GUIDANCE ON QUALITY ASSURANCE REQUIREMENTS DURING THE CONSTRUCTION PHASE OF NUCLEAR POWER PLANTS

May 10, 1974

UNITED STATES ATOMIC ENERGY COMMISSION

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GUIDANCE ON QUALITY ASSURANCE REQUIREMENTS
DURING THE CONSTRUCTION PHASE OF
NUCLEAR POWER PLANTS

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May 10, 1974

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1. ANSI N45.2.5 – Supplementary Quality Assurance Requirements for Installation, Inspection, and Testing of Structural Concrete and Structural Steel During the Construction Phase of Nuclear Power Plants

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GUIDANCE ON QUALITY ASSURANCE REQUIREMENTS
DURING THE CONSTRUCTION PHASE OF NUCLEAR POWER PLANTS

A. Introduction

The purpose of this document is to provide guidance concerning the establishment and execution of a quality assurance program for the construction phase of nuclear power plants. As used in this booklet, construction phase activities include those activities associated with fabrication and manufacturing in addition to site-related construction activities.¹

This document is not intended to cover preoperational and startup test activities, since they are covered in the October 1973 AEC document entitled "Guidance on Quality Assurance Requirements During the Operations Phase of Nuclear Power Plants."

B. Discussion


¹The terms construction and construction phase are used differently in other documents. For example, Section III of the Boiler and Pressure Vessel Code states "Construction, as used in this Section of the Code, is an all-inclusive term comprising materials, design, fabrication, examination, testing, inspection and certification required in the manufacture and installation of components, parts and appurtenances." The term "construction phase" is defined in ANSI N45.2.10-1973, "Quality Assurance Terms and Definitions" as "the period which commences with receipt of items at the construction site and ends when the components and systems are ready for turnover to operations personnel."
Past experience has made it clear that there is a need for augmented efforts to develop and apply improved quality assurance practices. To provide guidance concerning the implementation of a quality assurance program for the design and procurement phase, the AEC Regulatory staff, in June 1973, issued a document entitled "Guidance on Quality Assurance Requirements During Design and Procurement Phase of Nuclear Power Plants" (hereinafter referred to as the "Gray Book"). Most of the guidance provided in the Gray Book is in the form of standards that have been or are being developed under American National Standards Institute Subcommittee N45-2, "Nuclear Quality Assurance Standards." In addition, the Gray Book provides supplementary guidance and comments on these standards where the Regulatory staff considered it necessary. The June 1973 edition of the Gray Book is being revised to include applicable AEC regulations, issued regulatory guides endorsing applicable N45.2 Standards, and latest revisions of draft N45.2 Standards related to the design and procurement phase, including comments on these drafts where the Regulatory staff considers it necessary.

To provide guidance concerning the implementation of a quality assurance program for the operations phase, the AEC Regulatory staff, in October 1973, issued a document entitled "Guidance on Quality Assurance
Requirements During the Operations Phase of Nuclear Power Plants" (hereinafter referred to as the "Orange Book"). The Orange Book contains AEC regulations concerning quality assurance requirements during the operations phase; AEC regulatory guides which describe acceptable methods of complying with the pertinent quality assurance requirements of Appendix B; extracts from a draft standard (N45.2.8) related to installation, inspection, and testing of mechanical equipment and systems; and comments and supplementary guidance concerning organizations for quality assurance and training of personnel.

Most of the regulatory guides included in the Orange Book endorsed national standards, with appropriate exceptions, as being generally acceptable for complying with AEC quality assurance requirements.

In developing a comparable document for the construction phase, the AEC Regulatory staff is basing its guidance on Commission regulations, regulatory guides, and proposed national standards (included in Section C).

The responsibility for establishing national standards related to the construction phase of nuclear power plants rests with Subcommittee N45-2, "Nuclear Quality Assurance Standards," of the American National Standards Institute (ANSI) Standards Committee N45, "Reactor Plants and Their Maintenance." Included for background information purposes in the Gray Book is a paper entitled "Nuclear Power Plant Quality Assurance Standards - The Status and Application of ANSI N45.2 Standards" written by Sidney A. Bernsen and Stanley K.
Hellman, with assistance from the N45-2 Subcommittee membership. Although this paper is out of date with respect to the current status of N45.2 series standards, it does summarize typical activities of the N45-2 Subcommittee and contains observations regarding philosophy of the standards, with emphasis on ANSI N45.2-1971. "Quality Assurance Program Requirements for Nuclear Power Plants.

In May 1969, the subcommittee on nuclear power of the ASME Boiler and Pressure Vessel Committee expanded its scope of activities to include major components of the nuclear power system of a plant. A new Section III of the ASME Boiler and Pressure Vessel Code was published as the 1971 Edition of the Code. The quality assurance requirements of that Code apply directly to owners, manufacturers, and installers of nuclear power plant components and include provisions for the establishment and execution of a quality assurance program for activities covered by the Code. The quality assurance program requirements of Section III of the ASME Code are being revised to make them consistent with the requirements of ANSI N45.2-1971. In this regard, it is important to consider the relationship of the quality assurance requirements included in Section III of the Code with those included in ANSI N45.2. Code-covered activities are primarily intended to assure the integrity of the pressure boundary of an item. The Code does not address activities necessary to assure functional operability of some Code-covered items such as pumps or valves.
Therefore, to assure functional operability of these items, the quality assurance program must be extended to these other activities, and the guidance in N45.2 is appropriate.

In addition to Commission regulations, guides, and associated national standards applicable to quality assurance requirements for the construction phase included in Section C, the AEC Regulatory staff has provided comments on draft N45.2 standards in Section D, where appropriate.
QUALITY ASSURANCE GUIDANCE

RELATED TO THE CONSTRUCTION PHASE
C. Quality Assurance Guidance Related to the Construction Phase

AEC regulations, regulatory guides, and draft N45.2 standards which establish requirements and provide guidance on the quality assurance program are included in the following subsections. National standards referenced in the Commission's regulations or in regulatory guides are not included in this document. The sources from which these standards may be obtained are indicated in the regulations and regulatory guides.

Many other regulatory guides cover good practices to be used to assure that structures, systems, and components important to safety are designed, fabricated, erected, and tested to adequate quality standards. They describe measurements, acceptance tests, and periodic tests of structures, systems, and components which are important to the safety of the plant. Although these regulatory guides have not been included in this booklet, it should be recognized that they contribute significantly to the quality assurance program.

The AEC Regulatory staff recognizes that the draft N45.2 standards included in this section are subject to revision prior to their issuance as ANSI standards. Nevertheless, they provide needed and useful interim guidance on establishing and executing quality assurance programs which comply with the requirements of Appendix B to 10 CFR Part 50 pending their issuance as approved ANSI standards and endorsement by regulatory guides.
APPENDIX B TO 10 CFR PART 50

QUALITY ASSURANCE CRITERIA FOR

NUCLEAR POWER PLANTS AND FUEL REPROCESSING PLANTS
APPENDIX B - QUALITY ASSURANCE CRITERIA FOR NUCLEAR POWER PLANTS AND FUEL REPROCESSING PLANTS

I. QUALITY ASSURANCE PROGRAM

The applicant shall establish at the earliest practicable time, consistent with the schedule for accomplishing the activities, a quality assurance program which complies with the requirements of this appendix. This program shall be documented by written policies, procedures, or instructions and shall be carried out throughout plant life in accordance with those policies, procedures, or instructions. The applicant shall identify the structures, systems, and components to be covered by the quality assurance program. The quality assurance program shall provide control over activities affecting the quality of the identified structures, systems, and components, to an extent consistent with their importance to safety.

Activities affecting quality shall be accomplished under suitably controlled conditions. Controlled conditions include the use of appropriate equipment; suitable environmental conditions for accomplishing the activity, such as adequate cleanliness; and assurance that all prerequisites for the given activity have been satisfied. The program shall take into account the need for special controls, processes, test equipment, tools, and skills to attain the required quality, and the need for verification of quality by inspection and test. The program shall provide for incorporation and training of personnel performing activities affecting quality as necessary to assure that suitable proficiency is achieved and maintained. The applicant shall regularly review the status and adequacy of the quality assurance program. Management of other organizations participating in the quality assurance program shall regularly review the status and adequacy of that part of the quality assurance program which they are executing.

II. QUALITY ASSURANCE PROGRAM

The applicant shall establish at the earliest practicable time, consistent with the schedule for accomplishing the activities, a quality assurance program which complies with the requirements of this appendix. This program shall be documented by written policies, procedures, or instructions and shall be carried out throughout plant life in accordance with those policies, procedures, or instructions. The applicant shall identify the structures, systems, and components to be covered by the quality assurance program. The quality assurance program shall provide control over activities affecting the quality of the identified structures, systems, and components, to an extent consistent with their importance to safety.

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III. DESIGN CONTROL

Measures shall be established to assure that applicable regulatory requirements and the design basis, as defined in § 50.3 and as specified in the license application, for those structures, systems, and components to which this appendix applies are correctly translated into specifications, drawings, procedures, and instructions. These measures shall include provisions to assure that appropriate quality standards are specified and included in design documents and that deviations from such standards are controlled. Measures shall also be established for the selection and review for suitability of application of materials, parts, equipment, and processes that are essential to the safety-related functions of the structures, systems and components.

Measures shall be established for the identification and control of design interfaces and for coordination among participating design organizations. These measures shall include the establishment of procedures among participating design organizations for the review, approval, release, distribution, and revision of documents involving design interfaces.

The design control measures shall provide for verifying or checking the adequacy of design, such as by the performance of design reviews, by the use of alternate or simplified calculational methods, or by the performance of a suitable testing program. The verifying or checking process shall be performed by individuals or groups other than those who performed the original design, but who may be from the same organization. Where a test program is used to verify the adequacy of a specific design feature in lieu of other verifying or checking processes, such test program shall include suitable qualification testing of a prototype unit under the most adverse design conditions. Design control measures shall be applied to items such as the following: reactor physics, stress, thermal, hydraulic, and accident analyses; compatibility of materials;
PART 50 - LICENSING OF PRODUCTION AND UTILIZATION FACILITIES

accessibility for in service inspection, maintenance, and repair; and delineation of acceptance criteria for inspections and tests

Design changes, including field changes, shall be recorded in installation instructions, design bases, and other requirements which are necessary to assure adequate quality are sufficiently included or referenced in the documents for procurement of material, equipment, and services, whether purchased directly or through contractors and subcontractors, or components. Including partially fabricated assemblies.

