented, design engineering should ensure that the partial implementation is safe and consistent with the applicable design requirements and safety reviews. In addition, calculations and drawings should be revised to reflect accurately the actual plant configuration resulting from the partial implementation. Portions of design changes not implemented should be completed at the earliest possible time to prevent design changes remaining partially completed for extended periods. Specifically, design engineering personnel should identify possible effects on safety reviews or the operation of other systems. The approval of a partial implementation of a design change should be clearly communicated to the station, with any sketches, drawings, or specifications necessary to clearly identify the limits of the partial implementation and additional steps to be taken to ensure the partially implemented change will not create an adverse impact on plant operation and maintenance. The design engineering organization also should specify any specialized testing requirements associated with partial implementation and review test results to verify that the partially modified system meets design requirements. The plant operations safety review committee should review and approve the partial installation to ensure that the appropriate reviews and evaluations have been performed and the partial design installation does not constitute an unreviewed safety issue."

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SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter IV, Section C.6, Paragraph 1

"Design engineering personnel should support the return to service of a modified structure, system, or component by responding to installation and testing problems and by updating design documentation to reflect the as-built plant configuration. Field changes should receive a final review to confirm that all problems have been properly dispositioned and the installed and tested configuration meets design requirements. Critical drawings and procedures, such as those used by control room operators for safe and reliable plant operation, should be updated prior to returning the modified system to service. Training of applicable station personnel on the modified system or equipment should be performed prior to returning the system to service. In addition, design engineering support of configuration management activities should provide assurance that all design documentation reflects the as-built condition of the affected structure, system, or component."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section III, Section B, Paragraphs 1 and 2

"A modification is any physical or functional change in the design or design basis of a plant structure, system, or component. A planned design change should be accomplished within the requirements and limitations of applicable procedures, codes, standards, specifications, licenses, and predetermined safety restrictions. Functional changes, such as altered software or setpoints, may not involve an apparent physical change but nonetheless must be controlled. However, the control of functional changes may not include all of the steps outlined in this section.

The modification design process should ensure that the desired level of quality is achieved and the needs of the station are addressed. Whether performed by the utility or a contractor, certain design change process elements are essential to both permanent and temporary modifications. Other elements are essential to permanent modifications but not temporary modifications. This section describes these essential elements for permanent modifications and notes exceptions for temporary modifications."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section III, Section B, Paragraphs 3 and 4

"Design activities often are performed by station personnel for temporary or simple permanent modifications or by contracted architect-engineering firms for significant major modifications. The overall modification design process, however, should remain essentially as described in this section. The design engineering organization should see that the integrity of the plant design is maintained, regardless of which organization designs the modification.

At many stations, the controls used in designing temporary modifications omit steps normally in place to ensure design integrity for permanent modifications. For this reason, it is important that the design authority monitor the temporary modifications and also ensure that the temporary modification process is not used for permanent modifications. Additional guidance can be found in INPO 85-031, Guidelines for the Conduct of Technical Support Activities at Nuclear Power Stations."

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SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section III, Section C.1, Paragraphs 1 and 2

"It is essential that the organization designing a modification have a clear understanding of the modification's objective. The objective may be to correct a problem identified at the station or identified through external sources (e.g., industry operating experience or regulatory requirements).

A problem statement should be developed jointly by the requesting organization and design engineering and should be included in a request for design engineering assistance. The statement should serve as the principal mechanism for evaluating the need for a modification. It should provide a complete description of the problem, including all known effects and any unusual operational aspects. The problem statement should also provided a summary of all relevant information, such as maintenance and operating history and the results of investigations or tests. Previous and repetitive problems that have occurred with the system or related systems, should be described in the statement. Discussions of earlier attempts to correct the problem and explanations of why these efforts were unsuccessful also should be included. The problem statement should focus on the problem and its effects rather than on proposed solutions. Physical plant walkdowns to view symptoms firsthand, meetings with station personnel, and reviews of performance trends have proved successful when developing comprehensive problem statements."

7.2.5.1

Engineering-Driven Design Changes

Changes to approved designs shall be controlled, verified, and subject to other design control measures commensurate with those applied to the original design. Design change control measures shall be applied to changes to design information passed across interfaces within the design authority as well as to changes affecting approved designs released for construction or to others outside the design authority. Controls shall be applied to design information that is incomplete or requiring further evaluation, review, or approval. Changes to software used in the design process shall be controlled.

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Supplement 7S-1, Section 7

"CONTROL OF CHANGES IN ITEMS OR SERVICES

The Purchaser and Supplier shall assure that measures to control changes in procurement documents are established, implemented, and documented and are in accordance with this Standard."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter III, Section C.5.c, Paragraph 4

"Revisions and pending revisions to calculations should be clearly identified in the index, on the affected page, and on the cover sheet. The reason for the revision and which pages are affected also should be identified. Minor revisions may be made on the original calculation, with the original computation clearly deleted but not obliterated; revisions should be initialed and dated. Major revisions that supersede or revise a large portion of the calculation should clearly void the old calculation. Pending revisions should be annotated or posted on the original calculation. The review of a revised calculation should include a review of all the information contained in the calculation to ensure that each revision is compatible."

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SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Section I, Section C.1.b, Paragraph 1

"Policies and procedures implemented in the design engineering organization should reflect high standards and expectations and should convey an attitude of trust that encourages teamwork at all levels. These policies also should promote and foster professionalism in all personnel. Policies should be reflected in procedures and other documentation, as appropriate. The design engineering organization's responsibilities and its relationships with other organizations (utility and non-utility) should be defined clearly. Procedures also should define necessary controls over changes to the plant design. Policies and procedures should be reviewed periodically and improved as necessary."

7.2.5.2

Construction/Major Modification Changes

Field changes to final designs shall be justified and subject to design control measures commensurate with those applied to the original design. These measures include assurance that design analyses remain valid after the implementation of the change. Changes shall be approved by the groups or organizations that approved the original design except where a replacement group has been identified. The replacement group shall have demonstrated competence in the areas for which it is approving design changes. Measures shall be applied to ensure that the design bases and operating characteristics of the system, structure, or component being modified are understood.

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter IV, Section C.3, Paragraph 1

"Design engineering personnel should support the installation, inspection, and testing of modifications by resolving problems or deviations from the design specification identified during installation and testing. Modification problems identified by the installing, inspection, and testing organization(s) should be documented and reported to the design engineering organization through established interfaces and controls, such as a field change request or request for engineering assistance."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter IV, Section C.4, Paragraph 3

"The responsibility to complete the installation according to the issued design documents and approved field changes should be clearly understood by the installing organization. Field change requests for "ease of construction" should be minimized because the cost of analysis, documentation, and work delays related to the field change often will exceed the expected benefit."

7.2.5.3

Operations/Maintenance Changes

Changes to facility design in the course of plant operations and maintenance activities shall be controlled in a manner commensurate with the controls applied to the original design. Operations and maintenance changes include the installation or removal of temporary changes, changes to instrument setpoints, installation or use of replacement parts not identical to the original parts, and any other change to the facility that potentially affects the congruence of the as-built facility with the design documentation. Changes to facility design made in the course

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of operations or maintenance shall be done only with a clear understanding of the need for the change and with reviews to verify that the changes are consistent with design requirements. Modifications shall be evaluated for their effect on design margins.

SITE REQUIREMENT SOURCE: INPO-84-026-1986 Summary

"A setpoint change made to plant equipment constitutes a modification to that equipment. Many plant events have occurred due to inadequate setpoint control, and it is therefore appropriate that setpoint changes be subjected to the same types of controls as any other plant modification.

This good practice provides guidelines for establishing a program to initiate, control, and document setpoint changes.

The sample program provided simplifies the processing of setpoint changes by not requiring a full design change package. It includes balance-of-plant and safety-related systems because both are important to plant performance and reliability. It includes suggested equipment and setpoints to be included in the program and defines suggested responsibilities of plant and corporate personnel with regard to the program. The following steps are described in the program:

- o initiation of the setpoint change
- o technical review of the proposed change
- o implementation of the setpoint change
- o document update and package closeout

Also included in the document are sample setpoint lists, flowcharts, and change request forms, as well as other miscellaneous forms that may be of use.

This good practice is not intended to be all-inclusive, and users may find a need to develop more detailed guidance in certain areas of the setpoint change control program.

It is recognized that utilities may use different approaches or methods than those presented. In particular, specific organizational structure is not implied, and various setpoint change control functions may be performed by different groups."

7.2.5.4

Non-Conforming Item Design Changes

Items identified as not conforming to facility design bases and requirements may be dispositioned as rework, repair, use-as-is, or scrap. Of these, repair and use-as-is dispositions result in installed conditions that vary from approved design output documents. As such all dispositions of repair or use-as-is shall be controlled as design changes in a manner commensurate with the controls applied to the approved design. Justification for the disposition shall be documented. Temporary repairs shall be evaluated to determine if they are design changes.

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SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Supplement 15S-1, Section 4.4

"Disposition

The disposition, such as use-as-is, reject, repair, or rework, of nonconforming items shall be identified and documented.

Technical justification for the acceptability of a non-conforming item, dispositioned repair, or use-as-is shall be documented. Nonconformances to design requirements dispositioned use-as-is or repair shall be subject to design control measures commensurate with those applied to the original design. The as-built records, if such records are required, shall reflect the accepted deviation."

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Supplement 7S-1, Section 9

"CONTROL OF SUPPLIER NONCONFORMANCES

The Purchaser and Supplier shall establish and document methods for disposition of items and services that do not meet procurement documentation requirements.

These methods shall contain provision for (a) through (e) below:

- (a) evaluation of nonconforming items;
- (b) submittal of nonconformance notice to Purchaser by Supplier as directed by the Purchaser. These submittals shall include Supplier- recommended disposition (e.g., use-as-is or repair) and technical justification. Nonconformances to the procurement requirements or Purchaser- approved documents, which consist of one or more of the following, shall be submitted to the Purchaser for approval of the recommended disposition:
 - (1) technical or material requirement is violated;
 - (2) requirement in Supplier documents, which has been approved by the Purchaser, is violated;
 - (3) nonconformance cannot be corrected by continuation of the original manufacturing process or by rework;
 - (4) the item does not conform to the original requirement even though the item can be restored to a condition such that the capability of the item to function is unimpaired;
- (c) Purchaser disposition of Supplier recommendation;
- (d) verification of the implementation of the disposition;
- (e) maintenance of records of Supplier-submitted nonconformances."

SITE REQUIREMENT SOURCE: DOE5700.6C Attachment 1, Section B.3.g

"Before a procured item is used or placed in service, procurement specification, inspection, and test requirements are to be satisfied and nonconformance properly dispositioned."

SITE REQUIREMENT SOURCE: DOE5700.6C Attachment 1, Section B.4.a(4)

"When acceptance criteria are not met, deficiencies should be resolved and reinspection should occur as required."

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7.2.6

Standards and Guides

Controls shall be employed for the development, review, approval, and use of design standards and guides including standard design details and standard technical procurement requirements.

SITE REQUIREMENT SOURCE: DOE-RL6430.1C Section 7.b

"b. RL Contractors (Operating and Engineering [O&E], Research and Development [R&D], and Engineer/Constructor [E/C]).

- (1) Enforce use of HPS wherever applicable.
- (2) Request deviations or exemptions from SDC on a case by case basis.
- (3) Identify to the Operating and Engineering contractor (O&E), in writing, personnel in their organization to be assigned controlled copies of the HPS. Identify reassignments, in writing, to the O&E to allow for the accurate transmittal of new or revised HPS.
- (4) Provide recommendations to the RL Project Management Division when deficiencies in the policies or procedures of the HPS Program are noted.
- (5) Appoint members to each HPS Technical Group, who will be the contractor's official representative on matters within the scope of the group's functions. (Alternates with the same responsibilities and authorities as the regular Technical Group members may also be appointed.)
- (6) Assure timely submission of revisions, additions, and deletions of the HPS to the appropriate Technical Group."

SITE REQUIREMENT SOURCE: DOE-RL6430.1C Section 7.c

"c. Engineer/Constructor (E/C). (In addition to responsibilities in paragraph 6.b.)

- (1) Ensure that additions, revisions, and deletions of Standards and Guides are documented in a manner that ensures adequate control and prevents loss of historical information.
- (2) Provide appropriate engineering and other assistance in development and maintenance of the HPS.
- (3) Appoint a representative for overall technical coordination of the HPS program.
- (4) Review HPS against the GDC, other DOE Orders and national standard".

SITE REQUIREMENT SOURCE: DOE-RL6430.1C Section 8.a

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"a. General.

(1) The use of Standard Design Criteria is mandatory for all work done at or for Hanford. Exemptions or deviations from the SDC must be approved by the director of the RL Project Management Division.

(2) Standard Details and Standard Specifications are developed on the basis of sound engineering practice and judgment with consideration of cost benefits and quality requirements. As the Standards are established with these requirements in mind, their use is strongly recommended. If repeated modifications to a Standard are necessary for its use in a given application, or it is found that a Standard could otherwise be improved, the E/C appointed Program Manager or the appropriate Technical Group should be notified.

(3) Although not HPS, Guides and Instructions are part of the Hanford Plant Standard Program. They are to be originated, maintained and deleted in the same manner as the Standards.

(4) For work to be performed by onsite RL contractors, the SD and SS can be used on an "as is" basis by reference to the Standard's number and revision number. When only part of the SD or SS is applicable for use, only the appropriate portions need to be included in the drawings and/or specifications. However, for construction performed by offsite firm-fixed price (FFP) contractors, the applicable HPS detail or information shall be incorporated directly into the contract drawings and/or specifications.

(5) All HPS shall be maintained using a control and indexing system established to minimize redundancy or loss of historical"

7.2.7

Engineering Assistance Request Process

A program shall be established to control the process by which engineering assistance is provided in support of operations and maintenance requirements. In this context engineering assistance means providing engineering support for troubleshooting, root cause determinations for problems, evaluation of alternatives, and other engineering-design related support that is not directly in support of a new design or a change to an existing design. This process complements the design change control program by providing evaluations of problems where the need for a design change has not yet been determined to be necessary or may not be necessary. Engineering assistance to operations and maintenance activities shall be provided in a timely manner. The scope of such assistance shall be defined and the interfaces controlled. Sufficient resources shall be available to support the assistance requirements of the facility.

SITE REQUIREMENT SOURCE: INPO-85-013 Summary

"The objective of a good plant modification program is to provide controls to ensure that potential improvements in the plant are designed, reviewed, approved, installed, and operated in a safe and reliable manner. Since many groups are involved in the modification process, it is necessary to have a well-defined program that clearly identifies responsibilities and provides strong communications among the participants. An effective station program meeting the above objective should contain the following elements:

- o encouragement of ideas for improvements in plant design

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- o careful review, approval, and establishment of priorities for modification requests to ensure the best use of limited resources
- o tracking and timely feedback on status of modification requests
- o close coordination among responsible parties to ensure timely use of resources
- o plant walkdowns by the designer during the design phase
- o development of a conceptual design early in the design process based on engineering evaluation and root cause determination
- o operability, maintainability, constructibility, and ALARA reviews during the design process
- o careful evaluation of the expected costs and benefits of proposed modifications
- o adherence to the FSAR, regulatory requirements, technical specifications, applicable codes, standards, and design criteria of the plant in the design, installation, and testing of modifications
- o thorough and documented technical reviews and safety evaluations with independent review, including review and revision of the impact on the design bases, criteria, specifications, and regulatory commitments
- o reviews by on-site and off-site safety review groups as required by technical specifications
- o quality reviews and field inspections of design, procurements, and installation activities
- o thorough testing to ensure design performance and system compatibility
- o updating of important documents used in plant operations prior to returning affected systems to service
- o positive control by plant management of the authorization and performance of field activities
- o training of key plant personnel prior to returning affected systems to service
- o timely formal revision of design and operation documents, including specifications, as-designed and as-built drawings, vendor manuals, setpoint documents, FSAR, and technical specifications
- o timely updating of supporting programs to reflect modifications - examples include spare parts, in-service inspection, equipment history, surveillance, preventive maintenance, and equipment qualification

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o incorporation of applicable plant modifications into the plant-referenced simulator and appropriate training programs

The attached procedure is an example of a plant modification control program. While it addresses many of the above elements, some are not described fully. This approach is intentional to keep the good practice as straightforward as practicable and free from unnecessary detail. Users may find a need to develop more detailed guidance in certain aspects of their modification programs to address specific areas of concern."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter II, Section C.3, Paragraph 1

"The role of the design engineering organization in providing engineering support to the station also includes day-to-day station support as well as support for planned near and long-term activities. The design engineering organization should provide both direct and indirect support to station activities on a day-to-day basis. Direct support includes modification designs, analyses and calculations, and responses to questions. Indirect support includes functions such as responses to regulatory questions and reviews of industry information or events."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter II, Section C.3, Paragraph 5

"The design engineering organization should arrange to support urgent station requests after normal working hours and on holidays or weekends. A design engineering point of contact with authority to mobilize the necessary resources to respond to urgent requests should be identified."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter II, Section C.3, Paragraph 6

"The design engineering organization should track and report progress on the resolution of station requests for engineering assistance. This tracking mechanism should be integrated with the station tracking system. The mechanism should identify both the station point of contact and the individual within the design engineering organization responsible for providing a response to the station and should indicate the expected completion date for the response. In addition, it should track all open design engineering items from the inception of the tasks to their closeout. Periodic reports should be prepared for station and design engineering management giving the status of station requests for engineering assistance, expected completion dates, and the impact of any changes resulting from receipt of higher-priority requests. Station and design engineering management should evaluate the impact of any change on schedule dates. Design engineering management should monitor the resources necessary to respond to station request to ensure adequate resources are available to support long-range plans."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter II, Section C.3, Paragraphs 2-4

"As a support organization, design engineering should be responsive to station needs for operational and maintenance support. Engineering resources for day-to-day support should be assessed routinely to ensure engineering is not over committed and resources are effectively

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used. Day-to-day station support should be coordinated with other design engineering activities and integrated into the overall station engineering process as discussed in INPO 85-031, Guidelines for the Conduct of Technical Support Activities at Nuclear Power Stations.

Station management should review and approve as appropriate requests for design engineering assistance to ensure that the requests are valid. Requests requiring significant resources should be documented and controlled to ensure station management received the requests for review. Informal requests, occurring daily between station and design engineering individuals, should be controlled to limit the impact on scheduled work. However, urgent station problems should receive immediate support. Station management should work with design engineering management in assigning realistic priorities and desired completion dates to approved requests for design engineering assistance, thereby ensuring that requests are worked in the order needed and do not unnecessarily disrupt modification design and major engineering support activities.

Providing effective support for the wide range of station requests often requires firsthand knowledge of the plant systems and operation and face-to-face communications with the station staff. As a result, design engineers normally should visit the station when investigating station engineering problems. In those cases where the distance between station and design offices makes face-to-face communications difficult, establishing an on-site design engineering contingent staffed with representative from each design discipline may be an appropriate alternative for day-to-day station support."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter IV, Section C.3, Paragraph 1

"Design engineering personnel should support the installation, inspection, and testing of modifications by resolving problems or deviations from the design specification identified during installation and testing. Modification problems identified by the installing, inspection, and testing organization(s) should be documented and reported to the design engineering organization through established interfaces and controls, such as a field change request or request for engineering assistance."

7.2.8

Testing Program

Testing programs employed in the design process shall be controlled. Qualification testing used to verify designs shall demonstrate adequacy of performance under the most adverse design conditions. Operating modes and environmental conditions shall be considered in determining the most adverse design conditions. Requirements and acceptance criteria for functional testing of systems, structures, and components to meet engineering requirements shall be documented and controlled. Testing results shall be documented. The process for evaluation of test results and disposition of test deficiencies shall be controlled. Computer software used in the design process shall be verified by a process that includes testing.