XII. CONTROL OF SPECIAL PROCESSES

Measures shall be established to assure that special processes, including welding, heat treating, and nondestructive testing, are controlled by qualified personnel using qualified procedures in accordance with applicable codes, standards, or procedures, or drawings, or other suitable means.

X. INSPECTION

A program for inspection of activities affecting quality shall be established and executed by or for the organization performing the activity to verify conformance with the documentation, procedures, or drawings for accomplishing the activity. Such inspection shall be performed by individuals not otherwise involved in the design or manufacture of the item being inspected. Each inspection shall be recorded with results which shall be documented and reviewed by appropriate levels of management.

VII. CONTROL OF PURCHASED MATERIAL, EQUIPMENT, AND SERVICES

Measures shall be established to assure that purchased material, equipment, and services, whether purchased directly or through contractors and subcontractors, conform to requirements. These measures shall include provisions, as appropriate, for source evaluation and selection, purchase orders, inspection, and testing by the contractor or subcontractor, inspection at the contractor or subcontractor source, and examination of the material and equipment at the plant. Documentary evidence that material and equipment conform to the procurement requirements shall be available at the nuclear power plant or fuel reprocessing plant site prior to installation or use of such material and equipment. This documentary evidence shall be retained at the nuclear power plant or fuel reprocessing plant site and shall be sufficient to identify the specific requirements, specifications, or standards, and the extent of inspection and testing. The effectiveness of the control of quality by contractors and subcontractors shall be assessed by the applicant or designee at intervals consistent with the importance, content, complexity, and quantity of the product or service.

XVI. AUDITS

A comprehensive system of planned and periodic audits shall be carried out to verify compliance with all aspects of the quality assurance program. The audits shall be performed by appropriately trained personnel not having direct responsibilities in the areas being audited. Audit results shall be documented and reviewed by management having responsibility in the area audited. Followup action, including reaudit of deficient areas, shall be taken where indicated.

* 36 FR 18301
PARAGRAPH 50.55a, CODES AND STANDARDS, OF 10 CFR PART 50

LICENSENG OF PRODUCTION AND UTILIZATION FACILITIES

(ASME BOILER AND PRESSURE VESSEL CODE, SECTION III)
§ 50.55 Conditions of construction permits.

Each construction permit shall be subject to the following terms and conditions:

(a) The permit shall state the earliest and latest dates for completion of the construction or modification. If the construction or modification is completed before the earliest date specified, the holder of the permit shall promptly notify the Commission for the purpose of accelerating final inspection.

(b) If the proposed construction or modification of the facility is not completed by the latest completion date, the permit shall expire and all rights thereunder shall be forfeited. Provided, however, that upon good cause shown the Commission will extend the completion date for a reasonable period of time. The Commission will recognize, among other things, developmental problems attributable to the experimental nature of the facility or fire, flood explosion, sabotage, domestic violence, enemy action, an act of the elements, and other acts beyond the control of the permit holder, as a basis for extending the completion date.

(c) Except as modified by this section and § 50.55a, the construction permit shall be subject to the same conditions to which a license is subject.

(d) At or about the time of completion of the construction or modification of the facility, the applicant will file any additional information needed to bring the original application for license up to date, and will file an application for an operating license or an amendment to an application for a license to construct and operate the facility, for the issuance of an operating license, as specified in § 50.30(d).

(e) If the permit is for construction of a nuclear power plant, the holder of the permit shall notify the Commission of each deficiency found in design and construction, which, were it to have remained uncorrected, could have affected adversely the safety of operations of the nuclear power plant at any time throughout the expected lifetime of the plant, and which,除此...

As a minimum, the systems and components of boiling and pressurized water-cooled nuclear power reactors specified in paragraphs (c), (d), (e), (f), (g), and (i) of this section shall meet the requirements described in those paragraphs, except that the American Society of Mechanical Engineers (herein referred to as ASME) Code No. 1 should not be applied, and the applicable systems of nuclear power reactors specified in paragraphs (c), (d), (e), (f), (g), and (i) of this section, except as authorized by the Commission upon demonstration by the holder of a construction permit that:

(1) Design, fabrication, installation, testing, or inspection of the specified system or component, is to the maximum extent practical, in accordance with generally recognized codes and standards, and compliance with the requirements described in paragraphs (c) through (i) of this section or portions thereof would result in insurmountable difficulties without a compensating increase in the level of quality and safety; or

(ii) Proposed alternatives to the described requirements or portions thereof provide an acceptable level of quality and safety. For example, the use of inspection or survey systems other than those required by the specified ASME Codes and Addenda may be authorized under this subparagraph provided that an acceptable level of quality and safety in design, fabrication, installation, and testing is achieved.

(b) As used in this section, references to editions of Criteria Codes, and Standards include only those editions through 1971, references to Addenda include only those Addenda through the Summer 1973 Addenda.

(c) Pressure vessels:

(1) For construction permits issued before January 1, 1971, for reactors not licensed for operation, pressure vessels which are part of the reactor coolant protective boundary shall meet the requirements for Class A vessels set forth in section III of the ASME Boiler and Pressure Vessel Code, applicable Code Cases, and Addenda in effect on the date of issuance of the construction permit, provided, however, that if the pressure vessel is ordered more than 18 months prior to the date of issuance of the construction permit, compliance with the requirements for Class A, "as of" 1971 vessels shall be set forth in editions of this Code, applicable Code Cases, and Addenda which have become effective after the date of vessel order.

(2) For construction permits issued on or after January 1, 1971, pressure vessels which are part of the reactor coolant protective boundary shall meet the requirements for Class A or Class I vessels set forth in editions of section III of the ASME Boiler and Pressure Vessel Code and Addenda in effect on the date of order of the pressure vessel. Provided, however, that if the pressure vessel is ordered more than 18 months prior to the date of issuance of the construction permit, compliance with the requirements for Class A, "as of" 1971 vessels shall be set forth in editions of section III of the ASME Boiler and Pressure Vessel Code and Addenda in effect 18 months prior to the date of issuance of the construction permit.
ance of the construction permit is required. The pressure vessels may meet the requirements set forth in editions of this Code and Addenda which have become effective after the date of vessel order or after 12 months prior to the date of issuance of the construction permit.

(d) Piping:

Construction permits issued before January 1, 1971, for reactors not licensed for operation, piping which is part of the reactor coolant pressure boundary shall meet the requirements set forth in:

(i) The American Standard Code for Pressure Piping (ASA B31.1), Addenda, and applicable Code Cases or the U.S.A. Standard Code for Pressure Piping (USAS B31.1.0), Addenda, and applicable Code Cases, or the Class I section of the U.S.A. Standard Code for Pressure Piping (USAS B31.7) in effect on the date of order of the piping and

(ii) The nondestructive examination and acceptance standards of ASA B31.1 Code Cases N7, N9, and N10, except that the acceptance standards of Class I piping of the U.S.A. Standard Code for Pressure Piping (USAS B31.7) may be applied.

The piping may meet the requirements set forth in editions of ASA B31.1, USAS B31.2, USAS B31.3, USAS B31.7, Addenda, and Code Cases which became effective after the date of order of the piping.

(2) For construction permits issued on or after January 1, 1971, piping which is part of the reactor coolant pressure boundary shall meet the requirements for Class I piping set forth in editions of (i) the American Standard Code for Pressure Piping (USAS B31.7) and Addenda in effect on the date of order of the piping and

(ii) The requirements applicable to Class I piping of editions of section III of the ASME Boiler and Pressure Vessel Code and Addenda in effect on the date of order of the piping, or

(ii) the requirements applicable to Class I piping of editions of section III of the ASME Boiler and Pressure Vessel Code and Addenda in effect on the date of order of the piping, or

(ii) the requirements applicable to Class I piping of editions of section III of the ASME Boiler and Pressure Vessel Code and Addenda in effect on the date of order of the piping; Provided, however, That if the piping is ordered more than 6 months prior to the date of issuance of the construction permit, compliance with the requirements for Class I or Class I piping set forth in editions of USAS B31.7 or section III of the ASME Boiler and Pressure Vessel Code and Addenda in effect 6 months prior to the date of issuance of the construction permit is required. The piping may meet the requirements set forth in editions of these Codes and Addenda which have become effective after the date of issuance of the construction permit or after 12 months prior to the date of issuance of the construction permit.

(e) Pumps:

(1) For construction permits issued before January 1, 1971, for reactors not licensed for operation, pumps which are part of the reactor coolant pressure boundary shall meet—

(i) The requirements for Class I pumps set forth in the Draft ASME Code for Pumps and Valves for Nuclear Power, Addenda, and Code Cases in effect on the date of order of the pumps, or

(ii) The nondestructive examination and acceptance standards for Class I pumps set forth in the Draft ASME Code for Pumps and Valves for Nuclear Power and Addenda in effect on the date of order of the pumps, or

The pumps may meet the requirements set forth in editions of the Draft ASME Code for Pumps and Valves for Nuclear Power, Addenda, and Code Cases which became effective after the date of order of the pumps.

(2) For construction permits issued on or after January 1, 1971, pumps which are part of the reactor coolant pressure boundary shall meet the requirements for Class I pumps set forth in editions of (i) the Draft ASME Code for Pumps and Valves for Nuclear Power and Addenda in effect on the date of order of the pumps, or

(ii) the requirements applicable to Class I pumps set forth in editions of section III of the ASME Boiler and Pressure Vessel Code and Addenda in effect on the date of order of the pumps, or

The pumps may meet the requirements set forth in editions of the Draft ASME Code for Pumps and Valves for Nuclear Power, Addenda, and Code Cases in effect on the date of order of the pumps, or

The valves may meet the requirements set forth in editions of USAS B31.1, USAS B31.1.0, and the Draft ASME Code for Pumps and Valves for Nuclear Power, Addenda, and Code Cases on the date of order of the valves.

(f) Valves:

(1) The American Standard Code for Pressure Piping (ASA B31.1), Addenda, and applicable Code Cases, or the U.S.A. Standard Code for Pressure Piping (USAS B31.1.0), Addenda, and applicable Code Cases, or the Class I section of the Draft ASME Code for Pumps and Valves for Nuclear Power, Addenda, and Code Cases in effect on the date of order of the valves; or

(ii) the requirements applicable to Class I valves set forth in editions of section III of the ASME Boiler and Pressure Vessel Code and Addenda in effect on the date of order of the pumps; Provided, however, That if the pumps are ordered more than 12 months prior to the date of issuance of the construction permit, compliance with the requirements for Class I valves set forth in editions of the Draft ASME Code for Pumps and Valves for Nuclear Power and Addenda in effect on the date of order of the valves, or

The valves may meet the requirements set forth in editions of USAS B31.1, USAS B31.1.0, and the Draft ASME Code for Pumps and Valves for Nuclear Power, Addenda, and Code Cases on the date of order of the valves.

The valves and the requirements applicable to valves set forth in editions of section III of the ASME Boiler and Pressure Vessel Code and Addenda in effect on the date of order of the valves, or

(i) the requirements applicable to Class I valves set forth in editions of section III of the ASME Boiler and Pressure Vessel Code and Addenda in effect on the date of order of the valves, or

(ii) the requirements applicable to Class I valves set forth in editions of section III of the ASME Boiler and Pressure Vessel Code and Addenda in effect on the date of order of the valve; Provided, however, That if the valves are ordered more than 12 months prior to the date of issuance of the construction permit, compliance with the requirements for Class I valves set forth in editions of the Draft ASME Code for Pumps and Valves for Nuclear Power and Addenda in effect on the date of order of the valves, or

The valves may meet the requirements set forth in editions of USAS B31.1, USAS B31.1.0, and the Draft ASME Code for Pumps and Valves for Nuclear Power, Addenda, and Code Cases on the date of order of the valves.

The valves and the requirements applicable to valves set forth in editions of section III of the ASME Boiler and Pressure Vessel Code and Addenda in effect on the date of order of the valves, or

(i) the requirements applicable to Class I valves set forth in editions of section III of the ASME Boiler and Pressure Vessel Code and Addenda in effect on the date of order of the valves, or

(ii) the requirements applicable to Class I valves set forth in editions of section III of the ASME Boiler and Pressure Vessel Code and Addenda in effect on the date of order of the valves; Provided, however, That if the valves are ordered more than 12 months prior to the date of issuance of the construction permit, compliance with the requirements for Class I valves set forth in editions of the Draft ASME Code for Pumps and Valves for Nuclear Power and Addenda in effect on the date of order of the valves, or

The valves may meet the requirements set forth in editions of USAS B31.1, USAS B31.1.0, and the Draft ASME Code for Pumps and Valves for Nuclear Power, Addenda, and Code Cases on the date of order of the valves.
§ 50.55b Conditions of construction permit. The construction permit may incorporate, in construction permits for production or utilization facilities of the type described in § 50.22 for which applications were on file December 19, 1970, and in operating licenses for production or utilization facilities of a type described in §§ 50.22 and 50.21(b)(1), as to which a person who intervened or sought to be heard held hearing, in the construction permit proceeding for the facility to obtain a determination of antitrust considerations or to advance a jurisdictional basis for such determination within 25 days after the date of publication in the Federal Register of notice of filing of the application for an operating license or December 19, 1970, whichever is later, a condition to the effect that the license shall be subject to an antitrust review by the Atomic Energy Commission pursuant to section 105c of the Atomic Energy Act of 1954, as amended, that the license may be issued only upon finding that the information requested by the Atomic Energy Commission, as described in Appendix L to this part, that the Commission may take a hearing on antitrust matters in the construction or alteration permit, such condition to the effect that the construction or alteration permit in accordance with the regulations in this chapter, and the regulations of the Atomic Energy Commission will, in the absence of good cause shown to the contrary issue a hearing license in accordance with the regulations in this chapter.

The applicant is technically and financially qualified to engage in the activities authorized by the operating license in accordance with the regulations in this chapter, and the applicable provisions of Part 124 of this chapter have been satisfied.

The issuance of the license will not be inimical to the common defense and security or to the health and safety of the public.

Each operating license will include appropriate provisions with respect to any uncompleted items of construction and such limitations or conditions as are required to assure that operation during the period of the completion of such items will not endanger the public health and safety.

(c) An applicant may, in a case where a hearing is held in connection with a pending proceeding under this section, make a motion in writing pursuant to this paragraph (c), for an operating license authorizing low-power testing (operating license limited 1 percent of full power for the purpose of testing the facility), and further operations short of full power operation action on such a motion by the presiding officer shall be taken with due regard to the rights of the parties to the proceeding, including the right of any party to be heard to the extent that his contentions are relevant to the activity to be authorized. Prior to taking any action on a motion which any party opposes, the presiding officer shall make findings on the matters specified in paragraph (a) of this section as to which there is a difference of view among the parties. In the form of an initial decision with respect to the contested activity sought to be authorized. The Director of Regulation will make findings on all other matters specified in paragraph (a) of this section. If no party opposes the motion, the presiding officer will issue an order pursuant to § 2.730(e) of this chapter, authorizing the Director of Regulation to make the findings on the matters specified in paragraph (a) of this section and to issue a license for the requested operation.

(d) (1) An applicant for an operating license for a nuclear power reactor, in a case where a hearing is required in a pending proceeding under this section, may make a motion in writing, pursuant to this paragraph for a temporary operating license authorizing operation of the reactor pending final action on the application.

(2) A motion for a temporary operating license for a nuclear power reactor...
SAFETY GUIDE 28
QUALITY ASSURANCE PROGRAM REQUIREMENTS
(DESIGN AND CONSTRUCTION)

A. Introduction

Appendix B to 10 CFR Part 50, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," establishes quality assurance requirements for the design and construction of nuclear power plant structures, systems, and components. This safety guide describes an acceptable method of complying with the Commission's regulations with regard to overall quality assurance program requirements.

B. Discussion

Subcommittee N45-3, "Nuclear Quality Assurance Standards," (formerly ad hoc Committee N45-3.7) of the American National Standards Institute, Standards Committee N45, "Reactor Plants and Their Maintenance," under the sponsorship of the American Society of Mechanical Engineers, has developed a standard which includes general requirements and guidance for the establishment and execution of quality assurance programs during the design and construction phases of nuclear power plants. This standard was approved by the American National Standards Committee N45 and its Secretariat, and it was subsequently approved and designated N45.2-1971 by the American National Standards Institute on October 20, 1971.

C. Regulatory Position

The general requirements and guidelines for establishing and executing a quality assurance program during the design and construction phases of nuclear power plants which are included in ANSI N45.2-1971, "Quality Assurance Program Requirements for Nuclear Power Plants," are generally acceptable and provide an adequate basis for complying with the program requirements of Appendix B to 10 CFR Part 50.

1Copies may be obtained from the American Society of Mechanical Engineers, United Engineering Center, 345 East 47th Street, New York, N.Y. 10017.
SAFETY GUIDE 30
QUALITY ASSURANCE REQUIREMENTS FOR THE INSTALLATION, INSPECTION, AND TESTING OF INSTRUMENTATION AND ELECTRIC EQUIPMENT

A. Introduction

Appendix B to 10 CFR Part 50, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," establishes quality assurance requirements for the design, construction, and operation of nuclear power plant structures, systems, and components. This safety guide describes an acceptable method of complying with the Commission's regulations with regard to the quality assurance requirements for the installation, inspection, and testing of nuclear power plant instrumentation and electric equipment.

B. Discussion

Working Group N45-3.4 (formerly ad hoc committee N45-3.4, also designated ad hoc committee JCNP/3.H3 by the IEEE) of the American National Standards Institute Standards Committee N45, Reactor Plants and Their Maintenance, has developed a standard which includes quality assurance requirements for the installation, inspection, and testing of nuclear power plant instrumentation and electric equipment. This standard was approved by subcommittee N45-3, Nuclear Quality Assurance Standards, of the American National Standards Committee N45, and the full committee and its Secretariat, and it was subsequently approved and designated N45.2.4-1972 by the American National Standards Institute on March 1, 1972.

This standard was also approved by the IEEE Standards Committee on September 16, 1971, and was designated IEEE Std 336-1971.

C. Regulatory Position

The requirements for the installation, inspection, and testing of nuclear power plant instrumentation and electric equipment which are included in ANSI N45.2.4-1972, "Installation, Inspection, and Testing Requirements for Instrumentation and Electric Equipment During the Construction of Nuclear Power Generating Stations" (also designated as IEEE Std 336-1971) are generally acceptable and provide an adequate basis for complying with the pertinent quality assurance requirements of Appendix B to 10 CFR Part 50, subject to the following:

1. ANSI N45.2.4-1972 should be used in conjunction with ANSI N45.2-1971, "Quality Assurance Program Requirements for Nuclear Power Plants." (It is expected that future revisions of ANSI N45.2.4-1972 will include this provision.)

2. Section 9 of ANSI N45.2.4-1972 lists additional guides and standards made applicable by ANSI N45.2.4. The specific applicability or acceptability of these listed guides and standards has been or will be covered separately in other safety guides or in appropriate Commission regulations.

3. Although subdivision 1.1 of ANSI N45.2.4-1972 states that the requirements promulgated apply during the construction phase of a nuclear power plant, these requirements are also to be considered applicable for the installation, inspection, and testing of instrumentation and electric equipment during the operation phase of a nuclear power plant.