SITE REQUIREMENT SOURCE: ANSI-N45.2.11-1974 Section 6.3.3

"Qualification Testing. Design verification for some designs or specific design features can be achieved by suitable qualification testing of a prototype or initial production unit.

In those cases where the adequacy of a design is to be verified by a qualification test, the testing shall be identified and documented. Testing shall demonstrate adequacy of performance under the most adverse design conditions. All pertinent operating modes shall be considered in

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determining these design conditions where it is intended that the test program confirm the adequacy of the overall design. Where the test is only intended to verify a specific design feature, the other features of the design shall be verified by other means. For example, it may be most effective to verify that an instrumentation cabinet is designed to withstand the maximum earthquake-caused vibratory motions by actually subjecting the cabinet and its associated components to shaker tests which correspond to these vibratory motions. The shaker tests will not, however, verify that the circuitry is designed correctly, or that the component in the cabinet will perform its intended function. Other tests or verification means are required to confirm that remaining design functions are adequately performed by the instrumentation and that those components perform the intended functions for the varying design conditions to which they are subjected.

Qualification testing shall be performed in accordance with written test procedures which incorporate or reference the requirements and acceptance limits contained in applicable design documents. The test procedures shall include provisions for assuring that prerequisites for the given test have been met, that adequate instrumentation of the required range and accuracy is available and used, and that necessary monitoring is performed. Prerequisites include such items as calibrated instrumentation, appropriate equipment, trained personnel, condition of test equipment and the item to be tested, suitable environmental conditions and provisions for data acquisition. Test results shall be documented and evaluated by the responsible designer to assure that test requirements have been satisfied.

If testing indicates that modifications to the item are necessary to obtain acceptable performance, the modification shall be documented and the item modified and retested or otherwise verified to assure satisfactory performance. When tests are being performed on models or mock-ups, scaling laws shall be established and verified. The test configuration shall be clearly defined and documented. The results of model test work shall be subject to error analysis, where applicable, prior to use in final design work."

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Appendix 3A-1, Section 4

"Design verification for some designs or specific design features may be achieved by suitable qualification testing of a prototype or initial production unit. Qualification testing may be used in combination with other verification methods. For example, it may be most effective to verify that an instrumentation cabinet is designed to withstand the maximum earthquake-caused vibratory motions by actually subjecting the cabinet and its associated components to shaker tests which correspond to these vibratory motions. The shaker tests will not, however, verify that the circuitry is designed correctly or that the component in the cabinet will perform its intended function. Other tests or verification means are required to confirm that remaining design functions are adequately performed by the instrumentation and that those components perform the intended functions for the varying conditions to which they are subjected."

RELATED REFERENCES

1. ANSI-N45.2.11-1974 Section 6.3.3

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SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Supplement 3S-1, Section 4.2.3

***4.2 Methods**

Acceptable verification methods include, but are not limited to, any one or a combination of the following: design reviews, alternate calculations, and qualification testing.

[. . .]

4.2.3 Qualification Tests. Where design adequacy is to be verified by qualification tests, the tests shall be identified. The test configuration shall be clearly defined and documented. Testing shall demonstrate adequacy of performance under conditions that simulate the most adverse design conditions. Operating modes and environmental conditions in which the item must perform satisfactorily shall be considered in determining the most adverse conditions. where the test is intended to verify only specific design features, the other features of the design shall be verified by other means. Test results shall be documented and evaluated by the responsible design organization to assure that the test requirements have been met.

If qualification testing indicates that modifications to the item are necessary to obtain acceptable performance, the modification shall be documented and the item modified and retested or otherwise verified to assure satisfactory performance. When tests are being performed on models or mockups, scaling laws shall be established and verified. The results of model test work shall be subject to error analysis, where applicable, prior to use in final design work."

RELATED REFERENCES

1. ANSI-N45.2.11-1974 Section 6.3.3

SITE REQUIREMENT SOURCE: ASME-NQA-2-1989 Part 2.20, Section 2.3

"Results. Field activities and test results shall be documented in suitable test reports and data sheets. Each report shall identify the activity to which it applies, the procedures or instructions followed in performing the task, and the identification of the following:

- (a) pertinent test data such as identification of sample given boring or test pit number, depth and elevation, test results, testing equipment identification, and description of sample;
- (b) significant dates and times;
- (c) test completion signatures;
- (d) results of test;
- (e) unusual conditions encountered.

The signature of an approving reviewer (checker) constitutes a certification that the techniques utilized met the field and laboratory procedures. The evaluation regarding the adequacy of the results is covered in Section 6 of this Part."

SITE REQUIREMENT SOURCE: ASME-NQA-2-1989 Part 2.8, Section 5.1

"Installed Systems Inspection and Tests

General. Following the installation of mechanical items, the checking inspection and testing activities shall be performed to verify that the completed systems are in conformance with

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specified requirements. This is a final verification that the requirements defined by licensing commitments, drawings, specifications, and other contract documents are reflected in the completed installation. It is also a time to verify that field modifications and other changes made and controlled during installation activities have been incorporated in the as-built documents.

Controls shall be provided for the identification, documentation, and resolution of nonconformances disclosed by inspections or tests.

Tests shall be conducted on completed plant systems. Test procedures shall identify prerequisites for system testing, including required completed construction activities. The test procedures shall identify and describe any temporary or simulated condition or equipment. If not previously planned, a documented notice shall be prepared and issued with approval of the responsible organization stating the substitutions that existed for the test. Written verification shall also be provided that temporary installations have been satisfactorily replaced by permanent installations.

Checks and inspections shall be performed to verify the operational readiness and completeness of components and systems. These systems or partial systems shall be identified, tagged, and released for operational testing. These checks and inspections shall be performed to verify the following, as a minimum.

- (a) Equipment and materials have not sustained external physical damage.
- (b) The installation has been made in accordance with specified requirements.
- (c) All nonconforming items have been satisfactorily dispositioned.
- (d) Internal and external restrictions and obstructions to flow and full travel have been removed.
- (e) Supports and restraints are properly installed.
- (f) Interfacing connections with adjacent systems are compatible.
- (g) Original materials and component identification have been preserved with provisions for traceability throughout the installed system.
- (h) Safety features such as interlocks, cable separations, guards, warning devices, and lockouts have been installed, are being used, and comply with applicable codes and regulations.
- (i) Temporary connections, such as jumpers and bypass lines, and temporary trip points of control equipment are identified and documented so that their final condition can be verified.
- (j) System water chemistry is appropriate for operational testing.
- (k) External surface chemistry requirements have been maintained.
- (l) Permits and authorizations have been obtained."

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SITE REQUIREMENT SOURCE: ASME-NQA-2-1989 Part 2.8, Section 5.2

"Preoperational Testing. This testing involves the operation of all items in a system(s) or partial system(s) to assure that operation is in accordance with the design criteria and functional requirements. The testing shall include, but not be limited to, the following:

- (a) systems integrity;
- (b) in-line instrument installation is consistent with specified flow directions;
- (c) sensing lines are phased correctly to in-line elements and sensors;
- (d) service requirements for initial operation such as flow alignments, limiting flow orificing, and relief devices have been performed;
- (e) operation of controls, valves, dampers, operators, and load limiting devices;
- (f) rotating equipment (motors, pumps, blowers), rotation, speed, vibration, noise, and no-load operation;
- (g) handling equipment (load tests of cranes, hoists, conveyors, hooks, handling adapters, and accessories);
- (h) containment systems;
- (i) air handling systems;
- (j) fuel storage and handling systems;
- (k) reactor component handling systems;
- (l) instrument air systems;
- (m) fluid service systems;
- (n) auxiliary building systems.

Where mechanical equipment and systems interface with, and their operation must coordinate with, nonmechanical equipment or systems, the test performed shall include verifying the compatibility of interfacing equipment and functions."

SITE REQUIREMENT SOURCE: ASME-NQA-2-1989 Part 2.8, Section 5.3.2

"Functional and Flow Testing. The required individual systems shall be tested to demonstrate cold functional operability of individual components, subsystems, and systems, and to demonstrate compatibility with other systems. These test, where appropriate, shall demonstrate the following:

- (a) system pressure drop
- (b) flow rate
- (c) controls and throttling device settings
- (d) function of interlocks, alarms, and automatic features
- (e) instrument calibration
- (f) setting of meter biases
- (g) system stability
- (h) adequacy of pipe and equipment support settings
- (i) heat runs on rotating equipment
- (j) adequacy of ventilation, lubrication, and cooling systems under sustained operating conditions
- (k) ability to meet water chemistry requirements."

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SITE REQUIREMENT SOURCE: DOE5700.6C Attachment 1, Section B.2.i

"Testing to verify or validate acceptability of a specific design feature should demonstrate acceptable performance under conditions that simulate the most adverse design conditions. Operating or test modes and environmental conditions in which items must perform satisfactorily should be considered in determining the most adverse conditions."

SITE REQUIREMENT SOURCE: DOE5700.6C Attachment 1, Section B.3.g

"Before a procured item is used or placed in service, procurement specification, inspection, and test requirements are to be satisfied and nonconformance properly dispositioned."

SITE REQUIREMENT SOURCE: DOE5700.6C Attachment 1, Section B.4.b(1)

"b. Acceptance Testing

(1) Testing processes should be established and implemented to demonstrate that items and processes will perform as intended. Testing should include, as appropriate, bench tests and proof tests before installation, pre-operational tests, post-maintenance tests, post-modification tests, and operational tests. Testing should be structured so that proving designs should not be confused with proofing the adequacy of work."

SITE REQUIREMENT SOURCE: DOE5700.6C Attachment 1, Section B.4.b(4)

"Test procedures should be developed and include:

- (a) instructions and prerequisites to perform the test;
- (b) completeness and accuracy of data;
- (c) use of test equipment;
- (d) acceptance criteria;
- (e) inspection hold points as required; and
- (f) test article configuration."

SITE REQUIREMENT SOURCE: DOE5700.6C Attachment 1, Section B.4.b(5)

"Retesting of items or processes to determine that they meet acceptance criteria is required after deficiencies are corrected."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter IV, Section B, Paragraphs 3-4

"The design engineering organization should provide timely support of modification installation and testing activities and be responsive to field change requests. Design engineering personnel should be responsible for the review and approval or rejection of field change requests to ensure any proposed changes are consistent with the design requirements. Design engineers familiar with applicable analyses performed to establish the design can best identify those analyses that need to be reviewed and updated to address approved field change requests. The design engineering organization should provide alternative solutions for rejected field change requests to ensure that installation and testing problems are resolved."

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Engineering personnel designing a modification should specify the test parameters, acceptance criteria, and preferred method for post-modification testing. The definition of test requirements and acceptance criteria should be based on the system and component design requirements, including any specific assumptions or constraints applied to the design. Post-modification tests should include the appropriate physical tests to verify the components are installed properly (e.g., hydrostatic testing, meggering, continuity checks, and nondestructive examinations). In addition, function tests should be performed to verify the correct operation of the system over the full range of design conditions, such as system flow testing, flow balancing, system pressure drip testing, and system logic testing to prove automatic transfer, startup, or shutoff functions. Prior to closeout of the modification package, the responsible design engineer should perform a final review of test results to verify that the modified system performs in accordance with design assumptions and requirements."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter IV, Section C.3, Paragraph 3

"Post-modification testing should be performed by responsible station personnel to verify that the design requirements and test acceptance criteria specified in the modification test package are met. In addition to supporting testing, design engineering personnel should review, evaluate, and disposition deficiencies identified during testing prior to declaring the modified equipment or system operable."

7.2.9

Engineering Documentation

Engineering documentation required for the operation, maintenance, and modification of the facility shall be retrievable, legible, and complete. Content, format, and quality standards for drawings, specifications, and other design output documents should be defined. Controls shall be applied to ensure that design modification are performed using correct documentation. The design authority shall identify the documentation necessary to be maintained as facility records. The design authority shall determine which documentation shall be revised to reflect as-built conditions of the facility. The design change process closeout process shall ensure that necessary documentation is updated in a timely manner.

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Appendix 3A-1, Section 3, Paragraph 1

"The design activities may be prescribed in job specifications, work instructions, planning sheets, procedure manuals, test procedures, or any other typed or written form that provides adequate control and permits reviewing, checking, or verifying the results of the activity."

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Appendix 3A-1, Section 5

"Design documents should be maintained current to ensure their availability to support facility design, construction, and operation. However, design changes may be approved without revision to the affected document(s). When this occurs, procedures should be established to ensure that a determination of the final design or as-built condition can be made, consistent with the user's needs. Since not all affected documents require revision, procedures should identify those design documents which are subject to revision. Measures may include, but are

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not limited to, imposing a time limit for updating the affected document(s), limiting the number of design changes allowed to accumulate prior to revising the affected document, or providing for a process that continually updates the affected document(s).

During the operational phase, attention should be given to system modifications, mechanical and electrical temporary alterations and instrument setpoint changes to ensure that design changes are processed in accordance with design control requirements. Proposed modifications, alterations, and changes may overlap and may not be installed in the sequence that they were designed; therefore, it is incumbent upon the design organization and plant/facility owner to control approved (but not installed) design changes to ensure that changes do not conflict with each other. Where modifications, alterations, or changes must be installed in a particular sequence, the sequence should be specified. Partial installation of design changes should be approved by the design organization. Controls should ensure that documents that are required to support operation reflect the as-built condition of the facility. Temporary and permanent repair work and parts replacement should be reviewed to determine if these activities constitute design changes."

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Appendix 3A-1, Section 7

"The documentation and records for a facility should include provisions for as-built documentation. These provisions should address what documents are required, the depth of information required for the as-built documentation and the internal or other measure for updating and the identification of those document records. As-built documents may include documents such as the following:

- (a) drawings required for facility operation;
- (b) modification packages;
- (c) manufacturer operation and maintenance instructions;
- (d) manufacturer vendor manuals;
- (e) manufacturer technical bulletins;
- (f) equipment and instrumentation listings;
- (g) environmental qualification listings;
- (h) spare and replacement parts listings.

The status of the approved design should be readily available to the participating design organization(s). In addition, for the operation phase, the as-built configuration and the status of modifications being implemented should be readily available to the operating organization."

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Supplement 11S-2, Section 5

"TEST RECORDS

- (a) Verification test records shall identify (1) through (10) below.
 - (1) computer program tested
 - (2) computer hardware used
 - (3) test equipment and calibrations, where applicable
 - (4) date of test
 - (5) tester or data recorder
 - (6) simulation models used, where applicable
 - (7) test problems
 - (8) results and acceptability

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- (9) action taken in connection with any deviations noted
- (10) person evaluating test results
- (b) In-use test results shall identify (1) through (6) below.
- (1) computer program tested
- (2) computer hardware used
- (3) test equipment and calibrations, where applicable
- (4) date of test
- (5) tester or data recorder
- (6) acceptability"

SITE REQUIREMENT SOURCE: ASME-NQA-1-1989-1A Supplement 3S-1, Section 7

"7 Documentation and Records

Design documentation and records, which provide evidence that the design and design verification processes were performed in accordance with the requirements of this Standard, shall be collected, stored, and maintained in accordance with documented procedures.

The documentation shall include not only final design documents, such as drawings and specifications, and revisions there to but also documentation which identified the important steps, including sources of design inputs that support the final design."

RELATED REFERENCES

1. ANSI-N45.2.11-1974 Section 10

SITE REQUIREMENT SOURCE: DOE5700.6C Attachment 1, Section B.2.e

"Design records, maintained to provide evidence that the design was properly accomplished, should include not only the final design output and its revision, but also important design steps (calculations, analyses, and computer programs, for example) and sources of input that support final output.

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter III, Section C.5.c, Paragraph 3

"Calculations should be documented in a format that easily can be reviewed for completeness during verification, revision, and retrieval efforts. The utility design engineering organization should establish guidance for calculation content and ensure conformance by all organizations, either internal or external, performing design calculations. All calculations would include the following:

- a unique calculation identification number and revision level
- statement of the objective of the calculation
- safety classification
- identification of applicable unit, system, program, and/or building

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- list of applicable codes and standards, including issue dates and addenda
- list of design requirements, additional design inputs, and references
- calculation method used
- any engineering judgements, including the justification for the engineering judgement
- identification of incomplete information or assumptions requiring verification
- references to applicable station documents such as procedures, the final (or updated) safety analysis report, or technical specifications."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter III, Section C.5.e(4)

"All reviews and design verifications should be sufficiently documented to allow other technically competent individuals to understand the basis of conclusions reached without having to consult the reviewer. The independent reviewer should document the conclusions, their bases, and any missing or unclear information. Assumptions, analyses, alternate calculations, and conclusions should be documented. Documentation also should include approval signatures clearly indicating management concurrence.

A checklist may be used to ensure consistent depth of review and to stimulate additional questions. When a checklist is used, the bases for drawn conclusions should be documented in appropriate detail to support design verification."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter III, Section C.5.e, Paragraph 5

"All reviews and design verifications should be sufficiently documented to allow other technically competent individuals to understand the basis of conclusions reached without have to consult the reviewer."

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter IV, Section C.2, Paragraph 2

"The installation, inspection, and test package should include, as a minimum, the following items:

- a station work request or traveler that provides the appropriate administrative controls for component tag-out, modification installation, work inspection, radiological controls, and post-modification testing

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- directions for identifying, removing, and disposing of equipment that is to be replaced or is no longer needed, such as spared cables or disabled pumps
- sequencing requirements for the modification in relation to other issued or planned modifications
- procedures for the installation, modification, or removal of plant components, including material controls, welding, heat treating, cutting procedures; procedures for disassembly, assembly, alignment, inspection (including quality control and authorized nuclear inspector holdpoints); and cleanliness
- interface requirements with the authorized nuclear inspector (ANI)/authorized nuclear insurance inspector (ANII)
- applicable drawings and material lists, extracted from the design change package, to provide direction on the physical configuration of the system
- post-installation testing procedures (e.g., flushing, meggering, high-potential testing, and pressure testing procedures) with appropriate acceptance criteria
- post-modification testing procedures to demonstrate that the functional characteristics of the modified system satisfy the design requirements
- a listing of station procedures and documents impacted by change in areas such as operations, maintenance, radiological control, chemistry, surveillance, and training
- any field changes generated against the design change package"

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter IV, Section C.7, Paragraph 1

"Once the implementation of a design change is completed, the closeout process should begin. Package closeout verifies that appropriate records, whether hard copy or computer-bases, are updated and stored for later retrieval. The design engineer should identify those records to be maintained in the utility's records management system in accordance with established procedure".

SITE REQUIREMENT SOURCE: INPO-90-009-1992-R1 Chapter IV, Section C.7, Paragraphs 2-3

"As part of design change closeout, certain documents should be revised to reflect actual plant configuration. For temporary modifications, closeout often means that these documents are to be reviewed to ensure that temporary changes have been removed.

The following documents should be considered for revision, as appropriate, following plant changes:

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- design requirements documents
- system descriptions
- calculations and transient analysis
- electrical load studies
- plant and simulator drawings
- station procedures
- design and procurement specifications
- equipment and installation specifications
- vendor manuals and drawings
- plant safety analyses (final or updated safety analysis report)
- licensing documents and commitments
- plant technical specifications
- equipment lists (including NPRDS, as applicable)
- setpoint documents
- equipment environmental qualification data packages
- fire hazards analyses
- training materials
- plant-referenced simulator software and hardware configuration"

7.3

KEY INTERFACES

INTERFACE BOUNDARIES

The Engineering Design Functional Area applies to all design activities at a facility. This Functional Area interfaces essentially with all other functional areas to some degree, in both programmatic and technical functional areas. For example, the Management Systems Functional Area interfaces with this Functional Area with respect to document control and the Packaging and Transportation Functional Area establishes design considerations for packaging and transportation aspects of a facility.

In general the interface boundary between the Engineering Design RID and other RIDs is defined such that generally applicable requirements that are controlled in another functional area are not repeated in this RID. Specific requirements that derive from requirements in other RIDs are contained in this RID. For example, the general requirements for personnel

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qualification and training are contained in the Training and Qualification RID and are not repeated in this RID. Specific training requirements that apply to the engineering design function are contained in the Engineering Design RID.