Copies may be obtained from either the Institute of Electrical and Electronics Engineers or the American Society of Mechanical Engineers, United Engineering Center, 345 E. 47th Street, New York, N.Y. 10017.
QUALITY ASSURANCE REQUIREMENTS FOR CLEANING OF FLUID SYSTEMS AND ASSOCIATED COMPONENTS OF WATER-COOLED NUCLEAR POWER PLANTS

A. INTRODUCTION

Appendix B to 10 CFR Part 50, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," requires, in part, that measures be established to control the cleaning of material and equipment in accordance with work and inspection instructions to prevent damage or deterioration. This guide describes an acceptable method of complying with the Commission's regulations with regard to quality assurance requirements for on-site cleaning of materials and components, cleanliness control, and preoperational cleaning and layup of water-cooled nuclear power plant fluid systems. The Advisory Committee on Reactor Safeguards has been consulted concerning this guide and has concurred in the regulatory position.

B. DISCUSSION

Working Group N45-2.1 (formerly ad hoc committee N45-3.1) of the American National Standards Institute (ANSI) Standards Committee N45, Reactor Plants and Their Maintenance, has prepared a standard which includes quality assurance requirements for on-site cleaning of materials and components, cleanliness control, and preoperational cleaning and layup of nuclear plant fluid systems. The standard was approved by subcommittee N45-2, Nuclear Quality Assurance Standards, of the ANSI Standards Committee N45 and the full committee and its Secretariat. It was subsequently approved and designated N45.2.1-1973 by the American National Standards Institute on February 26, 1973.

C. REGULATORY POSITION

The requirements and recommendations for on-site cleaning of materials and components, cleanliness control, and preoperational cleaning and layup of water-cooled nuclear power plant fluid systems that are included in ANSI N45.2.1-1973, "Cleaning of Fluid Systems and Associated Components During Construction Phase of Nuclear Power Plants,"1 are generally acceptable and provide an adequate basis for complying with the pertinent quality assurance requirements of Appendix B to 10 CFR Part 50, subject to the following:

1. Subdivision 1.5 of ANSI N45.2.1-1973 states that other documents required to be included as a part of the standard are either identified at the point of reference or described in Section 10 of the standard. The specific applicability or acceptability of these listed documents has been or will be covered separately in other regulatory guides or in Commission regulations, where appropriate.

2. Although subdivision 1.2 of ANSI N45.2.1-1973 states that the requirements promulgated apply during the construction phase of a nuclear power plant, many of the requirements and recommendations contained in the standard are also appropriate to cleaning of fluid systems and associated components during the operation phase of a nuclear power plant, and they should be used when applicable. In this regard, however, it should be particularly noted that decontamination and cleanup of radioactively contaminated systems and components are not addressed by ANSI N45.2.1-1973. These operations will be considered separately in future regulatory guides.

3. Subdivision 3.2 of ANSI N45.2.1-1973 states that the selection of the water quality for a specific application shall be made by the organization responsible for the cleaning operations unless otherwise specified in the purchase document. The water quality

1 Copies may be obtained from the American Society of Mechanical Engineers, United Engineering Center, 345 East 47th Street, New York, N.Y. 10017.
for final flushes of fluid systems and associated components should be at least equivalent to the quality of the operating system water.

4. Section 5 of ANSI N45.2.1-1973 states, in part, that low sulfur, low fluorine, and/or low chlorine compounds may be used on austenitic stainless steels and that low sulfur and low lead compounds may be used on nickel-base alloys. Chemical compounds that could contribute to intergranular cracking or stress-corrosion cracking should not be used with austenitic stainless steel and nickel-base alloys. Examples of such chemical compounds are those containing chlorides, fluorides, lead, zinc, copper, sulfur, or mercury where such elements are leachable or where they could be released by breakdown of the compounds under expected environmental conditions (e.g., by radiation). This limitation is not intended to prohibit the use of trichlorotrifluoroethane which meets the requirements of Military Specification Mil-C-81302b for cleaning or degreasing of austenitic stainless steel provided the precautions of subdivision 7.3(4) of ANSI N45.2.1-1973 are observed.

5. Section 5 of ANSI N45.2.1-1973 states, in part, that operations such as grinding and welding which generate particulate matter should be controlled. Adequate control of tools used in abrasive work operations such as grinding, sanding, chipping, or wire brushing should be provided. Specifically, tools which contain materials that could contribute to intergranular cracking or stress-corrosion cracking or which, because of previous usage, may have become contaminated with such materials should not be used on surfaces of corrosion-resistant alloys. Examples of such materials are listed in Regulatory position 4.

6. Subdivision 1.4 of ANSI N45.2.1-1973 suggests the use of ASTM A 262-68 or ASTM A 393-63 for detection of intergranular precipitation of chromium carbides in corrosion-resistant alloys. ASTM A 393-63 has been withdrawn by ASTM and is no longer considered a valid test.
QUALITY ASSURANCE REQUIREMENTS FOR
PACKAGING, SHIPPING, RECEIVING, STORAGE, AND
HANDLING OF ITEMS FOR WATER-COOLED NUCLEAR POWER PLANTS

A. INTRODUCTION

Appendix B to 10 CFR Part 50, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," establishes overall quality assurance requirements for the design, construction, and operation of nuclear power plant structures, systems, and components. This guide describes an acceptable method of complying with the Commission's regulations with regard to the quality assurance requirements for the packaging, shipping, receiving, storage, and handling of items for water-cooled nuclear power plants. The Advisory Committee on Reactor Safeguards has been consulted concerning this guide and has concurred in the Regulatory position.

B. DISCUSSION

Working Group N45-2.2 (formerly ad hoc committee N45-3.2) of the American National Standards Institute (ANSI) Standards Committee N45, Reactor Plants and Their Maintenance, has prepared a standard which includes quality assurance requirements for the packaging, shipping, receiving, storage, and handling of items for nuclear power plants. This standard was approved by subcommittee N45-2, Nuclear Quality Assurance Standards, of the ANSI Standards Committee N45 and the full committee and its Secretariat. It was subsequently approved and designated N45.2.2-1972 by the American National Standards Institute on December 20, 1972.

As used in this guide, an "item" is defined as any level of unit assembly, including system, subsystem, subassembly, component, part, or material.

C. REGULATORY POSITION

The requirements and guidelines for packaging, shipping, receiving, storing, and handling of water-cooled nuclear power plant items that are included in ANSI N45.2.2-1972, "Packaging, Shipping, Receiving, Storage and Handling of Items For Nuclear Power Plants During the Construction Phase," are generally acceptable and provide an adequate basis for complying with the pertinent quality assurance requirements of Appendix B to 10 CFR Part 50, subject to the following:

1. Subdivision 1.5 of ANSI N45.2.2-1972 states that other documents required to be included as a part of this standard are either identified at the point of reference or described in Section 9 of the standard. The specific applicability or acceptability of these listed documents has been or will be covered separately in other regulatory guides or in Commission regulations where appropriate.

2. Subdivision 7.3.4 of ANSI N45.2.2-1972 delineates requirements for re-rating hoisting equipment for special lifts. This subdivision requires, in part, that re-rated equipment be given a dynamic load test over the full range of the lift using a test weight at least equal to the lift weight. The test weight used in temporarily re-rating hoisting equipment for special lifts in accordance with the provisions of subdivision 7.3.4 should be at least equal to 110% of the lift weight.

3. Subdivision A.3.5.2 of ANSI N45.2.2-1972 permits tapes containing not more than 0.10% by weight of halogens and sulfur to be used in contact with austenitic stainless steel and nickel alloy surfaces.

Copies may be obtained from the American Society of Mechanical Engineers, United Engineering Center, 345 East 47th Street, New York, N.Y. 10017.

Published guides will be revised periodically, as appropriate, to accommodate comments and to reflect new information or experience.
Subdivision A.3.6.3 of ANSI N45.2.2-1972 permits desiccants and desiccant bag materials containing not more than 0.25% halogens to be used with austenitic stainless steels. When used with austenitic stainless steel and nickel alloy materials, tapes, desiccants, and the materials for the desiccant bag should not be compounded from or treated with chemical compounds containing elements that could contribute to intergranular cracking or stress corrosion cracking. Examples of such chemical compounds are those containing chlorides, fluorides, lead, zinc, copper, sulfur, or mercury where such elements are leachable or where they could be released by breakdown of the compounds under expected environmental conditions (e.g., by radiation).

4. Although ANSI N45.2.2-1972 is entitled "Packaging, Shipping, Receiving, Storage, and Handling of Items for Nuclear Power Plants During the Construction Phase," the requirements and guidelines included in the standard are considered to be applicable during the operation phase and should be followed where appropriate.

5. Notwithstanding the provisions of subdivision 1.2 of ANSI N45.2.2-1972 with respect to applicability of this standard and the definition of carrier contained in subdivision 1.4 of ANSI N45.2.2-1972, nothing contained in section 4, "Shipping," shall be deemed to require a common or contract carrier transporting or shipping byproduct, source, or special nuclear material in the ordinary course of its business to comply with the provisions set forth in this section of the standard. In this situation these carriers are exempt from AEC regulation under the provisions of 10 CFR §§30.13, 40.12, and 70.12. Therefore, the provisions of section 4 of ANSI N45.2.2-1972 apply to the extent that they affect the activities of an AEC licensee (e.g., requirements related to shipping contained in 10 CFR Part 71) or a private carrier subject to AEC regulation.
A. INTRODUCTION

Appendix B to 10 CFR Part 50, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," requires that activities affecting quality be accomplished under suitably controlled conditions (e.g., suitable environmental conditions for accomplishing the activity). This guide describes an acceptable method of complying with the Commission's regulations with regard to housekeeping requirements for the control of work activities, conditions, and environments at water-cooled nuclear power plant sites. The Advisory Committee on Reactor Safeguards has been consulted concerning this guide and has concurred in the Regulatory position.

B. DISCUSSION

Working Group N45-2.3 (formerly ad hoc committee N45-3.3) of the American National Standards Institute (ANSI) Standards Committee N45, Reactor Plants and Their Maintenance, has prepared a standard which defines the housekeeping requirements for the control of work activities, conditions, and environments that could affect the quality of a nuclear power plant during the construction phase. This standard was approved by Subcommittee N45-2, Nuclear Quality Assurance Standards, of the ANSI Standards Committee N45 and the full committee and its Secretariat. It was subsequently approved and designated N45.2.3-1973 by the American National Standards Institute on March 15, 1973.

C. REGULATORY POSITION

The requirements and guidelines for the control of work activities, conditions, and environments at water-cooled nuclear power plant sites which are included in ANSI Standard N45.2.3-1973, "Housekeeping During the Construction Phase of Nuclear Power Plants," are generally acceptable and provide an adequate basis for complying with the pertinent quality assurance requirements of Appendix B to 10 CFR Part 50, subject to the following:

1. Subdivision 1.5 of ANSI N45.2.3-1973 states that other documents that are required to be included as a part of this standard are either identified at the point of reference or identified in Paragraph 5 of the standard. The specific applicability or acceptability of these listed guides and standards has been or will be covered separately in other regulatory guides or in Commission regulations, where appropriate.

2. Although subdivision 1.1 of ANSI N45.2.3-1973 states that the requirements promulgated apply during the construction phase of a nuclear power plant, these requirements should also be considered applicable for housekeeping during the operation phase of a nuclear power plant.

Copies of published guides may be obtained from the American Society of Mechanical Engineers, United Engineering Center, 451 La Salle 47th Street, New York, N.Y. 10017.

Copies of published guides may be obtained by request indicating the divisions desired to the U.S. Atomic Energy Commission, Washington, D.C. 20545, Attention Director of Regulatory Standards. Comments and suggestions for improvements in these guides are encouraged and should be sent to the Secretary of the Commission, U.S. Atomic Energy Commission, Washington, D.C. 20545, Attention Chief, Public Proceedings Staff.

The guides are issued in the following ten broad divisions:

1. Power Reactors 6. Products
2. Research and Test Reactors 7. Transportation

Published guides will be revised periodically, as appropriate, to accommodate comments and to reflect new information or experience.
QUALITY ASSURANCE REQUIREMENTS FOR PROTECTIVE COATINGS APPLIED TO WATER-COOLED NUCLEAR POWER PLANTS

A. INTRODUCTION

Appendix B to 10 CFR Part 50, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," establishes overall quality assurance program requirements for the design, fabrication, construction, and operation of safety-related nuclear power plant structures, systems, and components. This guide describes an acceptable method of complying with the Commission's quality assurance requirements with regard to protective coatings applied to ferritic steels, aluminum, stainless steel, zinc-coated (galvanized) steel, concrete, or masonry surfaces of water-cooled nuclear power plants. The Advisory Committee on Reactor Safeguards has been consulted concerning this guide and has concurred in the regulatory position.

B. DISCUSSION

Subcommittee N101.5.7 of the American National Standards Institute (ANSI) Standards Committee N101, Atomic Industry Facility Design, Construction, and Operation Criteria, under the sponsorship of the American Institute of Chemical Engineers, has developed a standard which includes quality assurance requirements for protective coatings applied to ferritic steels, aluminum, stainless steel, zinc-coated (galvanized) steel, concrete, or masonry surfaces of nuclear facilities. This standard was approved by the American National Standards Committee N101 and its Secretariat. It was subsequently approved and designated N101.4-1972 by the American National Standards Institute on November 28, 1972.

C. REGULATORY POSITION

The requirements and guidelines included in ANSI N101.4-1972, "Quality Assurance for Protective Coatings Applied to Nuclear Facilities," for protective coatings applied to ferritic steels, aluminum, stainless steel, zinc-coated (galvanized) steel, concrete, or masonry surfaces of water-cooled nuclear power plants are generally acceptable and provide an adequate basis for complying with the pertinent quality assurance requirements of Appendix B to 10 CFR Part 50 subject to the following:

1. ANSI N101.4-1972 should be used in conjunction with ANSI N45.2-1971, "Quality Assurance Program Requirements for Nuclear Power Plants."

2. Subdivision 2.7 of ANSI N101.4-1972 states that when references are made to other standards, these references shall imply the most recent or current editions of the referenced standards. The specific applicability or acceptability of referenced standards will be covered separately in other regulatory guides, where appropriate.

3. Subdivision 1.1.2 of ANSI N101.4-1972 states that quality assurance, as covered by this standard, comprises all those planned and systematic actions necessary to provide specified documentation and adequate confidence that shop or field coating work for nuclear facilities will perform satisfactorily in service. This statement should not be interpreted as implying that the end product of quality assurance actions is the production of specified documentation. The term...
"quality assurance" as used in ANSI N101.4-1972 should be considered to comprise all those planned and systematic actions necessary to provide adequate confidence that shop or field coating work for nuclear facilities will perform satisfactorily in service. In this connection it is emphasized that records and documents listed in Subdivisions 7.4 through 7.8, and included in the standard, are suggested forms only. Alternate documentation consistent with the requirements of Appendix B to 10 CFR Part 50 is also considered acceptable.

4. Sections 3 and 4 of ANSI N101.4-1972 delineate quality assurance requirements for coating materials and surface preparation of substrates. Coatings and cleaning materials used with stainless steel should not be compounded from or treated with chemical compounds containing elements that could contribute to corrosion, intergranular cracking, or stress corrosion cracking. Examples of such chemical compounds are those containing chlorides, fluorides, lead, zinc, copper, sulfur, or mercury where such elements are leachable or where they could be released by breakdown of the chemical compounds under expected environmental conditions (e.g., by radiation). This limitation is not intended to prohibit the use of trichlorotrifluoroethane which meets the requirements of Military Specification MIL-C-81302b for cleaning or degreasing of austenitic stainless steel provided adequate removal is assured prior to painting.
REGULATORY GUIDE
DIRECTORATE OF REGULATORY STANDARDS

REGULATORY GUIDE 1.58
QUALIFICATION OF NUCLEAR POWER PLANT INSPECTION, EXAMINATION, AND TESTING PERSONNEL

A. INTRODUCTION

Appendix B to 10 CFR Part 50, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," requires that the quality assurance program provide for indoctrination and training of personnel performing activities affecting quality as necessary to assure that suitable proficiency is achieved and maintained. This guide describes an acceptable method of complying with the Commission's regulations with regard to qualification of nuclear power plant inspection, examination, and testing personnel. This guide applies to all types of nuclear power plants. The Advisory Committee on Reactor Safeguards has been consulted concerning this guide and has concurred in the regulatory position.

B. DISCUSSION

Working Group N45-2.6 of the American National Standards Institute Standards Committee N45, Reactor Plants and Their Maintenance, has prepared a standard which delineates the qualifications of inspection, examination, and testing personnel for the construction phase of nuclear power plants. This standard was approved by subcommittee N45-2, Nuclear Quality Assurance Standards, of the ANSI Standards Committee N45 and the full committee and its Secretariat. It was subsequently approved and designated N45.2.6-1973 by the American National Standards Institute on January 25, 1973.

Although the purpose of ANSI N45.2.6-1973 is to delineate the qualifications of personnel who perform inspection, examination, and testing activities that assure the quality of important parts of a nuclear power plant during the construction phase, the Regulatory staff has concluded that these same qualifications, with due consideration for the specific activity performed, are also applicable to personnel performing inspection, examination, and testing activities during fabrication prior to receipt of items at the construction site and during the other phases of plant life, including preoperational and startup testing and the operational phase.

C. REGULATORY POSITION

The requirements and recommendations for qualification of nuclear power plant inspection, examination, and testing personnel that are included in ANSI N45.2.6-1973 are generally acceptable and provide an adequate basis for complying with the pertinent quality assurance requirements of Appendix B to 10 CFR Part 50. Subject to the following:

1. Although subdivision 1.2 of ANSI N45.2.6-1973 states that the requirements promulgated apply during the construction phase of a nuclear power plant, these requirements should also be considered generally applicable to inspection, examination, and testing activities during fabrication prior to receipt of items at the construction site and during other phases of plant life, including preoperational and startup testing and the operational phase.

2. Subdivision 1.5 of ANSI N45.2.6-1973 states that other documents that are required to be included as part of approval of a nuclear power plant design are generally acceptable and provide an adequate basis for complying with the pertinent quality assurance requirements of Appendix B to 10 CFR Part 50. These requirements should also be considered generally applicable to inspection, examination, and testing activities during fabrication prior to receipt of items at the construction site and during other phases of plant life, including preoperational and startup testing and the operational phase.

3. ANSI N45.2.6-1973 is not intended to apply to AEC licensed operators and senior operators for the performance of duties specified in 10 CFR Part 55, "Operators' Licenses."

USAEC REGULATORY GUIDES

Regulatory Guides are issued to describe and make available to the public methods acceptable to the AEC Regulatory staff of implementing specific parts of the Commission's regulations, to delineate techniques used by the staff in evaluating specific problems or postulated accidents, or to provide guidance to applicants. Regulatory Guides are not substitutes for regulations and compliance with them is not required. Methods and solutions different from those set out in the guides will be acceptable if they provide a basis for the findings requisite to the issuance or continuance of a permit or license by the Commission.

Published guides will be revised periodically, as appropriate, to accommodate comments and to reflect new information or experience.

Copies of published guides may be obtained by request identifying the division desired to the U.S. Atomic Energy Commission, Washington, D.C. 20545, Attention: Director of Regulatory Standards. Comments and suggestions for improvements in these guides are encouraged and should be sent to the Secretary of the Commission, U.S. Atomic Energy Commission, Washington, D.C. 20545, Attention: Chief, Public Proceedings Staff.