Applying the above guidance, specific major interface boundaries between engineering design and other functional areas have been defined as discussed in the sections below.

7.3.1

Management Systems

Engineering Design uses applicable higher tier policies and procedures developed outside the functional area. Policies and procedures applicable solely to the engineering design functional area are developed within the functional area, but are subject to general requirements for policies and procedures. Design-related requirements for document control and records management are contained in the Engineering Design functional area. Several engineering design activities such as those dealing with the control of design changes and modifications may be integrated with the Issue Management element

7.3.2

Quality Assurance

The Quality Assurance Functional Area provides oversight of the conduct of the Engineering Design Functional Area. Engineering Design should ensure that appropriate quality assurance controls are imposed on subcontractors and vendors. The Engineering Design Functional Area should incorporate into its processes a means of timely dispositioning of deficiencies whether identified by the QA function or through design verification and self-assessment activities. The Engineering Design Functional Area should also specify quality control inspection requirements for physical attributes important to design.

7.3.3

Operations

The Operations functional area provides design input regarding operational requirements, preferences, and capabilities. The output of the design process includes information necessary to permit the operations functional area to ensure operation of the facility within the limits imposed by the design. For example, the engineering design function must provide information on safety limits for equipment operation and provide inputs for use in operational activities such as instrument calibration and establishment of instrument setpoints. The system engineering function is within the scope of the Operations RID; however the Engineering Design RID includes requirements for obtaining system engineer input for design changes. The process engineering function is within the Operations RID. Process engineering provides inputs to the engineering design function.

7.3.4

Maintenance

The interface between Engineering Design and Maintenance functional area is defined so that maintenance activities that change the design are treated as design changes and are subject to applicable design control requirements. Maintenance activities that maintain or restore the facility to its as-designed condition are solely within the maintenance functional area. The Engineering Design functional area is responsible for defining post-maintenance testing requirements for work affects the design. The Engineering Design functional area develops technical requirements for materials and services used in maintenance activities that potentially affect the design.

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7.3.5

Construction

Design Engineering (or design authority) must approve construction design in order to meet their design authority responsibility. Engineering design output are used by construction to build or modify facilities. Applicable design outputs include drawings and engineering specifications from which construction procedures are developed. The engineering design process includes a means to review and disposition construction-generated design change requests and non-conformance documents where the disposition is "use-as-is" or repair. The engineering design process obtains from construction as-built information necessary to verify designs where as-built variations from approved designs ha engineering significance. The Engineering Design functional area includes the requirement to develop the technical requirements for purchase specifications field-procured items.

7.3.6

Fire Protection

The interface between Engineering Design and Fire Protection functional areas is defined so that the Fire Protection functional area evaluates the fire hazards and defines the design features that are necessary to mitigate those hazards. The Engineering Design functional area ensures that those design features are incorporated into the design and provides the necessary support services (power, water, etc.) required by fire protection systems designed within the scope of the Fire Protection functional area.

7.3.7

Nuclear Safety

The Nuclear Safety functional area contains the controls and requirements for SAR preparation, definition and analysis of credible accidents, and performing dose calculations needed for the SAR. The Engineering Design functional area recognizes the need for engineering input to this process and the need to ensure that designs are consistent with the SAR and other technical safety requirements and commitments.

7.3.8

Configuration Management

Engineering Design provides information to the Configuration Management functional area and uses the design and configuration baselines maintained within this functional area.

7.3.9

Emergency Preparedness and Management

The Engineering Design functional area incorporates into its designs the facilities necessary to support emergency preparedness and management function. Such facilities include those necessary to perform safety-related functions under emergency conditions, capabilities to monitor facility conditions, and provide communications and other necessary support.

7.3.10

Environmental Protection

Because the Tank Farm Facilities are RCRA facilities, it is important that the Engineering Design functional area produce designs that meet environmental protection requirements. The Environmental Protection functional area defines those requirements and the Engineering Design functional area contains the requirement to implement them.

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7.3.11 Occupational Safety and Health

The Occupational Health and Safety functional area provides design-related inputs to the engineering design process to ensure that occupational health and safety considerations are factored into the design. The design process includes steps to ensure that occupational health and safety requirements are met.

7.3.12 Radiation Protection

The Radiation Protection functional area provides design input on the radiation hazards associated with the processes being conducted within the facility. The Engineering Design functional area contains requirements for ensuring that appropriate design measures are taken by qualified personnel to ensure compliance with radiation protection standards and requirements. The Engineering Design functional area is required to obtain review and concurrence of its means of implementing the input requirements and resolves comments and questions on the radiation protection aspects of its design. The Radiation Protection functional area provides timely input to the design process by providing reviews of designs for compliance with radiation protection standards and requirements.

7.3.13 Training and Qualification

The Engineering Design RID contains requirements for defining the training needs of personnel assigned to carry out the requirements contained therein. Engineering Design is responsible for implementing engineering design-specific training and qualifications requirements. The Engineering Design RID contains requirements for subject matter experts for job task analysis, training materials development, and identification of standards for qualification or certification of the management and staff of the personnel who carry out the requirements contained in the RID. The Training and Qualification functional area defines training and qualification requirements that are generally applicable (i.e., requirements that also apply to personnel other than those responsible for design engineering). The Training and Qualification functional area defines the requirements for general employee training (GET), security training, and instructor training and qualification.

7.3.14 Waste Management

Design inputs related to waste management are established by that functional area and are used by the Engineering Design functional area. These inputs include radiation dose performance criteria specified in this functional area as inputs for the design of new tanks or modifications of the existing tanks.

WESTINGHOUSE HANFORD COMPANY

REQUIREMENTS

IDENTIFICATION

DOCUMENT

FACILITY:

HIGH LEVEL WASTE STORAGE
TANK FARMS/242-A
EVAPORATOR

FUNCTIONAL AREA:

Maintenance

REVISION 0

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10.0 MAINTENANCE

INTRODUCTION

SCOPE

The Maintenance Functional Area includes activities required to monitor and maintain facility structures, systems, and components in a manner that supports safe and efficient facility operations.

This Requirements Identification Document (RID) identifies requirements applicable to the Tank Farm Facility as defined by related DOE Orders, Federal regulations, industry codes, standards and good practices to ensure that property is maintained in a manner which promotes operational safety, worker health, environmental protection and compliance, property preservation, and cost-effectiveness while meeting the programmatic mission of the facility. This document has been developed in response to the Defense Nuclear Facility Safety Board (DNFSB) Recommendation 90-2 which called for DOE to:

1. Identify the specific standards that apply to DOE nuclear facilities;
2. Assess the adequacy of those standards for protecting public health and safety; and
3. Determine the extent of compliance with the identified standard;

This document will also be used as the basis for assessing compliance of the Maintenance Management Program in support of the facility's Operational Readiness Review.

The Maintenance functional area and corresponding element/subelement structure is based primarily upon DOE Order 4330.4A, "Maintenance Management Program". However, a wide range of references were reviewed for applicability and incorporated when the primary reference required amplification or expansion.

The scope of the Maintenance Functional Area, as relating to the Tank Farms, covers management controls and program requirements necessary to perform a full range of maintenance activities, including corrective, preventive, and predictive maintenance; materials management and control; event assessment and corrective actions; work control processes and material condition inspections. Subject Matter Expert comments are included when the DOE ORDERS or facility guidance is either weak or nonexistent.

The Maintenance Functional Area involves significant interfaces with other functional areas such as Operations, Engineering Design, Construction, Training, Quality Assurance, Radiation Protection, Occupational, Health and Safety, as well as with the processes for identification of facility deficiencies.

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The Maintenance Functional Area does not prescribe how to perform specific activities, but identifies DOE, industry practices, and subject matter expert recommendations for the programmatic controls of maintenance activities.

The Functional Area elements are discussed in Sections 10.0 through 10.11. Key Program Interfaces with other functional areas are discussed in Section 10.12.

As a result of reviewing the Facility's Authorization Basis, it has been determined that 11 of the primary elements currently identified in DOE's Configuration Functional Area Guidelines for Maintenance are applicable and appropriate for the Tank Farm Facility.

These elements are as follows:

1. Program Management
2. Maintenance Facilities, Equipment and Tools
3. Types of Maintenance
4. Maintenance Work Control System
5. Material Procurement and Control
6. Control and Calibration of Measuring and Test Equipment
7. Facility Condition Inspection
8. Analysis of Maintenance Problems
9. Modification Work
10. Post-Maintenance Testing
11. Seasonal Facility Preservation Information

This RID applies to the activities, personnel, structures, systems, components, and programs involved in maintaining the facility and executing the mission of the Tank Farms. The physical boundaries within which the requirements of this RID apply are the Single Shell Tank Farms, Double Shell Tank Farms, 242-A Evaporator-Crystallizer, 242-S,T Evaporators, Liquid Effluent Retention Facility (LERF), Purgewater Storage Facility (PWSF), and all interconnecting piping, valves, instrumentation, and controls. Also included is all piping, valves, instrumentation, and controls up to and including the most remote valve under Tank Farms control at any other Hanford Facility having an interconnection with Tank Farms. The boundary of the structures, systems, components, and programs to which this RID applies, is defined by those that are dedicated to and/or under the control of the Tank Farms.

10.1 PROGRAM MANAGEMENT

Maintenance managers should ensure high standards of performance in maintenance are achieved through effective management of all department activities. DOE and facility policies should reflect a philosophy of striving for excellence in facility operations. Additionally, professionalism should be cultivated as management instills in personnel a conservative approach to activities and a sense of responsibility for facility safety.

This element addresses the key management and organizational activities of an effective Maintenance Program. Formal organization of the Program is necessary to ensure that a

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deliberate and controlled approach to program management is achieved. Establishment of such a formal organization enhances the potential for achievement of improved levels of safety performance, compliance, and efficiency.

This element describes the extent of the formal Program organization structure necessary to define and communicate where personnel are assigned, what tasks they are expected to accomplish, methods for accomplishment, and management's expectation for performance.

The Management Systems functional area RID should be reviewed for determination of the programmatic requirements for policies and procedures, document control and records management, lessons learned, occurrence/event reporting, and regulatory affairs/issues management.

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 2.2, Paragraph 1

"A high level of performance in facility maintenance is accomplished by establishment of high standards by senior management, communicating standards to personnel who perform maintenance, selecting and training high quality personnel, providing sufficient resources to the maintenance organization, setting goals and objectives, closely observing and assessing performance in maintenance, effectively coordinating maintenance activities with operations and other facility organizations, and holding workers and their supervisors accountable for their performance in conducting maintenance activities."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 2.2, Paragraph 2

"Sufficient staff, equipment, and funding should be allocated to the maintenance organization so that its functions can effectively be performed."

10.1.1

Policies and Procedures

DOE and facility management provides definitive direction to facility personnel through a variety of mechanisms. An essential mechanism is the establishment of Maintenance policies and procedures. These directives should define maintenance objectives, establish expected performance levels, and clearly define maintenance responsibilities and accountabilities. Policies should be established to recognize the importance of the Maintenance Program, the extensive teamwork needed for the Program to be effective, and the Program's vital role in safe and reliable facility operations.

Policies covering work-at-risk should be established to provide controls on activities which could circumvent normal maintenance practices. Policies covering the "skill of the craft" concept of performing maintenance should be developed and consist of the following minimum requirements:

- a. Definition of qualification prerequisites for entry-level maintenance personnel
- b. Qualification requirements for each functional level of the Maintenance Program
- c. Alternatives to specified education, experience, and training requirements and

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d. Requirements to demonstrate proficiency for each functional level before being allowed to perform at that level.

Programmatic procedures should exist to control the overall maintenance process and its interfaces with other programs (CONDUCT OF MAINTENANCE).

The Policy, Plans, and Procedure System, the Document Control and Records Management Process elements of the Management Systems, and the Training and Qualification Functional Areas discuss additional controls that may be applicable to this sub-element.

The following key controls that should be in place to ensure maintenance activities should be conducted accurately, efficiently, and in a safe manner:

- a. Controls to ensure that procedures are used to guide maintenance activities that could result in a significant process transient, degraded facility reliability, or a personnel or equipment hazard;
- b. Controls to ensure that information such as required manpower and skill levels; time to accomplish the activity; special tools and materials needed; facility conditions needed; and clearance, radiation work permit, and other safety requirements and precautions should be included in procedures;
- c. Controls to ensure that procedures should be periodically reviewed and updated.

(SUBJECT MATTER EXPERT COMMENTS)

To provide the continuity required within the Maintenance Department, policies and procedures should be established defining the levels of signature authority and provisions for "back-up" management when line managers are unavailable for duty (i.e., vacation, illness). Provisions should also be defined concerning personnel "call-outs" for off-shift work activities.

(SUBJECT MATTER EXPERT COMMENTS)

The Maintenance process should have an established, clearly defined process to incorporate and implement requirements defined in:

- DOE Regulations and Commitments
- Codes, Standards, and Applicable Technical Reports
- FSAR, Technical Specifications, and OSRs
- Industry Generic Letters, Notices, Bulletins
- Corporate and Facility Directives

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 2.3.1

"It is a primary responsibility of the maintenance manager (1) to ensure implementation of contractor management and facility policies that affect the maintenance organization. Maintenance organization procedures should support contractor management and facility maintenance policies. Responsibilities for implementing these policies, including the responsibility of maintenance personnel, (2) should be clearly defined. Maintenance personnel should clearly understand their authority, responsibility, accountability, and interfaces with other groups. Procedures or other definitive documentation should specify policies that are used to guide maintenance organization activities. These documents should also specify the types of controls necessary to implement maintenance policies.

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/2 The term maintenance personnel denotes any individual performing a maintenance function."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 3.2, Paragraph 1, Bullet 1

"The training organization should maintain maintenance training programs that meet the intent of established industrial guidelines and that address specific company and facility needs. These training programs are supported and guided by the maintenance organization. This support and guidance normally includes all or a portion of the following tasks:

- o Defining the jobs, tasks, skill levels, and responsibilities of individuals in these positions;"

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 3.3.5

"In conjunction with the training organization, maintenance management should review an individual's training accomplishments prior to qualifying him for a given task. A similar method should be established to review the qualification of contractor personnel. This review should include the following:

- a. Verifying completion of all designated prerequisite training;
- b. Conducting or evaluating the results of a final written, oral, or practical demonstration examination and evaluating the recommendations of the individual's supervisors;
- c. Interviewing the individual regarding the knowledge and skill he has acquired (not as a verification of total expertise and proficiency but as an indicator of competency upon which to build); and
- d. Formal qualification approval and documentation."

FACILITY REQUIREMENT SOURCE: DOE5480.20 Chapter IV, Section 2.e

"Maintenance Personnel. Maintenance personnel are responsible for the maintenance and repair of mechanical and electrical equipment.

(1) Experience: Maintenance related 1 year"

SITE REQUIREMENT SOURCE: DOE5700.6C Section 9.b(1)(a)

"Quality Assurance Criteria Management Criterion 1 - Program Organizations shall develop, implement, and maintain a written Quality Assurance Program. The QAP shall describe the organizational structure, functional responsibilities, levels of authority, and interfaces for those managing, performing, and assessing adequacy of work. The QAP shall describe the management system, including planning, scheduling, and cost control considerations."

10.1.2

Responsibility, Authority, and Accountability

The authority and responsibility for the conduct of maintenance activities should be designated. The designated authority should have the responsibility for the overall facility maintenance to ensure safe and reliable operation and should be given the authority to carry out the various

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aspects of that responsibility. Delegation of that authority should be made only with established controls and specific limits. Accountability should be performance or results based with expectations established for both the performance of the maintenance process and the resulting application of that process on the facility structures, systems and components.

Accountability for the effectiveness of the maintenance program should be established. Managers, supervisors, engineers, planners, craftsmen and other personnel who support maintenance should be recognized for their performance.

This subelement identifies the requirements that provide the basis for the formulation and definition of the Maintenance Functional Area by Corporate and Facility Management. These requirements specify the relationship among maintenance personnel and supporting groups, as related to overall facility maintenance by defining responsibility, authority, and accountability. Proper implementation of this subelement include:

- a. Organizational charts which clearly show lines of authority, lines of communication, and organizational positions;
- b. Key position descriptions indicating authority, responsibility, qualification, and function;
- c. Maintenance procedures and plans which clearly define management and employee responsibilities, authorities, and accountabilities; and
- d. Program to monitor the performance of, and hold accountable, maintenance personnel through appraisals, promotions, counseling, and when necessary, disciplinary measures.

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 2.3.3, Paragraph 1

"The maintenance manager is responsible for helping to select high-quality personnel, for effective use of available resources, for assessment of resource adequacy, and for making recommendations regarding needed changes to the appropriate manager. He should be involved in defining entry-level criteria and screening of new personnel. High-quality personnel should be selected to establish a staff of supervisory, engineering, planning, technical (craftsmen), warehousing, and other support personnel needed to support the maintenance program. The entry-level criteria should ensure that maintenance personnel have the requisite background and experience to be trainable for work in nuclear facilities. A written or practical test has been used to demonstrate this minimum level of competence. If engineering personnel are not directly assigned to the maintenance organization, the maintenance manager should ensure that adequate engineering support is readily available (e.g., system engineers who are actively involved with daily maintenance activities such as troubleshooting and the evaluation of unusual conditions). Additionally, during temporary increases in staff to support planned outages or other activities, high-quality personnel should be selected."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 2.3.5, Paragraph 1

"Managers, supervisors, engineers, planners, craftsmen, warehouse personnel, and other personnel who support maintenance should be recognized for their performance. Rewards and other forms of recognition should be given for superior performance. Personnel involved in

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significant or frequent violations of maintenance requirements should be encouraged to improve through counseling, by remedial training, or by disciplinary measures where appropriate. A performance feedback program, such as performance appraisals, should be used to evaluate facility maintenance personnel. This program should include or should be augmented by routine managerial or supervisory discussions and feedback to each individual."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 8.3.3, Paragraph 1

"Maintenance supervisors (including the position of foreman) 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 actions should be initiated as needed."

10.1.3

Management Involvement

Managers should have effective mechanisms in place for monitoring the status of the maintenance program. Excellence in facility maintenance begins with the commitment and initiative of DOE and facility managers to be involved in and aware of maintenance performance by frequently touring the facility.

(NOTE: THIS ELEMENT TIES DIRECTLY WITH THE FACILITY INSPECTION ELEMENT)

In order to ensure that an effective Maintenance Program is established and maintained, maintenance and facility management should routinely conduct facility walk-throughs directed at observing the condition of the facility, the conduct of maintenance activities, and improving communication with the maintenance work force. Controls should be in place to ensure that these facility tours cover a variety of facility areas, personnel activities, and shifts and that they are documented, tracked, periodically reviewed, and closed.

This subelement identifies the requirements necessary to provide for effective and efficient management involvement in the maintenance program. Proper implementation of this subelement include:

- a. Periodic reviews of the Maintenance Program by management to assess the effectiveness of policy implementation;
- b. Establishment of the requirements for escalation of facility, personnel, or programmatic problems to management levels with the authority to provide necessary corrective action;
- c. Providing for effective feedback to management of performance indicators, goals, and objectives results for trending, evaluation, and upgrading as necessary; and
- d. Periodic assessments of each element of the maintenance program, at least every other year, by management for overall effectiveness and correction of deficiencies.