The guides are issued in the following ten broad divisions:

1. Power Reactors
2. Research and Test Reactors
3. Fuels and Materials Facilities
4. Environmental and Siting
5. Materials and Plant Protection
6. Products
7. Transportation
8. Occupational Health
9. Antitrust Review
10. General

August 1973
of this standard are either identified at the point of reference or described in Section 6 of the standard. SNT-TC-1A, its Supplements and Appendices,* are considered applicable for the qualification of personnel performing nondestructive examination operations. The specific applicability or acceptability of other listed guides and standards has been or will be covered separately in other regulatory guides where appropriate.

3. Item (7) of subdivision 2.2.4 of ANSI N45.2.6-1973 requires that the “basis used for certification” be documented in an appropriate form. The basis should include both the general education and experience requirements, as discussed in subdivision 3.1, and the specific technical requirements, as discussed in subdivision 3.2. The specific technical abilities of the person being certified should be related to the specific assigned tasks, e.g., electrical inspection, concrete inspection, etc.

4. Subdivision 1.1 of ANSI N45.2.6-1973 states that the requirements of the standard do not apply to personnel who perform inspections for government or municipal authorities, or who perform as authorized inspectors in accordance with the ASME Boiler and Pressure Vessel Code. The requirements and recommendations of ANSI N45.2.6-1973, subject to the provisions of Regulatory positions 1, 2, and 3, are considered acceptable for use by or for all AEC licensees, including licensees who are government or municipal authorities.

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*Copies of SNT-TC-1A, its Supplements and Appendices, "Recommended Practice for Nondestructive Testing Personnel Qualification and Certification," may be obtained from the Society for Nondestructive Testing, 914 Chicago Avenue, Evanston, Illinois 60202.
QUALITY ASSURANCE TERMS AND DEFINITIONS

A. INTRODUCTION

Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," of 10 CFR Part 50, "Licensing of Production and Utilization Facilities," establishes quality assurance requirements for the design, construction, and operation of nuclear power plant structures, systems, and components. This guide identifies quality assurance terms and acceptable definitions that are important to the understanding of these quality assurance requirements for the design, construction, and operation of nuclear power plant structures, systems, and components. This guide applies to all types of nuclear power plants. The Advisory Committee on Reactor Safeguards has been consulted concerning this guide and has concurred in the regulatory position.

B. DISCUSSION

Working Group N45-2.10 of the American National Standards Institute Standards Committee N45, Reactor Plants and Their Maintenance, has prepared a standard that contains certain terms and their definitions that are important to the understanding of the intent of required quality assurance practices for the construction of nuclear power plants. This standard was approved by subcommittee N45-2, Nuclear Quality Assurance Standards, of the American National Standards Institute Standards Committee N45 and the full committee and its Secretariat. It was subsequently approved and designated N45.2.10-1973 by the American National Standards Institute on May 31, 1973.

Although Section 1.1, "Scope," of ANSI N45.2.10-1973 states that the standard contains terms and their definitions that are important to the understanding of the intent of required quality assurance practices for the construction of nuclear power plants, these same terms are applicable to other phases of plant life, including design, preoperational and startup testing, and the operational phase.

C. REGULATORY POSITION

The quality assurance terms and definitions contained in ANSI N45.2.10-1973 are generally acceptable for use in describing and implementing quality assurance programs for the design, construction, and operation of nuclear power plant structures, systems, and components subject to the following:

The definition of "procurement documents" should be considered to include such documents as contracts, letters of intent, work orders, purchase orders, or proposals and their acceptances which authorize the seller to perform services or supply equipment, material, or facilities on behalf of the purchaser.

1 ANSI N45.2.10-1973, "Quality Assurance Terms and Definitions," may be obtained from the American Society of Mechanical Engineers, 345 East 47th Street, New York, New York 10017.
SUPPLEMENTARY QUALITY ASSURANCE REQUIREMENTS FOR INSTALLATION, INSPECTION, AND TESTING OF STRUCTURAL CONCRETE AND STRUCTURAL STEEL DURING THE CONSTRUCTION PHASE OF NUCLEAR POWER PLANTS

ANSI N45.2.5 - 1973

Secretariat
The American Society of Mechanical Engineers
An American National Standard implies a consensus of those substantially concerned with its scope and provisions. An American National Standard is intended as a guide to aid the manufacturer, the consumer, and the general public. The existence of an American National Standard does not in any respect preclude anyone, whether he has approved the standard or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standard. American National Standards are subject to periodic review and users are cautioned to obtain the latest editions.

CAUTION NOTICE: This American National Standard may be revised or withdrawn at any time. The procedures of the American National Standards Institute require that action be taken to reaffirm, revise, or withdraw this standard no later than five years from date of publication. Purchasers of American National Standards may receive current information on all standards by calling or writing the American National Standards Institute.
This standard delineates the requirements for the installation, inspection, and testing of structural concrete and structural steel in a nuclear power plant during its construction phase. The standard was developed by the American National Standards Committee N45 on Reactor Plants and Their Maintenance. This committee has been chartered to promote the development of standards for the location, design, construction, and maintenance of nuclear reactors and plants embodying nuclear reactors, including equipment, methods, and components specifically for this purpose.

In April of 1970, the N45 Committee established a subcommittee, N45-3, to guide the preparation of nuclear quality assurance standards. The subcommittee is responsible for establishing guidelines and policy to govern the scope and content of the various standards; monitoring the status of standards in process; recommending preparation of additional standards; and final approval of standards prior to their submittal to the N45 Committee for balloting.

In November of 1970, the N45-3 Subcommittee established an Ad Hoc Committee N45-3.5 on Quality Assurance Requirements for Civil and Structural Work. The purpose of this committee was to prepare a standard for general industry use that would define the installation, inspection, and testing requirements for structural concrete and structural steel items that would result in or assure attainment of quality construction. The Ad Hoc Committee was composed of representatives of key segments of the nuclear industry including utilities, reactor suppliers, architect-engineers, reactor constructors, consultants, and national laboratories. The standard contained herein was developed from this activity.

The initial draft of this standard was prepared in September of 1971.
Working with the N45-3 Subcommittee and concurrently with the development of this standard, other ad hoc committees of N45 are developing a series of standards that set forth more detailed technical requirements for certain activities to assure quality during the construction phase of nuclear power plants. These requirements will be coordinated with the requirements of this standard as they are developed.

In September 1971, these ad hoc committees were changed to work groups. In October 1972, the N45-3 Subcommittee was renumbered N45-2, and the work groups were renamed accordingly. As of August 1973, the following associated standards were in preparation or issued:

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<td>N45-2.17</td>
<td>N45.2.17 Quality Assurance Requirements for Control of the Welding Process for Nuclear Power Plants</td>
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Suggestions for improvement gained in the use of this standard will be welcomed. They should be sent to American National Standards Institute, 1430 Broadway, New York, New York 10018.
The Work Group on Quality Assurance Requirements for Civil and Structural Work included the following personnel during the development of this standard.

<table>
<thead>
<tr>
<th>Name of Representative</th>
<th>Organization Represented</th>
</tr>
</thead>
<tbody>
<tr>
<td>G. M. Schierberg, Chairman</td>
<td>Gibson Morris, Secretary</td>
</tr>
<tr>
<td>J. F. Artuso</td>
<td>Pittsburgh Testing Laboratory</td>
</tr>
<tr>
<td>B. G. Avers</td>
<td>General Public Utilities Service Corporation</td>
</tr>
<tr>
<td>C. Bonine, Jr.</td>
<td>Tennessee Valley Authority</td>
</tr>
<tr>
<td>J. J. Connelly</td>
<td>General Public Utilities Service Corporation</td>
</tr>
<tr>
<td>B. W. Howard</td>
<td>Gulf General Atomic Company</td>
</tr>
<tr>
<td>G. Morris</td>
<td>Oak Ridge National Laboratory</td>
</tr>
<tr>
<td>F. Ople</td>
<td>Gulf General Atomic Company</td>
</tr>
<tr>
<td>W. T. Quinn</td>
<td>Tennessee Valley Authority</td>
</tr>
<tr>
<td>R. W. Seidensticker</td>
<td>Argonne National Laboratory</td>
</tr>
<tr>
<td>G. M. Schierberg</td>
<td>Stone and Webster Engineering Corporation</td>
</tr>
<tr>
<td>C. C. Simpson</td>
<td>Burns &amp; Roe, Inc.</td>
</tr>
<tr>
<td>J. R. Wells</td>
<td>Duke Power Company</td>
</tr>
<tr>
<td>R. G. Wunderlich</td>
<td>Gulf General Atomic Company</td>
</tr>
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List of Referenced Documents
1. INTRODUCTION

1.1 SCOPE

This standard sets forth the supplementary quality assurance requirements for installation, inspection, and testing of structural concrete and structural steel for nuclear power plant construction. It is intended for application to those structures from which satisfactory performance is required:

1. For the plant to operate reliably
2. To prevent accidents that could cause undue risk to the health and safety of the public
3. To mitigate the consequences of such accidents if they were to occur.

Included are the following:

1. Formwork
2. Steel Reinforcement
3. Embedded Items
4. Foundation Preparation
5. Concrete
6. Structural Steel

The requirements may also be extended to other appropriate parts of nuclear power plants when specified in contract documents.

This standard is intended to be used in conjunction with ANSI N45.2.

1.2 APPLICABILITY

The requirements of this standard apply to the work of any organization or individual participating in the production, preparation, placement, inspection, and testing of structural concrete; and the erection, inspection, and testing of structural steel as identified in Section 1.1. The extent to which the
individual requirements of this standard apply will depend upon the nature and scope of the work to be performed and the importance of the item or service involved.

The requirements are intended to assure that only specified materials and workmanship are incorporated into the plant; that quality of materials and quality of workmanship are maintained throughout the construction process; that the work is performed in accordance with applicable construction procedures; and that the completed installation conforms to the specified requirements.

The ASME Boiler and Pressure Vessel Code, Section III, Divisions 1 and 2, as well as other American National standards, have been considered in the development of this standard; and this standard is intended to be compatible with their requirements. This standard applies to structural concrete and structural steel components of nuclear power plants not covered by the Code. For items covered by the Code, it is intended that the requirements of this standard shall supplement the requirements of the Code. In cases where conflict may exist, the requirements of the Code shall govern.