SITE REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 15.1

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"Additionally, DOE, contractor corporate, and facility managers should periodically review the maintenance program(s) to verify that they are effectively accomplishing the intended objectives and are upgraded as needed."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 15.3.2

"The results of maintenance performance indicators, goals and objectives, and other related information should be developed, trended, and reported to provide feedback. This feedback should be used by senior management in the progress and feedback reviews that are discussed below. Section discusses the development of performance indicators, goals, and objectives for maintenance. Reports should include trends of the performance indicators, goals and objectives; a brief explanation for trends that appear unusual (positively or negatively); and intended corrective measures where warranted."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 15.3.3

"A key element of management involvement is the establishment of a feedback system where feedback and communication are continuously encouraged. This system should include planners, engineers, craftsmen, warehousemen, and others so that participation in improvements is promoted at all levels of the maintenance organization. Project teams (for such purposes as discussing proposed modifications to the facility, prioritizing industrial safety actions, and improving facility material condition) should include representatives from the affected crafts."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 15.3.3[02]

"The ability to apply lessons learned from in-house maintenance experiences (and the experiences of others) is essential for long-term success. Management should use information about problems encountered during maintenance activities to improve performance. Maintenance can also benefit by taking advantage of related experience at other facilities."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 15.3.4

"Inspections, audits, reviews, investigation, and self-assessments are necessary for an effective maintenance program. Senior managers should periodically review and assess elements of the maintenance program. These assessments can assist line managers and supervisors in identifying and correcting program deficiencies. An evaluation of each maintenance program element should be conducted at least every other year and should include inputs from managers and supervisors from maintenance and other groups such as operation, technical staff, and appropriate corporate departments. This evaluation should address the overall effectiveness of the program element. It should also address interorganizational and intraorganizational coordination problems that create work delays and reduce productivity. Areas needing improvements should be assigned for corrective action and follow-up."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 15.3.4.b

"b. Assessment of Maintenance Training. Management should be directly involved in approving and periodically reviewing the maintenance training program. The performance of maintenance personnel should be monitored to identify needed initial and continuing training program enhancements and shifts in emphasis. Any management reviews and performance trends that indicate the need for maintenance knowledge and skills improvement should be

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considered during the review of the maintenance training programs. Trainee feedback for improving the training program should also be obtained. Needed changes should be made to the training program by the training organization, based on recommendations from the facility manager and maintenance manager."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 8.3.3, Paragraph 1

"Maintenance supervisors (including the position of foreman) 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 actions should be initiated as needed."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 8.3.3, Paragraph 1, all Bullets

"Examples of work practices that should be checked include the following:

- Proper use of pre-job briefings and applicable training (e.g., mockup training);
- Industrial safety and radiological protection practices (e.g., appropriate use of safety equipment, proper handling of hazardous chemicals, proper use of ALARA concepts, and minimizing spread of contamination);
- Quality of workmanship, material, and parts;
- Procedure use, including adherence to step-by-step requirements, sign-offs, and work hold points;
- Open system and component protection;
- Accountability of tools, chemicals, and materials;
- Correct tool use for the job (e.g., short, non-sparking tools for batteries; prybars, chisels, or punches used as intended rather than substituting screwdrivers; and test instruments used on correct ranges);
- Clean and orderly work sites;
- Work progress and time required to perform the job, especially if a Limiting Condition for Operation exists;
- Work being performed on the correct component, system, or unit; and
- Proper use of post-job reporting and, when applicable, post-job critiques."

10.1.4

Organizational and Programmatic Interfaces

Organizational and programmatic interfaces within the maintenance organization, between facility organizations that support the maintenance program, and with offsite organizations should be established and documented via a "CONDUCT OF MAINTENANCE" type of document. This element addresses the specific requirements for establishing programmatic controls as they relate to both facility and offsite interfaces.

This subelement identifies the specific requirements for establishing programmatic controls as they relate to both onsite and offsite interfaces. Proper implementation of this subelement include the following:

- a. Establishment and documentation of maintenance interfaces with onsite organizations, committees, and programs;

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- b. Establishment and documentation of maintenance interfaces, including limitations, with offsite organizations, companies, and agencies; and
- c. Integration of interface descriptions and responsibilities into site implementing procedures.

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 2.3.2(a)

"Each facility should develop an integrated approach to maintenance so that working relationships are developed among all organizational units that support the maintenance function (e.g., operations, health physics, stores, quality control, engineering, procurement, and modifications).

The maintenance strategy should chart the relationship among these supporting groups, as related to overall facility maintenance, by defining responsibility, authority, and accountability."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 8.2, Paragraph 1, Bullet 6

"Goals for high-quality workmanship, safe work practices, and improving radiological protection should be emphasized to maintenance personnel. A key factor in achieving these goals is work-site guidance and overview provided by maintenance supervisors. Monitoring to identify rework (maintenance that has to be repeated) can be effectively used to identify programmatic or qualification deficiencies."

FACILITY REQUIREMENT SOURCE: DOE5700.6C Chapter I, Section 9.b(1)(a)

"Criterion 1--Program. Organizations shall develop, implement, and maintain a written Quality Assurance Program. The QAP shall describe the organizational structure, functional responsibilities, levels of authority, and interfaces for those managing, performing, and assessing adequacy of work. The QAP shall describe the management system, including planning, scheduling, and cost control considerations."

10.2

MAINTENANCE FACILITIES, EQUIPMENT, AND TOOLS

Maintenance facilities, tools, and equipment should efficiently support the maintenance program to ensure the ability to maintain the facility in an optimum state of readiness, where the objective is to create and maintain a safe, professional, and productive workplace where high-quality work can be performed. Maintenance facilities directly affect the ability to maintain the facility in an optimum state of readiness.

The process of providing tools and test equipment for the facility should include proper storage, issuance, and accountability controls. Tools and test equipment should be kept in a high state of readiness, some by inclusion in the preventive maintenance program.

The following elements provide the programmatic requirements for meeting the previous objectives.

[SUBJECT MATTER EXPERT COMMENTS]

A hoist and rigging control and test program should be established with facilities to test and certify the hoisting and rigging equipment.

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[SUBJECT MATTER EXPERT COMMENTS]

A plan should be developed for the proper locating of crane booms and boom removal during times of inclement weather or non-use times utilizing the NATIONAL WEATHER SERVICE watches (i.e., tornado, severe thunderstorms, etc) as the identifying agency. Consideration should be given to the placement of a placard on such equipment.

[SUBJECT MATTER EXPERT COMMENTS]

Defined and controlled equipment removal paths should be identified and analyzed for heavy equipment as to the path's impact loading on under-ground piping and structures. This information should be utilized in work package preparation and other maintenance activities.

10.2.1

Maintenance Facilities

Safe and efficient performance of maintenance activities is dependent upon the availability and location of proper facilities. This sub-element defines the programmatic controls that should be established to ensure maintenance facilities, both permanent and temporary, are provided and evaluated for adequacy. Programmatic controls should be established to ensure that:

- a. Maintenance facilities are adequate to meet program needs; and
- b. The facilities needed to safely and efficiently perform maintenance activities (i.e., training, storage, laydown, shop, decontamination, and office) are provided and located to optimize personnel resources and safety.

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 4.3.1(a), Paragraph 1

"The layout of shop and satellite work areas should be designed with a high priority on industrial safety and efficiency. As shops are modified and satellite work areas are changed throughout the life of the facility, safety, and efficiency should remain foremost considerations."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 4.3.1(b), Paragraph 1

"A plan for identification and use of maintenance laydown and staging areas should be developed and kept current. This plan should define outage support requirements, area use, and responsibility for area upkeep and control and should include items such as the following:

- o Authorization for access, with provisions for security and fire protection;
- o Radiological control
- o Labeling of facilities to designate responsibility and entry authorization; and
- o Contingency plans for changes (such as unanticipated radioactive airborne contamination) that could render a facility unusable for its intended purpose."

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FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 4.3.1.a, Paragraph 3

"Each shop and satellite work area should have storage that is convenient and encourages craftsmen to keep the area neat and clean. Shelves, cabinets, lockers, and tool boxes are examples of storage facilities that could be provided for items such as tools, parts, reference materials, and personal items."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 4.3.1.c, Paragraph 1, all Bullets

"The evaluation performed to determine storage facility needs should address items such as the following:

- Environmental controls, considering such items as isolation/segregation of chemicals, flammability of lubricants and paint, qualification of parts/components, damage to elastomers and polypropylene parts because of exposure to light, and control of radioactive materials.
- Storage activity controls considering items such as material receipt, inspection, handling, storage, retrieval, and issuance (Section 11) and tool and equipment control (Section 13).
- Inventory level of spare parts, supplies, and equipment to support safe and reliable operation of the facility (Section 10 and Section 11)."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 4.3.1.d

"Temporary Facilities. Temporary facilities are required for activities involving airborne radioactivity and contamination control and contractor support during outages. Planning and coordinating temporary facilities with other groups, such as radiological protection and operations, results in more efficient use of space. Such necessary services as electrical power, compressed air, water, environmental controls, and lighting should be provided at temporary outage support facilities. ALARA should be considered when designing and locating temporary facilities. Glove boxes or temporary containments should be considered for work on contaminated equipment to prevent spread of contamination. Major temporary facilities should be controlled through the plant's design change programs to ensure additional building services (such as electrical, compressed air, and water requirements) do not overload the installed plant systems."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 4.3.3

"Maintenance facilities should include office equipment that supports the maintenance organization in efficiently completing its work in a high quality manner. Adequate communication, calculation, reproduction, and other office equipment should be accessible and maintained in a reliable working condition. When computerized data bases are used, convenient access to computer terminals should be provided. During outages or other high activity periods, additional office equipment should be provided as needed."

10.2.2

Control of Tools and Equipment

Provisions for storage, issuance, and availability of an adequate and readily available supply of tools and equipment, and for the development of special tools and equipment is essential for safe and effective maintenance activities.

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This subelement identifies the requirements necessary to ensure availability and control of tools and equipment. Proper implementation of this subelement should include:

- a. Program for the control and issuance of tools and equipment, possibly "BAR-CODING".
- b. Program for the proper storage and retrievability of tools and equipment, including "special tools";
- c. Requirements to control and decontaminate tools and equipment in radiologically controlled areas;
- d. Segregation and disposal of worn, defective, or otherwise unusable tools and equipment;
- e. Proper maintenance of tools and equipment (i.e., inclusion into the preventive maintenance program);
- f. Process to ensure the proper use of special tools, or equipment requiring special handling (i.e., lifting and rigging, mockups, models, etc.); and
- g. A program for scaffolding control should be established to ensure that scaffolding is properly identified, inspected, and stored.

[SUBJECT MATTER EXPERT COMMENTS]

Administrative procedures should be established defining the process and control of the welding program. The program should consist of requirements governing the issue of weld rod and the qualifications of the individual welder. Provisions should be included for timely qualification of welders on "special" welding processes.

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 13.1

"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."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 13.3.1

"Responsibility should be assigned for the proper storage and issuance of both stationary and portable tools and equipment. Permanent issuance of tools to individuals or groups of craftsmen who use them on a day-to-day basis and who are responsible for maintaining them contributes to worker efficiency. Other tools and equipment should be available on an as-needed basis. For these items, proper storage facilities should be centrally located to shops and normal work areas and should be readily accessible to the craftsmen in order to promote worker efficiency."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 13.3.2[02]

"Worn, defective, or otherwise unusable tools should be segregated so that only safe, usable tools are available for use. Unrepairable tools should be disposed of in a timely manner."

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FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 13.3.3

"Special tools, test rigs, special equipment, lifting and rigging equipment, and mockups should be suitable for their intended use and properly identified. To improve tool and equipment use and enhance job performance and efficiency, instructions should be provided for their use especially for high-hazard or high-stress tasks. Maintenance supervisors should review proposed designs for special tool and equipment to determine cost justification, effectiveness, safety considerations, and the need for reviews by other organizations. These tools should be stored and controlled in accordance with the guidance provided above."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 4.3.2

"Storage facilities should be centrally located to shops and normal work areas to improve maintenance efficiency. Storage facilities should provide for day-to-day tool and equipment use for craftsmen and for special tools and equipment, test rigs, and the ready retrieval of mockups when needed. These facilities should provide environmental controls for temperature, humidity, dust, and radioactive contamination, as needed. Facilities should also meet manufacturers' special handling or storage requirements. Facilities should be provided for segregation, calibration, and repair of maintenance and test equipment. Design considerations such as heavy loads and seismic criteria should be considered for in-plant storage of tools. See Section 13 for additional information on tool and equipment control."

10.3.

TYPES OF MAINTENANCE

The Maintenance Program should provide a high degree of equipment reliability, availability, and efficiency by identification and correction of equipment degradation through a proper blend of corrective and preventive maintenance. The proper balance of the types of maintenance should provide a degree of confidence that facility equipment degradation is identified and corrected, that equipment life is optimized, and that the maintenance program is cost effective.

Many factors should be considered in establishing an effective and efficient balance of the types of maintenance. On important systems and equipment, a thorough technical analysis using methods such as a reliability-centered maintenance (RCM) may be needed to establish this balance. On less important systems, the amount of preventive maintenance to be performed may be determined using a more basic judgmental engineering analysis.

This section provides requirements for establishing the correct relationships of the types of maintenance in the maintenance program. This section does not address OSR or technical specification requirements; however, surveillance, inspections, and in-service inspection should be considered in the establishing the scope of the preventive maintenance program.

This element defines the requirements for establishing the types of maintenance necessary for safe and efficient facility operations.

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 13.3.2

"Maintenance tools and other support equipment should be included in the preventive maintenance program (see Section 5). Inclusion in the preventive maintenance program enhances the availability and reliability of equipment such as cranes, portable lifting and

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rigging equipment, welding machines, weld rod ovens, shop machinery, and measuring and test equipment."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 5.1, Paragraph 1

"A proper balance of corrective and preventive maintenance should be employed to provide a high degree of confidence that facility equipment degradation is identified and corrected, that equipment life is optimized, and that the maintenance program is cost-effective. The maintenance program includes preventive, predictive, and corrective maintenance."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 7.3.2.a, Paragraph 2

"Each preventive maintenance action should be scheduled at appropriate intervals and, when appropriate, combined with corrective maintenance activities on the same equipment and with other related maintenance based on equipment similarity or proximity. For example, corrective maintenance could be scheduled with an upcoming preventive maintenance (PM) action that requires the same or a similar tagout, PM routes could be established that allow the craftsman to lubricate all equipment on a particular elevation, and an annual PM could be scheduled with a quarterly PM."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 7.3.2.a, Paragraph 3

"Conversely, preventive maintenance for the equipment should be reviewed and included with corrective maintenance activities as appropriate. When feasible, all preventive and corrective maintenance activities on the equipment that should or could be worked should be accomplished when a clearance is issued for maintenance. These principles also apply on an interdisciplinary basis. For example, operations, mechanical, electrical, instrumentation and control, and technical staff activities should be integrated."

10.3.1

Corrective Maintenance

Corrective maintenance is the repair and restoration of equipment or components that have failed or are malfunctioning and are not performing their intended function. As a rule, if the component requiring maintenance has failed, the action required to repair it should be classified as corrective maintenance.

This subelement defines the requirements for repair and restoration of equipment or components that have failed or are malfunctioning and are not performing their intended function. The corrective maintenance program should include:

- a. Controls to ensure that the condition that caused the failure is identified, corrected, and documented;
- b. Controls for establishing an equipment maintenance history data bank useful in performing analyses for reliability studies or possible changes to the preventive maintenance program;
- c. Priorities for corrective maintenance based on plant objectives and the relative importance of the equipment, i.e. Reliability-centered maintenance.

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- d. Compilation of a master equipment listing with each item classified according to its importance to safety; and
- e. Controls necessary to analyze failure modes and frequencies, determine failure causes, and identify preventive maintenance actions that could improve facility reliability and reduce operating costs.
- f. Ensure that temporary repairs, which may allow an item being maintained to remain or be returned to service in a condition that is not consistent with the technical baseline requirements, receives reviews prior to implementation of the repair.

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 16.1

"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 facility systems and components. The documentation of complete, detailed and usable history will be increasingly important as plant life extension becomes an issue. Trending should be directed toward identifying improvements for the maintenance program as well as needed equipment modifications. Sections 5, 7, and 17 provide guidance on programs that contribute to and are augmented by the maintenance history program.

This section addresses the development and use of a maintenance history program."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 5.3.1

"A detailed master list of both safety-related and non-safety-related equipment, components, and structures to be included in the maintenance program should be developed. Special tools and equipment should be included in this master list. This list can also be used effectively in establishing the maintenance history program (see Section 16)."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 5.3.2(a)

"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."

10.3.2

Preventive Maintenance

Preventive maintenance includes predictive, periodic, and planned maintenance actions taken to maintain a piece of equipment within design operating conditions and extend its life and is performed prior to equipment failure or to prevent equipment failure.

This subelement identifies the requirements for planned and scheduled actions performed for the purpose of preventing or prolonging equipment failure.

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FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 13.3.2

"Maintenance tools and other support equipment should be included in the preventive maintenance program (see Section 5). Inclusion in the preventive maintenance program enhances the availability and reliability of equipment such as cranes, portable lifting and rigging equipment, welding machines, weld rod ovens, shop machinery, and measuring and test equipment."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 5.3.2(b)
"Preventive maintenance consists of all those systematically planned and scheduled actions performed for the purpose of preventing equipment failure. The preventive maintenance program should define the required activities and the frequency at which they should be performed. Selection of required preventive maintenance actions should be based on manufacturer's recommendations, plant experience, and good engineering practice. The frequency of preventive maintenance should be based on adequately implementing the entire program, considering such elements as predictive maintenance results, vendor recommendations, ALARA considerations, and monitoring of performance. A documented basis for the planned actions should be provided. Further, any deferral of planned tasks should have a technical basis.

Maintenance action is often scheduled on a routine basis (e.g., by calendar hours or run timed on equipment to prevent breakdown and involves servicing such as lubrication, filter changes, cleaning, testing, adjustments, calibration, and inspections. Planned maintenance is done prior to equipment failure. This can be initiated by predictive or periodic maintenance results, by vendor recommendation, or by experience. This includes items such as the following:

- o Scheduled valve repacking;
- o Replacement of bearings as indicated from vibration analysis;
- o Major or minor overhauls based on experience factors or vendor recommendations; and
- o Replacement of known life-span components.

Planned maintenance is typically done during outages or on spare or redundant equipment that is available during facility operation."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 5.3.2(c), Pages 85,86

"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

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gathered should be analyzed, trends should be identified, and action needed should be defined. Action should be taken to provide feedback to the maintenance program in time to preclude equipment failure. The predictive maintenance program should provide data to the preventive maintenance program and provide and retrieve equipment history data. Root causes should be determined, if possible, and action taken and results fed back into the program.

Predictive maintenance actions are determined by the data required to describe equipment performance, for example:

- o Vibration analysis (including spectral analysis and bearing temperature monitoring) and lube oil analysis (ferrography) are used to monitor rotating equipment.
- o Infrared surveys (thermography) are performed on heat-producing equipment such as motors, circuit breakers, batteries, load centers, and insulated areas to monitor for high resistance or insulation breakdown.
- o Motor-operated valves are tested and analyzed. Such tests as operating current, voltage, and timing checks should be used.
- o Selected instrument data are identified, normal values and acceptance criteria are established, and readings are monitored and trended for the operation condition of the equipment to detect degradation.

When predictive maintenance requires in-process monitoring of the equipment, such action should specify establishing the proper conditions, systems configuration, and operating parameters to help ensure that the data collected are comparable and trendable. Equipment monitoring locations should be identified and marked to obtain consistent readings each time the predictive maintenance data are provided. Knowledgeable individuals must review and analyze these data for the predictive maintenance program to be successfully used to predict and address incipient failures. "

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 5.3.3, Paragraph 2, Sentence 2

"The justification for the preventive maintenance program should be documented, and the maintenance manager should approve the preventive maintenance program, including new or revised preventive maintenance actions and their frequencies. "

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 5.3.4

"Each preventive maintenance action should be scheduled at appropriate intervals and, when possible, combined with corrective maintenance activities on the same equipment and with other related maintenance based on equipment similarity or proximity. "

10.4

MAINTENANCE WORK CONTROL SYSTEM

This element defines administrative methods and controls by which Maintenance Work activities are identified, initiated, planned, approved, scheduled, coordinated, performed, and reviewed for adequacy and completeness. The controls for this element should be implemented to ensure that maintenance is accomplished in a timely manner; to improve

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maintenance efficiency; to reduce radiation exposure to as low as reasonably achievable (ALARA); and to increase equipment availability.