1.3 RESPONSIBILITY

The organization of organizations responsible for establishing the applicable requirements for the activities covered by this standard shall be identified, and the scope of their responsibilities shall be documented. The work of establishing practices and procedures and providing the resources in terms of personnel, equipment, and services necessary to implement the requirements of this standard may be delegated to other organizations, and such delegation also shall be documented. It is the responsibility of each organization performing work covered by this standard to comply with the procedures and instructions issued for the project and to conform to the requirements of this standard applicable to their work. It is the responsibility of the organization performing these activities to specify the detailed methods and procedures unless they are specified in the procurement documents.

1.4 DEFINITIONS

The following definitions are provided to assure a uniform understanding of select terms as they are used in this standard. Additional definitions of terms are included in ANSI N45.2.10.
Class of Concrete - Identified each individual design mix.

Curing - The process of maintaining a satisfactory moisture content and a favorable temperature in concrete during hydration of the cementitious materials so that desired properties of the concrete are developed.

Finishing - The process of obtaining specified surface characteristics of hardened concrete.

Qualified Procedures - Procedures which incorporate applicable codes and standards, manufacturer's parameters, and engineering specifications.

Qualification Tests - Tests performed to qualify the basic material source or manufacturer. These tests are mandatory unless current documentary test data are available to establish complete confidence in conformance to specification requirements.

In-Process Tests - Tests performed during the course of construction to maintain control of structural materials. These tests may be performed by the manufacturer or supplier, but samples for these tests must be taken from the lot or batch of materials supplied to the site for use.

Sampling Point - The point at which the concrete leaves the last piece of mixing or agitating equipment prior to being discharged to conveying equipment systems.

1.5 REFERENCED DOCUMENTS

Other documents that are required to be included as a part of this standard are identified at the point of reference and listed in Section 8 and the Appendix of this standard. The issue or edition of the referenced document that is required is specified in the Appendix.
2. GENERAL REQUIREMENTS

2.1 PLANNING

Measures shall be established and implemented for documenting installation, inspection, and testing operations to verify conformance to specified requirements.

Planning shall take into account the need for the preparation and control of procedures and work instructions necessary to comply with requirements for installation, inspection, and testing.

Planning shall include a review of the structure, system, or component design and procurement specifications, materials lists, drawings, construction work plans, procedures, and schedules to assure that installation, inspection, and testing activities have been incorporated; that they can be accomplished as specified; and that time and resources are sufficient to accomplish the scheduled construction without degradation of quality.

2.2 PROCEDURES AND INSTRUCTIONS

Installation, inspection and test procedures, and work instructions shall be prepared and documented for those activities falling within the scope of this standard. These documents shall be kept current and revised as necessary to assure that installation, inspections, and tests are performed in accordance with latest information and shall include as appropriate:

(1) Installation specifications.
(2) Inspection and test objectives and requirements.
(3) Precautions to avoid component or system damage during installation, inspection, and following inspection but prior to use.
(4) Inspection and test equipment required.
(5) Sequence of tests (if applicable).
(6) Sequential actions to be followed.
(7) Frequency of inspections and tests.
(8) Prerequisites.
(9) Approvals.
(10) Data report form.
(11) Identification of test equipment and date of required recalibration where required for interpretation of test results.
(12) Inspection and test acceptance limits.
2.3 RESULTS

Inspection and test results shall be documented in a suitable test report or data sheet. Each report shall identify the item to which it applies, the procedures or instructions followed in performing the task, and the identification of the following:

1. Pertinent inspection and test data such as identification of location where testing was performed or where test samples were taken.
2. Significant dates and times.
3. Inspection acceptance and test completion signatures.
4. Conditions encountered which were not anticipated, including nonconformance.

Test reports and data sheet shall include an evaluation of the acceptability of inspection and test results and provide for identifying the individual who performed the evaluation.

2.4 PERSONNEL QUALIFICATIONS

Personnel performing tests and inspections required by this standard shall be qualified in accordance with ANSI N45.2.6. Personnel performing field inspection and testing activities shall be certified for Level I capability. On-site supervisors of Level I personnel shall be certified for Level II capability and shall be responsible for the proper performance of on-site inspections and tests. Persons charged with engineering managerial responsibility of the inspection and testing organization at the site in either a resident or nonresident capacity shall be certified for Level III capability. Personnel performing nondestructive examinations shall be qualified to appropriate levels of capability as specified in American Society for Nondestructive Testing Recommended Practice SNT-TC-1A.

2.5 MEASURING AND TEST EQUIPMENT

2.5.1 Selection. Measuring and test equipment used to implement the requirements of this standard shall be selected on the basis of accuracy sufficient to determine conformance to specified requirements.

These measuring devices shall include but not be limited to thermometers, balances, scales, air entrainment meters, humidity meters, volumetric buckets, field soil density measuring devices, pressure gages, and torque wrenches.
2.5.2 Calibration and Control. The equipment shall be adjusted or calibrated or both at prescribed intervals against certified standards having known valid relationships to national standards, where such exist. If no national standards exist, the basis for the adjustment or calibration shall be documented. Records shall be maintained and equipment suitably marked to indicate calibration status. Measures shall be taken to assure proper handling, storage, and care of installation of inspection and testing equipment after calibration in order to maintain the required accuracy of such equipment.

Test equipment found to be out of calibration shall be clearly identified as such. When discrepancies, malfunctions, or inaccuracies in inspection and testing equipment are found during calibration, all items inspected with that equipment since the last previous calibration shall be considered unacceptable until an evaluation has been made by the responsible authority and appropriate action taken.

2.6 Housekeeping

In areas, facilities, and environments where installation, inspection, and testing of structural concrete and structural steel items are performed in accordance with the requirements of this standard, the housekeeping requirements shall be in accordance with ANSI N45.2.3.
3. PRECONSTRUCTION VERIFICATION

3.1 GENERAL

While it is recognized that the requirements for initial receipt inspections and storage are covered by another standard, ANSI N45.2.2, it is necessary to verify that the quality of an item has not suffered during the interim period. It is not intended to duplicate inspections but rather to verify that items are in a satisfactory condition for installation. The verification shall include:

(1) Visual examination of materials for proper identification, physical damage, and contamination.

(2) Review of manufacturer's documentation, test reports, or other evidence of quality conformance for correctness and compliance with specifications if not reviewed at time of receipt.

3.2 MATERIALS SUITABILITY

Verification that materials meet specified requirements shall be accomplished through qualification tests and in-process tests.

3.2.1 Qualification Tests. Qualification tests shall be performed and the results evaluated prior to the initial use of the materials to establish conformance of the materials to the specified requirements. A list of minimum required qualification tests or certifications is contained in Table A. This list contains tests necessary to qualify materials for normal application. Additional tests may be required to qualify materials for special applications.
<table>
<thead>
<tr>
<th>Material</th>
<th>Test For</th>
<th>Test Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete Aggregates</td>
<td>Compliance with ASTM C-33</td>
<td>As referenced in ASTM C-33</td>
</tr>
<tr>
<td>Cement</td>
<td>Compliance with ASTM C-150</td>
<td>As referenced in ASTM C-150</td>
</tr>
<tr>
<td>Admixtures</td>
<td>Compliance with ASTM C-260 or C-494 whichever is applicable</td>
<td>Manufacturer's certification</td>
</tr>
<tr>
<td>Fly Ash &amp; Pozzolans</td>
<td>Compliance with ASTM C-618</td>
<td>As referenced in ASTM C-618</td>
</tr>
<tr>
<td>Water &amp; Ice</td>
<td>Compliance with AASHO T-26 for effect on:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Compressive Strength</td>
<td>ASTM C-109</td>
</tr>
<tr>
<td></td>
<td>Setting Time</td>
<td>ASTM C-191</td>
</tr>
<tr>
<td></td>
<td>Soundness</td>
<td>ASTM C-151</td>
</tr>
<tr>
<td>Liquid Membrane Forming Curing Compounds</td>
<td>Compliance with ASTM C-309</td>
<td>As referenced in ASTM C-309</td>
</tr>
<tr>
<td>Sheet Materials for Concrete Curing</td>
<td>Compliance with ASTM C-171</td>
<td>As referenced in ASTM C-171</td>
</tr>
<tr>
<td>Concrete Mixes</td>
<td>Compliance with ACI 211</td>
<td>As referenced in ACI 211</td>
</tr>
<tr>
<td>Reinforcement</td>
<td>Physical properties of full section test specimen per ASTM A-615</td>
<td>One full section test in accordance with ASTM A-370 for each bar size.</td>
</tr>
<tr>
<td>Structural Steel</td>
<td>Compliance with appropriate specifications such as ASTM A-36, A-440, etc.</td>
<td>Manufacturer's certification</td>
</tr>
<tr>
<td>High Strength Bolts</td>
<td>Compliance with ASTM A-325 or A-490</td>
<td>Manufacturer's certification</td>
</tr>
</tbody>
</table>
3.3 CONSTRUCTION PROCESSES

Inspections shall be performed to verify that the prerequisites for control of construction processes such as welding, bolting, structural reinforcement splicing, and concrete measuring, mixing, transporting, placing, and curing have been accomplished. These inspections shall include:

(1) Verification that the process has been qualified as required.
(2) Verification that process controls are in effect.
(3) Verification that qualified procedures, instruction manuals, or both, if required for specific equipment, are available for use during construction.
(4) Verification that the process is suitable for the particular application.
(5) Verification that manpower, equipment, and materials are readily available and adequate to perform the work in accordance with drawing and specification requirements.
4. INSPECTION OF CONCRETE CONSTRUCTION

4.1 GENERAL

Inspection of concrete construction shall include inspections of preparations for concreting, as well as in-process inspections of concrete measuring, mixing, transporting, placement, curing, and protection to assure conformance to specified requirements. The inspection shall follow the Recommended Practice for Concrete Inspection, ACI 311.