With the exception of minor maintenance, i.e., "skill of the craft" and Priority emergency items, all work is planned and work packages made "task ready" before release to the field for implementation.

The Work Control System is the integrated process that should assure that the interfaces required to complete the assigned work are identified, scheduled, and the manpower resources obtained prior to the work package being released to the field for implementation by the maintenance craft. This process should provide ample "look ahead" for Maintenance Management to gather the qualified craft to perform the work effectively. The Work Control Process should be formalized via procedure and work flow diagrams to identify and minimize duplication of unnecessary reviews thereby providing a streamlined work flow process.

The Work Control System should also have provisions included to assess the impacts of the work on the overall safety of the facility (Impact Assessments).

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 7.3.1.b, Paragraph 2, all Bullets

"Following completion of the work, the review should address the following items:

- Review of completed work packages for proper documentation, adequate post-maintenance testing, and possible changes to the preventive maintenance program (see Section 5); and
- Equipment history update (see Section 16)."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 7.3.2.a, Paragraph 1

"The work control system should provide the maintenance manager and his supervisors with the means for identifying and recording the status of all valid work requests. The system should consider a work request as part of the backlog from the time the work is identified until all actions are complete, including post-maintenance testing and administrative reviews. The system should provide a serialized list of work requests with a brief description of the work required, priority assigned, date the work requests was initiated, and facility conditions required to perform the work. Features of the system that could be helpful in managing the work backlog include the following:

- o A computerized system with the ability to sort work requests by priority, work request date, facility conditions required, and systems affected;
- o A status of all work requests on hold for planning, parts, material, or other constraints;
- o A tracking system to maintain the status of all work requests currently being worked; and
- o A tracking system to ensure that all required post-maintenance testing is accomplished prior to the return of a piece of equipment or a system to service (especially important following outages where many jobs may be performed on a system that is removed

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from service for an extended period or where several jobs are done under one clearance)."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 7.3.2.a, Paragraph 4

"A method should be established for advising all facility groups of the short-range and long-range preventive maintenance schedules. It may be done independently of or within the work control scheduling system. Regardless of the method used, it is essential that all affected groups have adequate advance notification of each preventive maintenance action to be accomplished. "

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 8.2, Paragraph 1, Bullet 1

"Administrative procedures should describe the control of work from identification and planning through completion, review, and storage of history data. Personnel (including key nonnuclear facility contractor and subcontract personnel) involved in the conduct and support of maintenance should be trained in the use of these procedures."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 8.2, Paragraph 1, Bullet 10

"Nonnuclear facility contractor personnel and subcontractors conducting maintenance should be controlled and held accountable to the same policies and procedures as facility personnel."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 8.2, Paragraph 1, Bullet 2

"The responsibility for various types of work (such as packing adjustments, equipment lubrication, and maintenance on health physics portable instrumentation) should be identified."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 8.2, Paragraph 1, Bullet 4

"Troubleshooting should be controlled to prevent unplanned repairs and unauthorized modifications."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 8.2, Paragraph 1, Bullet 7

"Work accomplished and the results of post-maintenance tests, including satisfactory return to service of the equipment or system, should be documented."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 8.3.1, Paragraph 2, all Bullets

"The work control procedures should describe the work request form, including applicable attachments, and should, as a minimum, address the following:

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- Personnel responsibilities for identifying deficiencies and initiating work requests that adequately describe the symptoms or problems;
- Supervisory responsibility for controlling the conduct of maintenance activities and processing work requests;
- Description of the process for initiating and processing the work requests, including the pre-job review, approval cycle, and post-job review;
- Definition of the priorities used to schedule work;
- Determination of the impact of maintenance activities on facility operations;
- Work planning and scheduling (see Section 7);
- The conduct of routine maintenance planning meetings (see Section 7);
- Requirements for personnel and equipment safety and radiological protection (e.g., confined space entry permits, welding and burning permits, clearance tagouts, radiation work permits);
- Post-maintenance testing (see Section 9); and
- Collection of maintenance history (see Section 16)."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 8.3.2

"Maintenance performed on facility systems should be controlled by the facility work request or another approved work control document. The document(s) should clearly define the work to be performed and should address the following items:

- o Equipment identification;
- o Name of the person initiating the work request;
- o Date, work request initiated;
- o Description of the symptom, problem, or work requested;
- o Job priority;
- o Personnel safety and radiation protection requirements or permits (e.g., confined space entry permit, welding and burning permit, clearance tagout, isolation, draining, depressurization of the component, and radiation work permit);
- o Applicable technical specifications, time restraints, and associated limiting conditions for operations;
- o Identification of qualification requirements (such as environmental and seismic qualifications);
- o Applicable work instructions and references;
- o Inspection, safety, or ALARA hold points associated with the work;
- o Required post-maintenance testing, inspections, and acceptance criteria;
- o Authorization by the appropriate operations shift supervisor and maintenance supervisor to commence work;
- o Narrative description of conditions found by the craftsmen;

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- o Documentation of actual work performed with post-maintenance testing and inspection results;
- o Acceptance of the equipment by operations; and
- o Final reviews and sign-offs by maintenance, quality control, and other groups in the work request review cycle."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 8.3.6, Paragraph 2

"Non-facility contractor and subcontract 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 subcontract 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 post-maintenance testing and acceptance inspections to the extent needed to enforce these requirements."

FACILITY REQUIREMENT SOURCE: DOE5700.6C Chapter I, Section 9.b(2)(a)

"Criterion 5--Work Processes. Work shall be performed to established technical standards and administrative controls. Work shall be performed under controlled conditions using approved instructions, procedures, or other appropriate means. Items shall be identified and controlled to ensure their proper use. Items shall be maintained to prevent their damage, loss, or deterioration. Equipment used for process monitoring or data collection shall be calibrated and maintained."

10.4.1

Work Package Development

Complete work packages provide those performing maintenance activities clear, accurate, up-to-date information which will allow them to perform those activities in a safe, efficient, and timely manner. Work packages which include, as applicable, procedures, instructions, drawings, permits, clearances, precautions, vendor information, tool and material requirements, and ALARA requirements are an acceptable method of providing this information. Proper implementation of this subelement include:

- a. Requirements for initiating and processing work requests, work orders, and work packages including the pre-job review, approval cycle, and post-job review;
- b. Requirements for ensuring work packages are reviewed by operations and maintenance supervision for satisfactory completion prior to returning the equipment or system to normal service;
- c. Process to ensure all technical and administrative requirements to perform the work are included in the work package, as well as the identification of needed tools, material, safety precautions (including ALARA), permits, and support activities;
- d. Process for obtaining required sign-off of the completed work package;
- e. Process for obtaining feedback of any adverse condition, problem, or observation into the history files for further review and/or analysis;

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- f. Process to ensure required inspections, acceptance testing, and/or hold points are included in the work packages;
- g. Process to ensure inclusion of all required post-maintenance testing, including acceptance criteria, in the work package; and
- h. Process for review of completed work packages for proper documentation, adequate post-maintenance testing, equipment history update, and possible changes to the preventive maintenance program.

[SUBJECT MATTER EXPERT COMMENTS]

Guidelines and processes should be established defining "HOW TO" build and assemble work packages to ensure continuity and consistency of the "FINAL" work package.

[SUBJECT MATTER EXPERT COMMENTS]

A process should be in place to identify "repetitive maintenance" items so that the maintenance planner does not have to replan each work item every time the repeat work item is identified, thereby, increasing planner efficiency.

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 7.3.1.b, Paragraph 1

"All work requests or work packages should be reviewed by the planner. However, different levels of planning attention should be applied to different jobs; for example, correcting a packing leak on a manual valve does not normally need the same level of planning effort as overhaul of a major pump.

The review should address the following items:

- o Definition of the problem and identification of the work scope (e.g., by work site inspection, by review of preventive maintenance activities, and other corrective maintenance that should or could be worked within the tagout boundary for the equipment);
- o Identification and review of necessary procedures, drawings, vendor manuals, and maintenance history;
- o Identification of needed and available data for use in analysis of maintenance problems (see Section 17);
- o Procurement of necessary repair parts, materials, tools, and equipment;
- o Assessment of manpower and skill requirements for facility, nonnuclear facility, and subcontractor personnel;
- o Identification and review of resources including other tasks scheduled to occur in the immediate area during the same time period;
- o Prejob ALARA planning;
- o Identification of initial conditions and prerequisites, including applicable technical specifications and limiting conditions of operation;

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- o Identification of quality control inspection, code, and technical specification requirements;
- o Establishment of equipment restoration and post-maintenance inspection or testing requirements; and
- o Review of work instructions or work packages for completeness."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 7.3.2.b, Paragraph 1

"Work Priority. Each work request related to production equipment repairs should be reviewed by the operations department to determine its impact on facility operations. Meaningful priorities that determine how soon a work request needs to be worked should be set based on safety and reliability. Communication among cognizant groups should be established to set priorities properly. A method should be established that avoids congesting the work control system with jobs that are not important to safe and reliable operation."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 7.3.2.b, Paragraph 2

"The priority system should be simple in order to enhance its use and accuracy. Typically, the priority system is limited to about six categories. Corrective maintenance should be assigned a priority based on the maximum time allowed before corrective action must be taken, as well as the system or equipment importance."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 8.2, Paragraph 1, Bullet 3

"A work request form (and/or work package) should be prepared and used to direct and document maintenance activities. This form should provide for documented review at the appropriate level. The work request should be used to control maintenance activities by ensuring correct equipment isolation, personnel safety, and the proper conduct of maintenance and post-maintenance tests."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 8.2, Paragraph 1, Bullet 5

"Troubleshooting should be controlled to prevent unplanned repairs and unauthorized modifications."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 8.2, Paragraph 1, Bullet 8

"Work requests should be reviewed following the completion of maintenance to verify that the activity was satisfactorily completed in accordance with facility procedures and standards and to capture maintenance history data."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 8.3.1, Paragraph 2, all Bullets

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"The work control procedures should describe the work request form, including applicable attachments, and should, as a minimum, address the following:

- Personnel responsibilities for identifying deficiencies and initiating work requests that adequately describe the symptoms or problems;
- Supervisory responsibility for controlling the conduct of maintenance activities and processing work requests;
- Description of the process for initiating and processing the work requests, including the pre-job review, approval cycle, and post-job review;
- Definition of the priorities used to schedule work;
- Determination of the impact of maintenance activities on facility operations;
- Work planning and scheduling (see Section 7);
- The conduct of routine maintenance planning meetings (see Section 7);
- Requirements for personnel and equipment safety and radiological protection (e.g., confined space entry permits, welding and burning permits, clearance tagouts, radiation work permits);
- Post-maintenance testing (see Section 9); and
- Collection of maintenance history (see Section 16)."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 8.3.2, Paragraph 2

"The work request should be reviewed by affected groups or representatives of these groups (such as maintenance, operations, technical support, quality control, safety, and radiation protection personnel) during the planning process. This review can be simple or extensive, depending on various factors, such as the complexity of the job and its relation to facility safety and reliability."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 8.3.4, Paragraph 2

"Maintenance supervisors should review completed work requests for the adequacy of repair, complete documentation, and identification of rework. A post-job review should be held with the craftsmen involved. This review could 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 can 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."

FACILITY REQUIREMENT SOURCE: DOE5700.6C Chapter I, Section 9.b(2)(a)

"Criterion 5—Work Processes. Work shall be performed to established technical standards and administrative controls. Work shall be performed under controlled conditions using approved instructions, procedures, or other appropriate means. Items shall be identified and controlled to ensure their proper use. Items shall be maintained to prevent their damage, loss, or deterioration. Equipment used for process monitoring or data collection shall be calibrated and maintained."

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10.4.2

Maintenance Planning

A mature Maintenance Program establishes the programmatic controls for incorporation of both long-range and short-range planning activities into the maintenance process. Planning activities should be established to optimize personnel, equipment, and monetary resources while minimizing facility down-time. The planning process should identify the activities and required resources that make up a maintenance task and their mutual dependence. Long-range and seasonal planning should anticipate those major activities that are needed either to provide seasonal protection or to accomplish major maintenance objectives. An achievable maintenance plan should include the interdependencies of parts availability (including procurement), engineering design reviews and input, inspection, and post-maintenance testing.

This subelement identifies the requirements for incorporation of planning work activities into the maintenance program. Planning activities are established that optimize personnel, equipment, and monetary resources while minimizing facility down-time.

Proper implementation of this subelement includes:

- a. Establishment of the scope of near-term and long-range major maintenance activities (major component overhaul, outages, modifications, replacement of equipment reaching the end of service life);
- b. Means for staffing and funding of these major activities;
- c. Establishment of the requirements for performing value-impact assessments of maintenance methods and approaches/alternatives the results of which are factored into planning of work activities;
- d. Process for evaluating government and industry issues and events that may change or impact planning in the Maintenance Program;
- e. Process for incorporation of ALARA, maintenance history records, and results of predictability/reliability studies into planning;
- f. Process for providing planning personnel sufficient for the size and/or complexity of the facility. These may be a dedicated group from various organizations or the Maintenance supervisor as the need dictates; and
- g. Process for critiquing completed major maintenance activities (outage, component overhaul, etc.) to determine how improvements could be made, and assign personnel to implement these improvements.

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 2.3.2.b

"Long-Range Planning. Effective management of the maintenance program requires long-range planning. By establishing a scope of long-range major activities, funding and staff resources can be managed to meet the needs of the maintenance program. Items such as the following should be part of long-range planning:

- Recurring major maintenance items such as major component overhaul, inspections, and rebuilds;
- Timing of planned maintenance and reactor refueling outages or equipment outages;
- Major projects and modifications requiring maintenance organization involvement;

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- Future organizational structure and staffing changes aimed at continuing improvements in the maintenance program and the plant as a whole;
- Planning for equipment replacement as components reach the end of their service life;
- Timing of outages for other plants in the system when reliance on them for resources is part of the maintenance plan;
- Value-impact assessment of maintenance methods, processes, and approaches/alternatives to performing work should be done periodically;
- Government and industry issues and events that will change or impact the maintenance program;
- Budget changes or projects that may divert major dollars from maintenance activities; and
- Contractor and corporate long-range support."

10.4.3

Maintenance Scheduling Requirements

Scheduling of corrective and preventive maintenance and of planned and forced outage work is necessary to ensure that maintenance is conducted efficiently and within prescribed time limits. Scheduling daily activities based on accurate planning estimates will improve the use of time on the job and help reduce radiological exposure. Proper implementation of this subelement includes:

- a. Process that provides for identifying and recording the status of all valid work requests;
- b. Process to monitor the maintenance backlog to ensure work important to safety is not being unduly delayed and control is maintained over the amount of work in the backlog;
- c. Assignment of a priority to each work activity and schedule the work according to its priority;
- d. Establishment of the requirement to group all scheduled maintenance activities (corrective and preventive) by the required facility condition and approximate duration;
- e. Process to schedule and maintain a listing of corrective maintenance, modifications, surveillances, preventive maintenance, special items, or commitments that must be performed under a system or facility outage condition or production reduction; and
- f. Process to ensure scheduling includes the availability and prestaging of required procedures, materials, and/or special tools and equipment.

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 7.3.1.b, Paragraph 2, all Bullets

"Following completion of the work, the review should address the following items:

- Review of completed work packages for proper documentation, adequate post-maintenance testing, and possible changes to the preventive maintenance program (see Section 5); and
- Equipment history update (see Section 16)."

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FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 7.3.2.a, Paragraph 6

"Delays beyond the approved grace period of the scheduled interval in performing preventive maintenance actions should be approved by the maintenance manager. The maintenance manager should report this exception status periodically (e.g., quarterly) to the facility manager indicating the reasons and intended actions."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 7.3.2.a, Paragraph 7

"Maintenance backlog should be monitored to help ensure that important jobs are not being necessarily delayed and control is maintained over the amount of work in the backlog."

10.4.4

Coordination of Maintenance Activities

Coordination of maintenance activities, within the maintenance department as well as with other facility organizations, is essential to ensure needed support (equipment availability, radiation work permits, quality control, engineering) is available and radiation exposure (ALARA) and equipment downtime is minimized. This subelement identifies the requirements necessary to ensure integration among facility organizations in the accomplishment of maintenance activities. Proper implementation of this subelement includes:

- a. Process for notifying facility personnel of scheduled maintenance activities that affect them to ensure proper activity coordination;
- b. Requirements to ensure that the lead coordination role is assumed by the group having responsibility for the most significant portion of the job;
- c. Process for ensuring planning and scheduling coordination meetings are conducted for large or complex maintenance jobs to identify potential problems or delays, establish milestones, and assign responsibilities. Representatives from affected organizations attend these scheduling and planning meetings.

(SUBJECT MATTER EXPERT COMMENTS)

"CONDUCT OF" documents and/or procedures should be developed to define the interfaces and relationships between the various groups and departments.

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 7.3.2.a, Paragraph 4

"A method should be established for advising all facility groups of the short-range and long-range preventive maintenance schedules. It may be done independently of or within the work control scheduling system. Regardless of the method used, it is essential that all affected groups have adequate advance notification of each preventive maintenance action to be accomplished. "

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FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 7.3.2.a, Paragraph 5

"Delays beyond the schedule dates for preventive maintenance actions should be approved by the work discipline supervisor. If the action has the potential to exceed the grace period (normally, 25 percent), the maintenance manager should be informed and be directly involved in the decision process."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 7.3.2.a, Paragraph 6

"Delays beyond the approved grace period of the scheduled interval in performing preventive maintenance actions should be approved by the maintenance manager. The maintenance manager should report this exception status periodically (e.g., quarterly) to the facility manager indicating the reasons and intended actions."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 7.3.2.a, Paragraph 7

"Maintenance backlog should be monitored to help ensure that important jobs are not being necessarily delayed and control is maintained over the amount of work in the backlog."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 7.3.3, Paragraph 1

"The planning group (or maintenance supervisors) should maintain the status of all open work requests and preventive maintenance items that are overdue or coming due, and recommend work assignments from this list based on job priority. Meetings involving routine job scheduling need to be held frequently to properly communicate priorities, current problems, job interferences, and requests for support among facility organizations. These meetings should be chaired by a designated individual closely involved in the planning process. Supervisors or responsible spokespersons from all maintenance disciplines, safety, operations, quality control, radiological protection, technical support, and the warehouse should attend these meetings. Other personnel should be invited as needed."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 7.3.3, Paragraph 2

"Facility personnel should be apprised of scheduled maintenance activities that affect them to ensure proper activity coordination. This may be done by publishing and updating a short-duration, rolling schedule covering approximately 3 days. A schedule of this nature would identify scheduled activities for the next 1 to 2 days and planned activities for the remaining days. This schedule should be updated either daily or every other day following the routine planning meeting."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 7.3.3, Paragraph 3

"The responsible maintenance supervisor should be provided with work packages soon enough for adequate shop-level preparation before starting the job. Each supervisor should have

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sufficient fill-in work assigned to maintain crew productivity. When feasible, this fill-in work should be independent of facility condition requirements, easily coordinated, and easily initiated. If this is not the case, the fill-in work should be identified on the rolling schedule so that all cognizant groups are aware of the jobs that may be initiated by maintenance supervisors."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 7.3.3, Paragraph 5

"After jobs have been assigned and scheduled on the rolling schedule, the responsibility for support coordination should be assumed by the group having responsibility for the most significant portion of the job (lead group). The lead group should then be responsible for coordinating such activities as verifying that clearance tagouts are available as required, that quality control inspectors are available as required, and that parts are available at the job site."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 7.3.4.a, Paragraph 4

"A current list of proposed outage activities should be maintained. The list should include all demands for resources such as non-nuclear facility contractor and subcontractor resources, and activities such as corrective maintenance, preventive maintenance, surveillance, in-service tests and inspection, and modifications. Outage planning meetings should be held periodically to refine and update this list."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 7.3.4.b, Paragraph 3

"A forced-outage work list should be prepared, and outage activities should be coordinated. Forced-outage planning meetings should be conducted periodically to update the list (typically, once every 2 weeks). Copies of the proposed forced outage list reflecting current planning for forced outages should be sent to all affected facility organizations after each planning meeting."

10.5

MATERIAL PROCUREMENT AND CONTROL

All phases of receiving, inspecting, handling, storing, retrieving, and issuing equipment, parts, and materials for maintenance should be effectively controlled from the time an item is received until it is installed in the facility. This element identifies the requirements for receipt, handling, and storage of material as it pertains to maintenance activities.

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 7.3.3, Paragraph 3

"The responsible maintenance supervisor should be provided with work packages soon enough for adequate shop-level preparation before starting the job. Each supervisor should have sufficient fill-in work assigned to maintain crew productivity. When feasible, this fill-in work should be independent of facility condition requirements, easily coordinated, and easily initiated. If this is not the case, the fill-in work should be identified on the rolling schedule so that all cognizant groups are aware of the jobs that may be initiated by maintenance supervisors."

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10.5.1

Establishment of Receipt Inspection Requirements

A process is required to ensure design basis, system integrity, and operations requirements are maintained by verification that correct parts, material, or equipment are received from stores and installed in the facility. This subelement identifies the requirements for assuring received items agree with specified descriptions, and appear to be in good condition while in the custody of maintenance through time of installation. The receipt inspection program should include:

- a. Process to inspect parts, materials, and equipment before they are accepted for storage or use. Items are to be verified against approved purchase documents;
- b. Process to accept material that has been repaired or reworked by the facility maintenance organization; and
- c. Parts files to be updated to reflect receipt of the material and any shelf-life or preventive maintenance requirements.

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 11.3.1

"Upon receipt, stores personnel should inspect parts, materials, and equipment before they are accepted for storage or used. This is done to verify that the items delivered agree with the approved purchase documentation, are packaged in accordance with purchase order specifications, have necessary product control requirements furnished by the vendor (such as special storage or shelf-life information), and appear to be in good condition. In the case of safety-related items and designated critical items that are important to reliable facility operations, physically inspect the items to ensure that the vendor has supplied what was ordered, that the necessary formal documentation has accompanied the shipment or is otherwise on hand, and that items have been received in an acceptable condition. Technical staff and maintenance personnel may be needed to assist in the inspection of more complicated parts, materials, and equipment.

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Technical staff and QC personnel should approve any deviation from design specifications of material or equipment received before it is accepted into the stores system. Technical staff and QC personnel should also approve any upgrade of material or equipment from nonsafety-related to a safety-related category. An acceptance tag or label placed on the received material may be used to signify that the receiving inspection was satisfactory and that the applicable requirements have been met.

A separate receiving and inspection area should be provided as well as a separate hold area. The latter area is used to hold material and equipment that has not been officially received into the stores system because of a nonconformance.

Nonconforming material must also be clearly tagged or labeled to prevent inadvertent issue. A tracking or follow-up method should be established to ensure nonconformance problems are promptly resolved.

A method should be developed to accept material that has been repaired or reworked by the facility maintenance organization. Whenever materials or parts are repaired or reworked, suitable testing and inspection requirements should be specified by design engineering to ensure the material or part will perform acceptably when placed in service. This method should also address material that has been issued and is sent back to stores for reissue. Warehouse documents should be updated to reflect receipt of the material and any shelf life or preventive maintenance requirements."

10.5.2

Special Handling Requirements

Provisions must be made for special handling of large, fragile, and/or critical components. This subelement identifies the requirements for controlling lifting and handling activities to ensure the protection and safety of personnel and components. The lifting and rigging program should include:

- a. Process to identify special handling information, as required, for all components such as attachment/balance points, weight, sensitivity, etc.;
- b. Process to ensure all lifting and rigging equipment is certified and the rated capacities are clearly identified; and
- c. Process to ensure personnel required to operate cranes, forklifts, and other lifting equipment to be properly trained and qualified.

This subelement identifies the requirements to ensure that material and equipment is stored in a manner that provides maximum protection and ready availability for its intended use. The material and equipment storage program should include:

- a. Requirements for material and equipment to be stored with due consideration for environmental conditions and safety;
- b. Methods to provide controlled access to storage areas;
- c. Requirements for field storage of consumables such as lubricants and solvents to ensure they are properly stored, identified, and used;

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- d. A shelf-life control program for stock items that are important to safe and reliable facility operation;
- e. Process to segregate safety-related and nonsafety-related material and equipment from each other to prevent inadvertent use of the wrong category of item;
- f. Process to ensure that items placed into or removed from stock be promptly documented so that the inventory accurately reflects current status; and
- g. Process to control parts, materials, and equipment after issue to ensure use in the correct application and to maintain the necessary traceability.

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 11.3.2

"Procedures should be prepared for items requiring special handling instructions. The procedure should include information such as the weight, size, chemical reactivity, radioactivity, and susceptibility to physical shock, damage, or electrostatic sensitivity. Sling location balance points, method of attachment to the load, and other pertinent factors' in handling loads should be clearly identified. Sound handling practices should be followed whether or not a specific procedure is used.

Hoisting equipment should be certified by the manufacturer, indicating maximum loads to be handled. The facility inspection program for hoisting equipment and rigging should be applied to items that are used in the stores operation. Personnel required to operate cranes, fork lifts, and other lifting equipment should be properly trained and qualified."

10.5.3

Storage of Material and Equipment

Parts, materials, and services needed for maintenance activities should be available when needed. Proper parts and materials in good condition are necessary to maintain technical requirements during normal facility operation periods and to support both forced and planned outages. Services are periodically needed to provide unique or supplementary maintenance support. This sub-element describes the programmatic controls necessary to ensure proper parts, materials, and services required for maintenance are procured and available for safe and efficient plant operation. Controls should be established for the initiation of procurement documents to ensure parts, materials, or services are correctly identified and code, specification, or quality assurance requirements are accurately imposed. Programmatic controls should be established to ensure that:

- a. Needed parts, material, and services are identified by performing reviews and analysis of corrective and preventive maintenance, modifications, stock inventory, limited shelf-life items, and equipment nearing design-life limits;
- b. An approved spare parts list is developed and maintained for each item on the master equipment list; and
- c. Only approved parts, material, and services are specified on requisitions and that deviations are approved by cognizant organizations (quality, engineering, operations, etc.) to maintain compliance with applicable codes, standards and technical bases.

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10.5.4

Procurement of Parts, Materials, and Services

Parts, materials, and services needed for maintenance activities should be available when needed. Proper parts and materials in good condition are necessary to maintain technical requirements during normal facility operation periods and to support both forced and planned outages. Services are periodically needed to provide unique or supplementary maintenance support. This sub-element describes the programmatic controls necessary to ensure proper parts, materials, and services required for maintenance are procured and available for safe and efficient plant operation. Controls should be established for the initiation of procurement documents to ensure parts, materials, or services are correctly identified and code, specification, or quality assurance requirements are accurately imposed. Programmatic controls should be established to ensure that:

- a. Needed parts, material, and services are identified by performing reviews and analysis of corrective and preventive maintenance, modifications, stock inventory, limited shelf-life items, and equipment nearing design-life limits;
- b. An approved spare parts list is developed and maintained for each item on the master equipment list; and
- c. Only approved parts, material, and services are specified on requisitions and that deviations are approved by cognizant organizations (quality, engineering, operations, etc.) to maintain compliance with applicable codes, standards and technical bases.

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 10.1, Paragraph 1

"Parts, materials, and services required for maintenance activities should be available when needed. Proper parts and materials in good condition are necessary to maintain design requirements for maintenance activities during normal facility operation periods and to support both forced and planned outages. Services are periodically needed to provide unique or supplementary maintenance support. An effective procurement process should be developed in conjunction with the Quality Assurance requirements of reference g to ensure that parts, materials, and services are available when needed."

10.5.5

Procurement Control

Control of procurement activities ensure that proper parts, materials, and services are available to support maintenance activities. This sub-element identifies the controls that should be in place to ensure acceptable parts, material, and services are procured in a timely manner and meet the requirements for safe and reliable facility operation. Programmatic controls should be established to ensure that:

- a. Where parts are no longer available from the original supplier, have new identification numbers, or have different material specifications, they are identified and replacements or upgrades are qualified;
- b. Design requirements, with supporting documentation, are reviewed by appropriate personnel to ensure that upgraded or substitute parts will perform their intended function;

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- c. Emergency procurement and expediting processes are available to obtain parts, materials, and services that are needed immediately to facilitate safe and reliable operation;
- d. Parts and materials reorder systems are established that assures material availability for anticipated usage while minimizing unnecessary inventory;
- e. Procurement progress is tracked and that measures are taken expedite the process to meet maintenance and outage schedules.
- f. Parts and material that is retrieved and issued is properly controlled in conformance with its eventual application and potential impact on safety.

[SUBJECT MATTER EXPERT COMMENTS] Policies should be developed defining the processes to "CANNIBALIZE" parts from used or new equipment when they are not available or the procurement lead times are to long.

[SUBJECT MATTER EXPERT COMMENTS]

List(s) of acceptable substitutions (parts, materials, etc.) should be developed, maintained and issued as a controlled document.

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 10.3.1, Paragraph 1[2]

"Procedures should be prepared to specifically describe the responsibilities of personnel involved in the procurement function. Specific procurement actions should be included in these procedures."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 10.3.3

"Controls should be developed and maintained throughout the procurement process to help obtain parts, materials, and services in a timely manner. Controls such as the following should be provided:

- o Reliability of supplier performance should be verified. This can be accomplished by audits, inspections, or surveillance of supplier facilities, processes, methods, or records relevant to the part, material, or service provided.
- o Deficient or nonconforming items should be resolved in an effective and timely manner. Technical reviews should be initiated promptly to aid in the resolution of these items.
- o Quality assurance records need to be controlled and maintained to provide documentation for qualified parts and materials and to ensure traceability of parts and materials.
- o A process should be provided to qualify nonqualified material. An effective upgrade process will result in improved availability of quality parts and materials.
- o A process for acceptable substitution should be provided to obtain parts that are no longer available from the original supplier, that have new identification numbers, or that have different material specifications. Engineering and maintenance experience

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should be provided to support this process. Change approval documentation and substitution information should be maintained in a retrievable form.

- o Design requirements should be reviewed by appropriate personnel to ensure that upgraded or substitute parts are consistent with the application of the part and component. Retrievable documentation should exist to support the identification of inspection and testing requirements necessary to ensure the qualification and acceptability of the part.
- o Emergency procurement and an expediting process should be developed to obtain parts, materials, and services that are needed immediately to support safe and reliable facility operation. Due dates should be clearly identified for parts, materials, and services that require emergency procurement.
- o A parts and materials reorder system should be established that assures material availability for anticipated usage while minimizing unnecessary inventory."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 11.3.4, Paragraph 1

"Parts, materials, or equipment removed from storage should receive the same care they received when handled for storage (see Section 11.2 above). A method should be established to control parts, materials, and equipment after issue to ensure use in the correct application and to maintain the necessary traceability."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 11.3.4, Paragraph 2

"All receipt documents and inspections should be satisfactorily completed before an item is issued. For items such as safety-related and environmentally qualified spare materials, and parts, proper documentation should be maintained to ensure traceability."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 11.3.4, Paragraph 3

"A catalog for parts, materials, and equipment should be developed allowing facility personnel to determine what is available for issue. This catalog should provide a cross-reference listing that provides such information as manufacturer part number, facility part number, noun name, and component or system for which a part is used. This catalog could assist in more efficient planning and execution of maintenance activities."

10.5.6

Control Procurement of Services

Controls should be established that identify the need for specialized services from vendors and staff augmentation for peak activity periods in time to provide for solicitation of bidders, receipt and evaluation of bids, and awarding contracts.

The Quality Assurance Functional Area should be referenced for additional controls relating to procurement.

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FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 10.3.4

"Identification of the need for specialized services from vendors should be made in time to provide for solicitation of bidders, bidding on, and awarding contracts. Provisions should be made when possible for general service agreements so that services can be supplied at short notice."

10.6

CONTROL AND CALIBRATION OF MEASURING AND TEST EQUIPMENT (M&TE)

Measuring and Test Equipment (M&T) is used to verify acceptability of an instrument or piece of equipment to predetermined requirements by inspection, tests, calibration, or measurement. Permanently installed process or control instrumentation and test equipment used for preliminary checks where data obtained will not be used to determine acceptability or verify conformance are not considered M&T. This element describes the requirements for M&T as they apply to maintenance activities.

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 12.2

"A comprehensive M&TE program should include the following elements:

- o All M&TE should have unique identification numbers that accurately identify the specific devices and provide positive traceability.
- o A master list identifying all M&TE should be developed and kept current. "

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 12.2, Items 3 through 6

"A comprehensive M&TE program should include the following elements:

- o The M&TE calibration program must be based upon standards that are traceable to a national standard or that are recognized standards unto themselves.
- o Procedures should be used to calibrate M&TE to help control the performance of calibration, provide repeatable calibrations, and provide acceptance criteria.
- o A calibration frequency that helps maintain M&TE accuracy and availability should be established.
- o M&TE should be functionally checked, when applicable. "

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 12.3.4.b

"Performance Training. Results of M&TE calibrations should be trended, and corrective actions should be determined for any M&TE reliability problems. This predictive technique can identify needed corrections or changes to the M&TE program, such as adding or deleting M&TE devices, adjusting calibration frequencies, correcting procedures, or upgrading M&TE quality."

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10.6.1

Control of Measuring and Test Equipment (M&TE)

Measures should be established to control and uniquely identify each piece of M&T. Identification shall include a master list describing the items as well as permanent markings, either on or attached to each piece, in order to identify, trace, and control M&T. Provide for traceability of M&T to support timely evaluation of instruments, systems, and other equipment associated with M&T found to be deficient. The M&T control program should include:

- a. Process for identification of the types of M&T equipment required to support maintenance activities; and
- b. Establishment of an M&T log system to ensure M&T equipment is controlled and accounted for.

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 12.1

"The program for control and calibration of measuring and test equipment (M&TE) should be consistent with the Quality Assurance requirements of reference g and ensure the accurate performance of facility instrumentation and equipment for testing, calibration, and repairs. M&TE includes all tools, gauges, instruments, devices, or systems used to inspect, test, calibrate, measure, or troubleshoot in order to control or acquire data for verifying the conformance of an instrument or piece of equipment to specified requirements. M&TE does not include permanently installed facility process or control instrumentation, nor does it include test equipment used for preliminary checks where data obtained will not be used to determine acceptability or verify conformance to established criteria.

The M&TE selected for use should have the precision necessary to ensure that facility instrumentation and equipment will operate within design accuracy requirements and be durable enough for their intended application. Control and calibration requirements for M&TE apply to both on-site and off-site calibration facilities and nonnuclear facility contractor or subcontractor groups that are engaged in maintenance activities. "

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 12.3.1

"Each piece of M&TE should be assigned a unique identification number that is permanently marked on or attached to the M&TE (the identification number may consist of the manufacturer's serial number). These numbers assist in identifying, tracing, and positively controlling M&TE. A master list of all controlled M&TE should be maintained. If separate organizations control their own M&TE, each organization should maintain or have access to a list of its own equipment. Lists should include the following, as a minimum:

- a. Generic description of equipment, trade or marketing name of equipment, manufacturer, model, and serial number;
- b. Unique identification number;
- c. Equipment range(s) and accuracy;
- d. Calibration procedure;
- e. Calibration frequency;

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f. Responsible organization or person. "

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 12.3.3.a

"Storage. As discussed in Section 4, proper facilities are needed to help ensure that equipment is protected from damage in storage, is properly maintained, and is readily retrievable. M&TE devices that are relatively easy to damage the transporting and handling should be provided more protection by boxing or special mounting rigs (e.g., test gauges mounted in portable frames). M&TE in the issue area should be segregated from defective, out-of-calibration, or other M&TE requiring investigation so that only a calibrated M&TE is available for issue. This should be a physically and distinctively marked separation."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 12.3.3.d

"One or more controlled issue points should be provided to help ensure that only qualified persons are allowed access to M&TE. Traceability of M&TE should be provided to support a timely evaluation of instruments, systems, and other equipment associated with M&TE found to be deficient. This can be accomplished by recording the M&TE user, when the equipment was used, what instrument or equipment it was used on and for what purpose (typically by referencing maintenance request or procedure number), and what ranges were used or values were read. Maintenance history that can be readily sorted by specific M&TE used to perform maintenance is an alternative method for providing traceability.

A recall system should be implemented to ensure that M&TE devices are removed from service prior to or at the expiration of their calibration. "

10.6.2

Use of Measuring and Test Equipment (M&TE)

The use of M&T is controlled to ensure use only by qualified personnel, correct application, and traceability. This subelement identifies the requirements to maintain facility instrumentation and equipment accuracy following maintenance by proper use, storage, and care of M&T. Implementation of this subelement should ensure that:

- a. M&T is controlled and issued for use by only qualified individuals;
- b. M&T devices are calibrated prior to use to verify they meet acceptance criteria, are functional, and are safe to use;
- c. M&T devices that have special uses, limitations, or restrictions to be clearly labeled to describe their applications or limitations.
- d. M&T has the desired response or acceptance criteria for operational tests, functional checks, or battery checks clearly indicated on the equipment; and
- e. M&T is protected from damage, properly maintained, readily retrievable, and segregated from expired or defective M&T.

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FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 12.3.3.b, Paragraph 2

"Uncalibrated test equipment used only for troubleshooting should be clearly marked so that it is not used as M&TE for taking data. Test equipment that is used only for troubleshooting does not need to be fully calibrated, but it should be periodically checked for operability and safety. For example, a volt-ohm meter might be checked for operability every 6 months."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 12.3.3.c

"M&TE devices that have special uses, limitations, or restrictions should be clearly labeled to describe their applications or limitations. The following are examples of information that should be reflected on M&TE tags or labels:

- o Scales or ranges that are inaccurate or inoperable, including some indication of the amount of inaccuracy;
- o Calibrations that do not include the full indicating range;
- o Internal radioactive contamination; and Limited or restricted use such as an oil, oxygen, salt water, or demineralized water systems."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 12.3.3.c, Paragraph 1, Sentence 1

"M&TE with Limited Use. M&TE devices that have special uses, limitations, or restrictions should be clearly labeled to described their applications or limitations."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 12.3.3.e

"Contaminated M&TE. Equipment subject to radioactive contamination should be packaged and used in a manner that minimizes the possibility of external and internal contamination (e.g., wrapping in clear plastic, taping, isolating). This should be emphasized as part of the on-the-job training program addressed in Section 3. These practices can help minimize the spread of contamination and minimize the amount of M&TE kept only for use on contaminated systems and equipment. In addition, consideration should be given to establishing an area for storing and calibrating contaminated M&TE."

10.6.3

Control Calibration of Measuring and Test Equipment (M&TE)

The calibration program should ensure M&T accuracy and availability is maintained and calibration frequency is determined based on the manufacturer's recommendations, M&T usage, and historical reliability. This subelement identifies the requirements for M&T calibration as they pertain to maintenance activities. Proper implementation of this subelement includes:

- a. Process to ensure traceability of M&T to support a timely evaluation of instruments, systems and other equipment associated with M&T found to be deficient
- b. Recall system to ensure that M&T devices are removed from service prior to or at the expiration of their calibration;

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- c. Establishment of an area for storing and calibrating contaminated M&T;
- d. Process to ensure performance of an evaluation of the instruments and equipment a particular device has measured or tested since the M&T was last calibrated and to determine whether recalibration or rework is needed when an M&T device is found or suspected to be out of calibration, defective, or otherwise unreliable; and
- e. Requirements for trending of M&T calibration results and determining corrective actions for any M&T reliability problems.

The Quality Assurance RID should be reviewed for determination of additional controls relating to M&T.

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 12.2, Bullets 7-14

"A comprehensive M&TE program should include the following elements:

- o Facilities should be provided to control storage, issue, and calibration of M&TE.
- o M&TE with suspected or actual deficiencies should be segregated and marked to prohibit its use;
- o M&TE devices that are not fully calibrated or usable should be clearly marked to indicate their limitations.
- o M&TE issues should include records for accountability and traceability of use. A recall system should be developed for recalibrations.
- o A maintenance policy that minimizes contamination of M&TE should be developed.
- o M&TE devices found out of calibration or defective should receive timely evaluations to determine the validity of all measurements and/or calibrations for which they were used;
- o M&TE reliability problems should be trended to determine any corrective actions needed.
- o Reviews to determine that the control of M&TE is effective should be periodically conducted."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 12.3.2.a

"Only calibration standards that are traceable to the National Institute of Standards and Technology or other nationally recognized standards should be used for calibration of M&TE. If repair or calibration of a standard is necessary, the recalibration must be traceable to the National Institute of Standards and Technology or to the standard of record for the M&TE. Calibration standards maintained at the facility should be kept in the calibration facilities in designated storage locations. If calibration standards are issued for field use, the supervisor responsible for the standard should authorize and minimize the period of issue. The issue of laboratory standards for field use should be discouraged. Standards should be calibrated on a

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frequency consistent with vendor recommendations and facility experience. Calibration records for standards should be consistent with those of all other M&TE."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 12.3.2.b

"Calibration of equipment should be performed by qualified technicians using approved procedures. (NOTE: The "ratio of accuracy" of the standard to the M&TE being calibrated should be as high as reasonably achievable and consistent with national standards.) These procedures should be written as described in Section 6 and should contain the following:

- o Precautions or limitations;
- o Accuracy of calibration standards to be used;
- o Calibration standards to be used;
- o Calibration instructions and data sheets for as-found and as-left data;
- o Acceptance criteria for each scale, expressed as a range and in the units that are being measured (e.g., represent 9.75 volts as 9.726-9.774 volts rather than as 9.75 volts +/- 0.25 percent);"

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 12.3.2.c

"Calibration frequency should be determined based on the manufacturer's recommendations, M&T usage, and M&TE historical reliability. Consideration should be given to the amount and type of M&TE available for use compared to the M&TE needed to support peak activity periods such as outages. This information can help determine calibration frequency and schedule requirements that result in adequate M&TE support for facility needs."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 12.3.2.d

"When operational tests, functional checks, or battery checks of M&TE are performed, the desired response or acceptance criteria should be clearly specified or indicated on the equipment. These types of checks are intended to detect M&TE problems before and after an instrument is used in the field. These checks are not substitutes for calibration checks."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 12.3.4.a

"Out-of-Calibration and Defective M&TE. When an M&TE device is found or suspected to be out of calibration, defective, or otherwise unreliable, an evaluation of the instruments and equipment a particular device has measured or tested since the M&TE was last calibrated should be performed promptly to determine whether recalibration or rework is needed. Records of the field instruments calibrated by the M&TE should be reviewed to determine whether recalibration is necessary. M&TE devices in this status should be controlled as discussed above in Section 12.3.3."

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10.7

FACILITY CONDITION INSPECTION

Corporate management should ensure that maintenance activities at the facility are effective in maintaining equipment in a high state of readiness and in good material condition to support safe and reliable facility operation.

Safe and reliable facility operations are dependent upon maintaining equipment and working areas in optimum condition. A process should be established for the performance of facility inspections by maintenance personnel to ensure plant material condition, industrial safety practices, housekeeping, and radiological protection practices conform to criteria established by management to provide for safe and reliable plant operations.

Characteristics of a well maintained facility ,as indicated by its material condition are:

- a. Fluid systems leaks are minimized.
- b. Equipment is appropriately protected from adverse environmental conditions.
- c. Instruments, control, and associated indicators are calibrated, as required.
- d. Good lubrication practices are evident.
- e. Fasteners and supports are properly installed.
- f. Equipment, structures and systems are properly preserved and insulated.
- g. Material deficiencies are identified and are in the work control system.
- h. Management involvement in a formalized facility inspection program.

This element identifies the requirements necessary for detection and correction of unsafe and faulty conditions through the conduct of routine inspections.

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 14.3.1, Paragraph 2

"Standards must be communicated effectively to all personnel so that they are clearly understood. Adherence to these standards should be assessed by facility managers and supervisors through the conduct of routine inspections."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 14.3.2

"Personnel involved in inspection activities should be knowledgeable of the standards expected by the facility manager and the techniques required to perform facility condition inspections. In addition, all personnel should be aware of the importance of good facility condition and housekeeping. An effective method of imparting expected standards is for the facility manager to conduct some inspections with selected individuals."

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FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 14.3.3

"Administrative procedures that describe the inspection program should define expected standards, provide for documentation of deficiencies, provide for a means to follow up on deficiency corrective actions, assign responsibilities for program implementation, and establish a means to measure program effectiveness. Facility inspection implementing procedures could be incorporated into the preventive maintenance or surveillance program in a manner similar to other visual inspections such as housekeeping inspections."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 14.3.3[02]

"Deficiencies identified during the inspection should be documented by the inspector (e.g., by initiation of a work request, by use of an area inspection report). Checklists of equipment to be inspected and types of problems to look for could be useful as guides for inspectors."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 14.3.4

"The inspection should include detailed walk-downs of assigned areas. Remote and limited access areas should be included. The ALARA concept should be considered when assigning inspectors and inspection frequencies to radiation and high radiation areas."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 14.3.4[02]

"Key individuals should accompany the managers and supervisors during their inspections. Discussions during the inspection should improve inspection techniques and convey the expected standards for facility condition and housekeeping."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 14.3.4[03]

"Inspections should include, but not be limited to identifying such deficiencies as those discussed above in Section 14.3.1. The facility manager may designate specific types of deficiencies that should be given special attention during the inspection, based on his desire to emphasize and upgrade particular aspects of facility condition and housekeeping."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 14.3.5

"Routine inspections should include the following elements:

- Limit the size of inspection areas so that they are small enough to be thoroughly inspected in the time allotted;
- Schedule each facility are for periodic inspection; and
- Periodically rotate inspectors through the various inspection areas. (This practice helps to avoid familiarity with an inspection area, which can hinder deficiency identification.) "

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 14.3.6

"The inspector should report the results of each inspection to the inspection coordinator. Significant facility condition and safety deficiencies observed should be immediately reported to the shift supervisor for appropriate near-term attention."

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FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 14.3.6[02]

"If a facility deficiency tagging system is in use, the individual identifying the deficiency should attach a deficiency identification tag to the equipment or hang it in the area for non-equipment deficiencies. These tags should be removed after the deficiency has been corrected or the equipment has been functionally accepted by operations."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 14.3.6[03]

"In addition to routine inspections, all personnel should be responsible for the prompt identification, correction (if feasible), or documentation of facility condition and housekeeping deficiencies during normal course of their duties."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 14.3.7

"A list of all deficiencies not included in the work control system or some other corrective action system with responsibility for correction or disposition of each deficiency should be prepared. Personnel assigned corrective action should periodically report results of the actions planned or conducted to the inspection coordinator, and deficiencies should be tracked to completion."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 14.3.7[02]

"Reported deficiencies should be monitored to identify recurring, generic, and long-term problems. Action taken to resolve these problems should include a failure or root-cause analysis and not merely a correction of symptoms. For example, frequent low oil levels in operating pumps may be due to leakage or to an improper lubrication schedule. Adjustment to the lubrication schedule or additional training of personnel may be needed to maintain correct oil levels. Section 17 addresses the analysis of maintenance problems."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 14.3.7[03]

"Follow-up of selected corrective action from previous inspections is necessary for evaluating the timeliness and effectiveness of the corrective action and obtaining the maximum benefit from the inspection program. Several methods may be used to accomplish this follow-up. For example, the inspection coordinator may select some previously identified deficiencies to verify that these deficiencies were corrected or are being corrected in a timely manner. This could be accomplished during each facility condition and housekeeping inspection."

10.8

ANALYSIS OF MAINTENANCE PROBLEMS

An analysis program should include the methodical collection of facts describing the unplanned occurrence. These facts should then be reviewed from the standpoint of management controls and engineering and human performance perspectives to develop probable causes for the unplanned occurrence.

This element describes the actions necessary for assuring that Maintenance problems are analyzed and corrective action initiated. In particular, it includes maintenance occurrence reporting and investigation. Unusual occurrences involving maintenance should be properly investigated, analyzed, and corrected.

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FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 17.2

"An analysis program should include the methodical collection of facts describing the unplanned occurrence. These facts should then be reviewed from the standpoint of management controls and engineering and human performance perspectives to develop probable causes for the unplanned occurrence."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 17.3.1

"When all initial information related to the unplanned occurrence is collected, additional information pertinent to the investigation should be identified and obtained. This may include diagnostic information operating procedures, vendor-recommended maintenance requirements, maintenance schedules, recommended maintenance that was not accomplished, information related to personnel training and qualifications, adequacy of communications, maintenance procedures, and relevant information obtained from documentation of maintenance history."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 17.3.5

"In the case of an equipment problem, post-maintenance testing should be used to determine whether additional maintenance work or diagnostic factfinding should be performed. Upon completion of the additional factfinding or repairs, an additional retest should be performed and the test results analyzed to determine whether the cause or causes of the malfunction have been corrected. Retest alone, however, does not always ensure that all causes have been detected and corrected. Closely monitoring the equipment during an extended period of operation to provide sufficient assurance that the cause or causes have been properly addressed may also be necessary. Similar long-term follow-up is appropriate to determine whether the desired results are obtained from such corrective actions as retraining, procedural changes, and preventive maintenance changes."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 17.3.6

"The analysis program should address any generic corrective actions needed to be taken after, problems with one piece of equipment have been determined and corrected. This could include such items as review of similar equipment, preventive maintenance and surveillance programs, improvement of training and qualification programs for various facility and or company personnel, and changes to maintenance and operating procedures."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 3.3.6

"In addition to training in technical maintenance functions as described in the preceding, a select group or team should be schooled in principles and methods of root-cause analysis. This group should include individuals with demonstrated expertise in human performance, systems, failure analysis, facility operations, and relevant technical disciplines (e.g., stress analysis and corrosion). Group leadership should be placed with individual(s) who are experienced in root-cause analysis and who can function impartially with no particular allegiance to any facility organization. Group members should be trained in various approaches to cause-and-effect analysis and should be given the background necessary to select and implement an approach that is suitable for a particular situation."

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FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 5.3.3, Paragraph 1, Sentence 1

"Using the master equipment list, preventive actions and their frequencies are analyzed to identify periodic actions that should be taken to improve equipment performance."

10.8.1

Cause of Occurrence

Information should be available to further determine the cause(s) of unusual occurrences related to maintenance activities. A process should be established for timely collection and retrieval of information pertinent to the investigation including, as applicable, diagnostic information (such as vibration measurements, infrared heat distribution profiles, lube oil sample analysis, and previous operating and maintenance history), operating procedures, vendor-recommended maintenance requirements, maintenance schedules, recommended maintenance that was not accomplished, information related to personnel training and qualifications, adequacy of communications, maintenance procedures, and relevant information obtained from documentation of maintenance history.

This subelement identifies the requirements for identification and retrieval of data necessary for occurrence causal analysis and/or determination.

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 17.2

"An analysis program should include the methodical collection of facts describing the unplanned occurrence. These facts should then be reviewed from the standpoint of management controls and engineering and human performance perspectives to develop probable causes for the unplanned occurrence."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 17.3.1

"When all initial information related to the unplanned occurrence is collected, additional information pertinent to the investigation should be identified and obtained. This may include diagnostic information operating procedures, vendor-recommended maintenance requirements, maintenance schedules, recommended maintenance that was not accomplished, information related to personnel training and qualifications, adequacy of communications, maintenance procedures, and relevant information obtained from documentation of maintenance history."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 17.3.2

"The purpose of the analysis phase is to reconstruct the event. A detailed sequence of facts and activities is developed and the apparent event causal factors are identified and categorized into human performance or equipment performance problems."

10.8.2

Corrective Action Requirements

A process should exist to ensure corrective actions resulting from the unusual occurrence investigation which involve maintenance are promptly developed, executed, and tracked to completion. This subelement identifies the requirements for implementing this corrective action process.

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The Occurrence Reporting System requirements identified within the Management Systems functional area RID should be reviewed for further programmatic requirements relating to identification and reporting unusual occurrences.

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 17.3.3

"The above actual or probable causes of a problem should be evaluated by one or more techniques or methodologies to establish a final root cause. An acceptable root cause should meet three criteria: (1) its correction should prevent recurrence of the unplanned occurrence; (2) its correction should be feasible; and (3) its correction should not adversely impact safety, reliability, or operational goals."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 17.3.4

"When all of the causes involved have been determined, a corrective action plan should be developed, executed, and tracked to completion. The plan may be as simple as initiating a maintenance request for repair, changing a preventive maintenance frequency, counseling personnel, or modifying the training program slightly. It may also be extensive, such as developing and installing a major modification, procuring long lead time parts and materials, contracting for specialized services, revising procedures, and training personnel for continued operation and maintenance of the installation."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 17.3.5

"In the case of an equipment problem, post-maintenance testing should be used to determine whether additional maintenance work or diagnostic factfinding should be performed. Upon completion of the additional factfinding or repairs, an additional retest should be performed and the test results analyzed to determine whether the cause or causes of the malfunction have been corrected. Retest alone, however, does not always ensure that all causes have been detected and corrected. Closely monitoring the equipment during an extended period of operation to provide sufficient assurance that the cause or causes have been properly addressed may also be necessary. Similar long-term follow-up is appropriate to determine whether the desired results are obtained from such corrective actions as retraining, procedural changes, and preventive maintenance changes."

10.9

MODIFICATION WORK

Modifications are activities, either temporary or permanent, that alter a facility structure, system, or component. Controls should be established to ensure that changes to structures, systems, and components resulting from modifications are incorporated into the maintenance program prior to the performance of maintenance activities on the affected items.

Programmatic controls should be established to ensure that:

- a. Facility maintenance personnel are cognizant of the effects of the modification prior to maintaining modified structures, system and components
- b. Temporary modifications are reviewed for any safety implications prior to implementation and time frames established for the removal of the temporary modification.
- c. Temporary modifications are tracked for any adverse effects on personnel or equipment.

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- d. Required changes; resulting from modifications, to documents such as drawings, procedures, spare parts lists, history files, and vendor information are incorporated in a timely manner.
- e. Maintenance personnel have received training on the modification;and
- f. The effects of the modification have been reviewed to identify future maintenance activities and that these activities are added to the Preventive and Predictive maintenance programs, as applicable.

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 18.3.1

"A modification is a planned and controlled change to a permanent facility structure, system, or component that is accomplished in accordance with the requirements and limitations of applicable procedures, codes, standards, specifications, licenses, and predetermined safety restrictions identical to or commensurate with those of the item being modified.

Facility maintenance personnel should be cognizant of the effects of modifications prior to maintaining modified structures, systems and equipment. The required changes to such documents as drawings, procedures, spare parts lists, and vendor information should be accomplished prior to operation of the system or equipment and any subsequent maintenance activities.

The maintenance program should require that all plant modifications be reviewed to identify future required maintenance activities and should specify that these activities be added to the preventive and predictive maintenance programs, as applicable."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 18.3.2

"Temporary repairs are temporary modifications to the facility that allow equipment to remain in or be returned to service in a condition that is not the same as the original design specification. Prior to implementation, temporary repairs should receive a safety review in accordance with the facility temporary modification program to ensure the adequacy of the repair and its effect on personnel and equipment safety and reliability. Temporary repairs should be tracked after their completion for consideration of permanent repairs. Permanent corrective action should be taken as soon as practicable."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 18.3.2[02]

"Temporary repairs should be tracked after their completion for consideration of permanent repairs. Permanent corrective action should be taken as soon as practicable."

10.10

POST-MAINTENANCE TESTING

The parameters for post-maintenance testing should be clearly defined to ensure that equipment, after having maintenance performed, will operate safely and within specified design limits. This subelement specifies the controls necessary to ensure that the requirements for post-maintenance testing are clearly and accurately specified and incorporated into the work control system. Programmatic controls should be in place to ensure:

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- a. Work packages provide specific instructions for conducting post-maintenance testing, or cross-reference a test procedure, and provide traceability to post-maintenance test results;
- b. Plant equipment subject to post-maintenance testing is defined;
- c. Proposed maintenance work activities are reviewed for post-maintenance test requirements;
- d. Tests of any equipment affected by code or technical specification requirements are reviewed by cognizant personnel, including operations and engineering representatives;
- e. Processes are in place to obtain technical support on tasks that are complex and require engineering assistance, even though no code and technical specification requirements apply; and
- f. Specified post-maintenance testing requirements will provide adequate confirmation that the equipment will be capable of performing within safety and technical limitations.

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 9.3.1, Paragraph 1

"A program should be established to control and document post-maintenance testing. This program may be a part of the facility work control system and may use the facility work request or work package to specify testing, assign responsibility, and document acceptance of all post-maintenance tests. The work request should provide specific instructions or cross-reference a test procedure and should provide traceability to post-maintenance test data. This may be accomplished by recording the data directly on the work request or by referencing data recorded on post-maintenance test data sheets or documents."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 9.3.2, Paragraph 1

"Since corrective maintenance is performed to correct a deficient condition, most corrective maintenance should have a retest associated with it to verify that the equipment functions properly. Some preventive maintenance activities also require post-maintenance testing. The rigor of the testing performed should be based on the work done and the importance of the component to safe and reliable facility operation. Post-maintenance testing should be accomplished on both safety-related and nonsafety-related equipment, systems, or activities such as the following:

- o Maintenance that affects the integrity or operation of a liquid or gas system;
- o Maintenance that affects mechanical strength of components or fittings;
- o Equipment that is included in special programs such as the in-service inspection and environmental qualification programs;
- o Maintenance that affects or removes design-approved radiation shielding;
- o Electrical distribution equipment such as breakers, bus work, or high-voltage connections;

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- o Electrical control circuitry such as protection relays, limit switches, or permissive relays;
- o Electronic components such as controllers, circuit cards, and transmitters;
- o Instrumentation and instrument loops;
- o Health physics and chemistry instrumentation;
- o Measuring and test equipment; and
- o Temporary systems that have been installed as substitutes for normally operational systems or portion of systems."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 9.3.3

"A program should be established to control post-maintenance testing. When more than one group is involved in the post-maintenance test or where the test must be delayed until conditions permit, one organization, such as the operations organization, should be responsible for coordinating test performance. The designated organization should review the total work scope to minimize redundant testing. The department performing or having the lead for performing the post-maintenance test should assign an individual with overall responsibility for conducting the test and an individual for reviewing test data and determining the acceptability of equipment.

If facility conditions dictate that the post-maintenance testing cannot be completed immediately after maintenance is performed, the work request should be held open or some other tracking method should be used by the department having lead responsibility for testing until the equipment can be tested. Danger or caution tags may be required for the equipment until proper post-maintenance testing can be completed. Safety-related equipment should not be declared operable until post-maintenance testing has been satisfactorily completed. Operators should know the status of equipment on hold for post-maintenance testing and minimize the amount of equipment in this condition. This status should be reviewed prior to any scheduled mode change. Equipment that can be tested during the upcoming mode change should be identified and the post-maintenance tests accomplished in that process or as soon as feasible after reaching the new condition."

10.10.1

Post-Maintenance Testing Requirements

This subelement describes the programmatic controls for the conduct of post-maintenance testing to ensure equipment operability within specified limits, confirm correction of the original deficiency and demonstrate the capability of performing its intended function prior to returning the equipment to service.

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 9.3.1, Paragraph 2

"When work requests are received for planning, a review should be conducted to determine post-maintenance test requirements and whether the proposed repair is to equipment covered by applicable codes or technical specifications. Tests of any equipment affected by code or technical specification requirements should be reviewed by cognizant personnel. These

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reviews should ensure incorporation of testing required by the applicable code and technical specifications and any additional testing, data recording, or special documentation requirements. Technical support organization assistance is also normally required on tasks that are complex and require engineering assistance, even though no code and technical specification requirements apply. The work request should be reviewed by the operations organization to verify that the post-maintenance testing requirements listed will provide adequate verification that the equipment will be capable of performing its designed functions."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 9.3.2, Paragraph 4

"For "troubleshooting" work requests, it may not be feasible to determine fully the post-maintenance test requirements until the troubleshooting is complete. The responsible individual should add instructions to the troubleshooting work request stating that post-maintenance test instructions will be specified after completion of the work. Upon completion of the work, the appropriate post-maintenance test should be specified, verified by the appropriate individuals, and performed."

10.10.2

Conduct of Post-Maintenance Testing

Post-maintenance testing should be based on the extent of preventive and/or corrective maintenance performed. Post-maintenance testing should be performed following corrective maintenance activities. In addition, testing should be done following preventive maintenance and troubleshooting activities that might have impaired proper functioning of the component. Programmatic controls should be in place to ensure that:

- a. Post-maintenance tests are conducted under conditions that represent normal operating parameters, such as flow, differential pressure, temperature, input signal values, and fluid type unless, due to special requirements, it is stipulated that tests be conducted under conditions that represent abnormal or emergency operating conditions;
- b. Post-maintenance testing is performed on both safety-related and nonsafety-related systems, equipment, or components;
- c. Tests do not expand beyond their original scope without prior review and approval;
- d. Proper system configuration is maintained prior to, during, and after testing;
- e. Responsible personnel are available to monitor post-maintenance test activities to ensure that the test is conducted in strict compliance with the approved test requirements;
- f. Processes are established for performing analysis of failed tests to identify and correct the deficiency and also determine the root cause to minimize further rework;
- g. The status of tests which cannot be performed immediately after maintenance are tracked and maintained; and
- h. Technical specifications and operational safety requirements are consulted for safety-related equipment and appropriate actions taken until the equipment is properly tested and returned to service.

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The parameters for post-maintenance testing should be clearly defined to ensure that equipment, after having maintenance performed, will operate safely and within specified design limits. This subelement specifies the controls necessary to ensure that the requirements for post-maintenance testing are clearly and accurately specified and incorporated into the work control system. Programmatic controls should be in place to ensure:

- a. Work packages provide specific instructions for conducting post-maintenance testing, or cross-reference a test procedure, and provide traceability to post-maintenance test results;
- b. Plant equipment subject to post-maintenance testing is defined;
- c. Proposed maintenance work activities are reviewed for post-maintenance test requirements;
- d. Tests of any equipment affected by code or technical specification requirements are reviewed by cognizant personnel, including operations and engineering representatives;
- e. Processes are in place to obtain technical support on tasks that are complex and require engineering assistance, even though no code and technical specification requirements apply; and
- f. Specified post-maintenance testing requirements will provide adequate confirmation that the equipment will be capable of performing within safety and technical limitations.

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 8.3.4, Paragraph 1, Sentence 1

"The operations shift supervisor should compare the work accomplished to the post-maintenance testing or inspection performed to determine that all work is acceptable prior to returning the equipment or system to normal service."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 9.3.2, Paragraph 2

"Equipment that is important to safe and reliable facility operation should be tested in accordance with approved procedures. Post-maintenance test procedures should contain acceptance criteria that aid in measuring the performance of repaired equipment. Baseline data should be provided, if applicable."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 9.3.2, Paragraph 3

"Various classifications of equipment will require different levels of procedure support for post-maintenance testing. Where applicable, existing surveillance test procedures can be used to verify the operational acceptability of the equipment. If the entire procedure is not to be performed, the applicable sections, including necessary prerequisites and precautions, should be identified. An engineering or system acceptance test procedure, alignment check procedure, generic test procedure, or special test procedure may also be used to provide test instructions. Post-maintenance test procedures used for a range of generic equipment, such as manual valves or flow controllers, should have data sheets for specific equipment when acceptance specifications or performance data are required."

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FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 9.3.4, Paragraph 1

"The operations organization should be assigned responsibility for the operational acceptability of all equipment and systems. Accordingly, operators should normally perform or be closely involved in post-maintenance testing. Maintenance, technical support, quality control, and other personnel may also be involved in or called upon to perform post-maintenance testing. For tests involving participation of more than one group, an individual in the lead group should be assigned to coordinate testing activities. Minor equipment post-maintenance testing may be performed by the operator returning the equipment to service, the craftsman performing the maintenance, the engineer following the maintenance, or a combination of these and other needed individuals. The organization responsible for specifying the post-maintenance test should review the work actually performed to ensure that the post-maintenance test is appropriate. Any questions should be resolved with the organization that determined the post-maintenance testing requirements. "

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 9.3.4, Paragraph 2

"Operational acceptance of the equipment, based on satisfactory post-maintenance test completion, should be verified by the operations organization by signature on the work request or another reference document. This verification should be made from objective evidence, such as conducting or witnessing the post-maintenance test and reviewing completed procedures and documented test results. Post-maintenance test data and its acceptability should be entered or cross-referenced to maintenance history with the work request. "

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 9.3.4, Paragraph 3

"Deficiencies identified during post-maintenance testing should be documented and corrected on the original work request and on a new work request or on another reporting system before the original work request is accepted as complete by operations. The original work request should reference any new work requests or other documents written to resolve these deficiencies. "

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 9.3.4, Paragraph 4

"If a post-maintenance test fails and the equipment or system cannot be repaired and tested satisfactorily in a short period of time (normally, prior to the next shift change), the degraded or inoperable status of the equipment should be documented such that operators understand the limitations of this equipment. Technical specifications should be consulted for safety-related equipment and appropriate actions should be taken until the equipment is properly tested and returned to service. "

10.11

SEASONAL FACILITY PRESERVATION REQUIREMENTS

A program should be in place to prevent equipment and building damage due to adverse weather conditions.

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Seasonal reminders to maintenance personnel in the form of procedures, night orders and training should include the following to:

- a. Maintain an awareness of extreme weather predictions
- b. Winterizing cooling and lubricating systems, and
- c. Increase the inspection frequency of equipment under maintenance's responsibility.

This element identifies the requirements to ensure that a facility freeze protection plan exists which includes details on inspections, preventive maintenance, and corrective maintenance to assure continued safe operations.

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 19.3.1

"A freeze protection plan should be prepared for each DOE nuclear facility. The plan will detail the actions and requirements to be imposed on the facility to assure the protection of the equipment/facility from cold weather or freezing. The plan will ensure that, in all cases, the actions and requirements to be imposed to provide cold weather/freeze protection, particularly prior to those taken to restrict or cutoff nuclear systems coolant, will be reviewed by facility operations and safety personnel to assure that the facility will be maintained in a safe condition to protect the health and safety of the public."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 19.3.1[02]

"As a minimum, this plan should ensure that:

- Heating systems in all nuclear facilities will be cleaned, serviced, and functionally tested.
- Antifreeze used in cooling systems will be checked and replaced as necessary.
- Heating system power and temperature controls will be protected against inadvertent deactivation by unauthorized personnel.
- Operations or maintenance staff have specific responsibility for monitoring the temperatures in facilities' on and off shifts, including weekends and holidays.
- All air intakes, windows, doors, and other access ways that could provide abnormal inflows of cold air be secured. Automatically controlled systems of this type will be functionally tested.
- Plans exist for altering personnel and providing increased surveillance in periods of extreme, unusual, or extended cold. Operations or maintenance personnel will be on call to respond to such events."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 19.3.1[03]

- Systems requiring or deserving special protection due to hazards or costs associated with freeze damage will have temperature alarms and/or automatic backup heat sources.
- Facility personnel will inspect, test, and stage portable auxiliary heaters and have identified sources to obtain more, if needed. Personnel will be trained in the safe use of portable heaters.
- The main water supply cutoffs for each nuclear facility will be identified, tested, and readily accessible to emergency personnel responding to a freeze/thaw incident.
- Outside storage pads and unheated storage areas will be inspected to ensure that there are no materials susceptible to freeze damage.

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- Employees will be aware of the need to identify and report any suspected problem with heating or other cold weather protection equipment.
- Cold weather gear will be available for emergency and operations personnel.
- Procedures will be developed for implementation and suspension of cold weather protection measures to ensure proper approval and review.
- Provisions are made to remove cold weather protection features after the cold weather season or freezing period is over with appropriate verification and documentation of removal through the facilities configuration management system.
- Wet-pipe sprinkler systems will be reviewed for areas susceptible to freezing, and appropriate actions planned, such as provisions for auxiliary heat; draining and posting a fire watch; etc.
- Contingency plans are prepared and available for temporarily curtailing operations in those nuclear facilities which are likely to sustain freeze damage when unusually severe weather is expected."

10.12

MAINTENANCE HISTORY

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 16.3.1.a

"Equipment Identification. The maintenance history program should clearly define the system and equipment that require documentation and retention of historical data. Systems and components that affect safe and reliable facility operation are obvious candidates for the program. In addition, equipment requiring repetitive maintenance should be considered for inclusion in this program. This compilation of system and equipment should provide an engineering data base or allow easy cross-reference to such information as the equipment unique identification number and name; system manufacturer, model, serial number, and other appropriate name plate data; lubrication data; applicable vendor manuals and drawings; spare parts reference numbers; and common equipment cross-references. The master equipment list (discussed in Section 5) could be effectively used to establish this compilation."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 16.3.1.b

"Data Identification. The maintenance history program should define the type of data that should be collected and recorded to effectively support the uses discussed below in Section 16.3.3. Some examples of data that should be included or cross-referenced in the program are corrective maintenance records, appropriate preventive maintenance records, modification packages, vendor repair information (e.g., correspondence on component repairs and modification bulletins), startup tests and other baseline data, appropriate surveillance test data, calibration data, and applicable industry experience information. The specific data to be collected should include details of the work performed, special equipment and tools used, procedures or drawings needed, spare parts installed, personnel safety and radiation protection requirements, post-maintenance testing, and any other information that may be useful at a later date."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 16.3.3

"Maintenance history data should be readily available for use by all organizations, especially the maintenance and technical support organizations. If maintenance history is computerized, users should be trained to access and manipulate the history data bases."

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10.13 KEY PROGRAM INTERFACES

10.13.1 Configuration Management

The Maintenance Program is a key process that has the potential for making configuration changes. The Configuration Management (CM) Functional Area provides change controls to ensure that changes to configuration are documented and appropriately reviewed. The CM Functional Area also provides controls to ensure that the latest information is available to the Maintenance Program for incorporation into its programmatic control systems.

Configuration Management ensures that safety-related drawings, flow control diagrams, electrical one-lines, I&C schematics, etc., of critical structures, systems and components are controlled and reflect the current approved configuration/operational status. Maintenance should ensure that any activities that change the design of the facility are treated as design changes and are implemented using applicable design control and configuration management guidelines. Maintenance work request should be periodically reviewed to ensure that they are not used to implement facility design and configuration changes.

10.13.2 Engineering Design

The interface between the Maintenance and Engineering Design Functional Areas should be defined and controls established so that maintenance activities do not make changes that effect the technical baseline without Engineering Design review and approval. The Engineering Design Functional Area is responsible for defining post-maintenance testing requirements for activities affecting the facility design. The Engineering Design Functional Area provides specifications for materials and services used in maintenance activities that may impact the technical baseline. The Maintenance Program must establish controls to ensure that changes to the facility design are reflected in the maintenance procedures.

Engineering provides the basis for maintenance of the facility through the issuance of equipment design/purchase specifications, drawings, change control documents and operational limits. Specific maintenance related guidance, recommended spare parts lists and preventive maintenance criteria are typically provided by equipment vendors. The design output and vendor supplied information and subsequently used to develop the facility's specific maintenance, inspection, surveillance and testing procedures.

Maintenance and Engineering have a critical interface on Post-Maintenance testing. Equipment testing requirements are normally issued as part of the original facility basis and subsequently modification work control packages. Feedback must be provided to Engineering on the adequacy of inadequacy of testing requirements. Maintenance must also have a continuous interface with Engineering and technical support functions in determining the cause of repetitive equipment failures and to investigate the root cause of unplanned events.

10.13.3 Operations

The Operations Functional Area should provide input to the Maintenance Program regarding operational requirements, preferences, capabilities, and restraints. The Maintenance Functional Area should establish controls to ensure that maintenance planning, scheduling and work activities are tightly integrated with planned operational activities to ensure that the maintenance activity can be performed as anticipated.

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All Maintenance activities on equipment that is important to safety, that affects operation or that changes control indications or alarms must be authorized by Operations. This authorization should be in writing on the document controlling the work. Maintenance is responsible for ensuring that documentation on the status of work in progress is available in the control area for review by Operations personnel.

Operations interface with Maintenance on Post-Maintenance and Post-Modification testing is also an important link to safe operation of the facility. Testing by maintenance personnel should include performance of all functions that may have been affected by the work. The testing should also verify the maintenance or modification performed served to correct the original problem and that no new problems were introduced. Any testing following maintenance should be specified on the maintenance work order other work authorizing document. The Operation's supervisor ensures that testing appropriately proves equipment operability.

10.13.4

Quality Assurance

The Quality Assurance Functional Area provides oversight and inspection to the conduct of maintenance. The Maintenance Functional Area incorporates into its processes the controls for ensuring inspections are completed and for the dispositioning of deficiencies and non-conformances.

The Maintenance Organization is responsible for establishing and implementing a process to detect and prevent quality problems and to ensure quality improvement. Data on equipment reliability and performance, maintenance work process, personnel training and qualifications should be reviewed and analyzed to identify items and processes needing improvement. The elements of this quality improvement process are used as input to the facility's QAP so that a method exists for providing continuous feedback on potential areas of improvement.

The Maintenance organization will also closely interface with Quality Assurance on procurement, inspection and testing to ensure that approved suppliers continue to provide acceptable parts and services, that processes are conducted using established acceptance and performance criteria and that equipment used for inspections and tests are properly calibrated and maintained. These interfaces should be defined in policy and facility level guidelines and procedures that control these activities.

10.13.5

Radiation Protection

The Radiation Protection Functional Area provides input into the Work Control portion of the Maintenance Functional Area regarding the requirements necessary to perform the maintenance task ALARA. The Maintenance Functional Area should establish controls to ensure that maintenance planning and the maintenance craft are integrated with the Radiation Protection activity to ensure that the maintenance task can be performed as planned and within the ALARA guidelines.

The primary personnel safety concerns affecting Maintenance activities are to ensure that radiation exposure levels are maintained in accordance with ALARA criteria. Maintenance interfaces with the Radiation Protection functional areas through the use of Radiation Work Permits and facility specific Radiation Protection training. Both of these areas incorporate ALARA criteria and guidelines but require feedback from Maintenance in order to be effective. Maintenance should interface with the Health Physics organization during facility condition inspections to assist in determining levels of radiation and determining areas and

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levels of surface and airborne contamination. Physics provides supporting services to Maintenance organization by measuring radiation exposures, incorporating ALARA criteria into work control documents and processes, and by specifying temporary shielding, protective clothing and respiratory protection required for maintenance activities in controlled areas.

10.13.6

Training and Qualification

The Maintenance manager is responsible and accountable for determining the training and qualification needs of each individual in the maintenance organization. The Maintenance manager and supervisors should closely interface with the Training organization to establish and maintain course content, determine and support training schedules, accomplish on-the-job training (OJT) and provide feedback to adjust course content and emphasis. The Maintenance manager is also responsible for developing and maintaining appropriate personnel job descriptions.

The Training organization maintains existing programs, develops new training programs and presents the training using in-house personnel or vendor supplied personnel when appropriate. The Training organization should maintain maintenance training programs that meet the intent of established industrial guidelines and address specific facility needs. These training programs should be supported and guided by the Maintenance organization via periodic reviews. The Training organization is also responsible for developing and implementing performance-based training.

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 3.3.1

"The responsibilities for establishing, maintaining, and implementing the maintenance training programs should be clearly defined and understood. The key element for success is close coordination between the managers and supervisors of the maintenance and training organizations."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 3.3.2

"Training should be defined and should include managerial, supervisory, planning, engineering, warehousing, craft positions, contractor personnel, and other positions, as deemed necessary. Courses should then be obtained or developed. Detailed guidance in accomplishing this is available in established industrial guidelines."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 3.3.3

"The maintenance manager and supervisors should work closely with the training organization to accomplish items such as the following:

- o Prepare schedules that reflect instructor, training facility, and trainee availability and include (as appropriate) self-study, classroom instruction, practical training, vendor or other noncontractor employee training, and OJT.
- o Review each trainee's previous education, experience, and skill level to determine which portions of the training program can be exempted for his position. One method to accomplish this is to require potential employees to pass a written test as part of the interview process. Based on the test results, the training program and milestones for that individual are established.

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- o Ensure qualified instructors are available to teach specific courses."

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 3.3.4, Bullet 1

"OJT Program Adherence - - OJT should be conducted in accordance with formally defined training programs that specifically identify items the trainee must accomplish. Knowledge requirements for each item, as well as what the trainee must do (perform, simulate, observe, or discuss), should be defined. Both the trainer and the trainee should understand what is required for each training item. "

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 3.3.4, Bullet 2, Sentence 1 and 3

"OJT Trainer Qualification - - OJT should be conducted by personnel who have successfully qualified as OJT trainers. These trainers should have good verbal communication skills and technical knowledge and should have the ability to effectively provide trainees with hands-on experience. "

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 3.3.4, Bullet 3, Paragraph 1, Sentence 1

"Trainee Supervision and Control - When trainees perform maintenance on installed equipment, a qualified OJT instructor should observe the work so that the trainee properly accomplishes the activity and understands how to avoid errors that could affect personnel safety or adversely impact the station. "

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 3.3.4, Bullet 3, Paragraph 2

"The trainer should review any information recorded by the trainee on official work and data sheets and stress to the trainee the importance of maintaining accurate training and facility records. In addition, the instructor should discuss out-of-specification values and their consequences and the required reporting of such issues with the trainee. "

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 3.3.4, Bullet 4, Sentence 1

"Number of Trainees - To determine the number of trainees allowed to simultaneously participate in any particular training evolution, the trainer should consider training effectiveness and the effect on the equipment being maintained. "

FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 3.3.4, Bullet 5, Sentence 1

"Trainee Conduct of Maintenance - The maintenance manager should establish a policy that allows trainees to independently perform maintenance only on equipment for which they are qualified. "

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FACILITY REQUIREMENT SOURCE: DOE4330.4A Chapter II, Section 3.3.4, Sentence 1 and 2

"On-the-job training is practical hands-on training in which employees achieve learning objectives through training conducted in the job environment. OJT is a formal part of the maintenance training program. "

10.13.7

Occupational, Health and Safety

The Maintenance organization interfaces with the Occupational Health and Safety (OSHA) functional areas by using and following industry accepted guidelines and practices covering a wide spectrum of personnel and equipment\ safety issues. These interfaces should be defined in the policy and facility level guidance and procedures that control the safety issues.

A shared responsibility exists between the Maintenance and Safety organizations to insure that work documents and activities are developed and conducted in accordance with OSHA criteria and guidelines. The areas that most affect the conduct of Maintenance are as follows:

1. Toxic and Hazardous Materials
2. Personal Protection Equipment
3. Materials Handling and Storage
4. Hand Held Equipment and Tools
5. Welding and Brazing
6. Hoisting and Rigging
7. Carcinogen Control
8. Medical and First Aid
9. Confined Space Entry
10. Powered Platforms and Lifts
11. Electrical Safety
12. Health and Safety Training

*NOTE: The Section 12 Interfaces discussed should be covered, as they relate to the overall Maintenance Program, within the Facility "CONDUCT OF MAINTENANCE" document.