4.2 PROTECTION OF MATERIALS

Inspections shall be performed to verify the adequacy and proper maintenance of material storage conditions and handling techniques. These inspections shall include the following:

(1) Inspection of cement storage facilities to verify weather tightness, cement temperature and the absence of lumps, and review of records to verify type and age of cement.

(2) Inspection of aggregate stockpiles to verify: handling techniques are not resulting in segregation; storage and handling adequately prevent contamination with deleterious substances; proper temperature and uniform moisture control; and use of frozen materials is prevented.

(3) Inspection of admixture storage and handling facilities to verify that deterioration and contamination are prevented.

(4) Inspection of water sources and cooling and heating facilities to verify the specified water quality and assure that the specifications for concrete temperature are met.

4.3 MEASURING, MIXING, AND TRANSPORTING EQUIPMENT

Inspections shall be performed prior to and during the production of concrete to verify the adequacy and proper operation of measuring, mixing, and transporting equipment in accordance with ACI 304, ASTM C-94, and National Ready Mix Concrete Association - Concrete Plant Standard and Truck Mixer and Agitator Standard. These inspections shall include the following:

(1) Inspection of measuring facilities for the specified accuracy of measuring, weighing, and weight recording devices to control the following:
   (a) Proportions of cement, water, and aggregates
   (b) Quantities of admixtures
   (c) Aggregate moisture compensation
(d) Mixing time
(e) Temperature control: Heating or cooling of concrete.

(2) Inspection of central mix plant and truck mixers for wear of drum blades, function of revolution counter and water measuring device, proper speed of rotation, and ability to mix concrete completely in the specified time.

4.4 PREPLACEMENT PREPARATIONS

Inspection of preparations for concrete placement shall include the following:

(1) Inspection of compacted structural fill during placement to verify correct material, condition of material, gradation, moisture content, in-place density, and compliance with compaction procedures.

(2) Inspection of rock surfaces which will be in contact with structural concrete to verify surface cleanness, removal of loose rock and free water, correct contour, and specified subgrade condition.

(3) Inspection of previously placed concrete to verify proper preparation for the next lift.

(4) Inspection of formwork, reinforcing, and embedded items to verify: correct location and configuration of formwork; installation and integrity of water stops and membrane waterproofing; condition of form material to produce the specified concrete finish; installation of ties, anchors, bracing, shoring and supports; correct size, orientation, and installation of reinforcing steel and embedded items; correct location and dimensions of control joints, expansion joints, construction joints, blockouts, and waterstops; proper form coating; and cleanness.

(5) Inspection of mechanical reinforcing bar splicing operations to verify conformance to the requirements of Section 4.9.

(6) Documentation inspections (1) through (5) above shall be verified as being complete and indicate that all results are satisfactory.

4.5 CONCRETE PLACEMENT

Inspection of concrete placement shall be performed to verify the following:

(1) Specified tests of concrete have been performed.

(2) Adherence to specified requirements for: class of concrete, age, rate of placement, lift height, placing sequence, and hot or cold weather concreting practice.
(3) Proper use of adequate conveying and placing equipment.
(4) Adequate concrete consolidation equipment and technique of operation.
(5) Embedded items are not disturbed nor forms displaced.

4.6 FINISHING AND REPAIR

Inspections shall be performed to verify that specified finishes, i.e., wood float, steel trowel, as cast, or other type, are obtained. After forms have been removed, inspections shall be performed to verify that the formed surfaces have been repaired and finished in accordance with specified requirements.

Any indications of voids or contamination, such as at a construction joint, shall be explored, by physical removal of concrete if necessary, to determine the extent of such voids or contamination. Appropriate repairs shall be made.

4.7 CURING

Inspections shall be performed throughout the specified curing period to verify the following:

(1) Correct curing method is used, i.e., use of ponding, fog spray, wet burlap, curing compound, or other method in accordance with specified requirements.

(2) Concrete is kept continuously, i.e., not periodically, wet during the entire curing period, if one of the wet curing methods is used.

(3) Membrane curing compounds are specifically approved for use prior to application.

(4) Curing temperature is maintained within specified limits during the entire curing period.

(5) Shoring and forms are left in place until concrete has reached the specified strength necessary to preclude the possibility of damage from construction loads.

4.8 IN-PROCESS TESTS ON CONCRETE AND REINFORCING STEEL

In-process tests shall be performed during the course of construction to maintain control of structural concrete. A list of the required in-process tests is contained in Table B. The test frequencies given shall be considered minimums. In-process tests shall be performed more frequently if test results are erratic or if the trend of results or an apparent change in material characteristics indicate that the frequency should be increased. Samples for in-process
Tests of concrete shall be taken at the sampling point in accordance with ASTM C-172. This point may be at the truck mixer discharge if the last piece of conveying equipment is a chute, bucket, conveyor system, or similar equipment. Pumped concrete must be sampled from the pump line discharge. No water or other ingredients may be added to any concrete batch at the sampling point for in-process tests. Samples shall not be taken from concrete after it has been deposited in the form.

**TABLE B**

**REQUIRED IN-PROCESS TESTS**

<table>
<thead>
<tr>
<th>Material</th>
<th>Requirement</th>
<th>Test Method</th>
<th>Test Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete</td>
<td>Mixer uniformity</td>
<td>ASTM C-94</td>
<td>Initially and every 6 months thereafter</td>
</tr>
<tr>
<td></td>
<td>Sampling method</td>
<td>ASTM C-172</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Compression cylinders</td>
<td>ASTM C-31</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Compressive strength</td>
<td>ASTM C-39</td>
<td>2 cylinders for 28-day test from each 100 cu yd or a minimum of 1 set/day for each class of concrete</td>
</tr>
<tr>
<td></td>
<td>Slump</td>
<td>ASTM C-143</td>
<td>First batch produced each day and every 50 cu yd placed</td>
</tr>
<tr>
<td></td>
<td>Air content</td>
<td>ASTM C-173 or C-231</td>
<td>With each set of compression cylinders</td>
</tr>
<tr>
<td></td>
<td>Temperature</td>
<td></td>
<td>First batch produced each day and every 50 cu yd placed</td>
</tr>
<tr>
<td></td>
<td>Unit weight/yield</td>
<td>ASTM C-138</td>
<td>Daily during production</td>
</tr>
<tr>
<td>Grout</td>
<td>Compressive strength</td>
<td>ASTM C-109</td>
<td>Daily during production</td>
</tr>
<tr>
<td>Aggregate</td>
<td>Compliance with requirements for:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Gradation</td>
<td>ASTM C-136</td>
<td>Daily during production</td>
</tr>
<tr>
<td></td>
<td>Moisture content</td>
<td>ASTM C-566</td>
<td>Daily during production</td>
</tr>
<tr>
<td></td>
<td>Material finer than No. 200 sieve</td>
<td>ASTM C-117</td>
<td>Daily during production</td>
</tr>
<tr>
<td>Material</td>
<td>Requirement</td>
<td>Test Method</td>
<td>Test Frequency</td>
</tr>
<tr>
<td>--------------------------</td>
<td>------------------------------</td>
<td>------------------------</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>Aggregate</td>
<td>Organic impurities</td>
<td>ASTM C-40</td>
<td>Weekly during production*</td>
</tr>
<tr>
<td>(continued)</td>
<td>Friable particles</td>
<td>ASTM C-142</td>
<td>Monthly during production*</td>
</tr>
<tr>
<td></td>
<td>Lightweight pieces</td>
<td>ASTM C-123</td>
<td>Monthly during production*</td>
</tr>
<tr>
<td></td>
<td>Soft fragments</td>
<td>ASTM C-235</td>
<td>Monthly during production*</td>
</tr>
<tr>
<td></td>
<td>Los Angeles abrasion</td>
<td>ASTM C-131 or C-535</td>
<td>Every 6 months*</td>
</tr>
<tr>
<td></td>
<td>Flat and elongated particles</td>
<td>CRD C-119</td>
<td>Every 6 months*</td>
</tr>
<tr>
<td></td>
<td>Potential reactivity</td>
<td>ASTM C-289</td>
<td>Every 6 months*</td>
</tr>
<tr>
<td>Water &amp; Ice</td>
<td>Soundness</td>
<td>ASTM C-88</td>
<td>Every 6 months*</td>
</tr>
<tr>
<td></td>
<td>Compliance with AASHO T-26</td>
<td></td>
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<tr>
<td></td>
<td>for effect on:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Compressive strength</td>
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*These test frequencies shall be considered minimum unless current documentary test data are available to establish complete confidence in conformance to specification requirements.
4.9 MECHANICAL (CADWELD) SPLICE TESTING

4.9.1 Qualification of Operators. Prior to the production splicing of reinforcing bars, each member of the splicing crew (or each crew if the members work as a crew) shall prepare two qualification splices for each of the splice positions (e.g., horizontal, vertical, diagonal) to be used. The qualification splices shall be made using the same materials (e.g., bar, sleeve, powder) as those to be used in the structure. To qualify, the completed splices must meet the specified visual inspection acceptance requirements and meet the tensile test requirements of Section 4.9.3. Each member of the splicing crew (or each crew if the members work as a crew) is subject to requalification (1) if the specific splice position (e.g., horizontal, vertical, diagonal) has not been used by member or crew for a period of three months or more or (2) if there is another reason to question their ability, such as the completed splices not passing visual inspection or tensile testing. The requalification procedure should be identical to the original qualification procedure.

4.9.2 Visual Inspection. All completed mechanical splices shall be inspected at both ends of the splice sleeve and at the tap hole in the center of the splice sleeve for longitudinal centering of sleeve on the spliced ends, permissible gap between rebar ends, allowable voids in filler metal, extent of leaking of filler metal, gas blowout, amount of packing and slag at the tap hole. All visual inspections on completed splices shall be performed only after the splices have cooled to ambient temperatures. Splices that fail to pass visual inspection shall be discarded and replaced and shall not be used as tensile test samples.

4.9.3 Tensile Testing. Splice samples may be production splices (i.e., those cut directly from in-place reinforcing) or sister splices (i.e., those removable splices made in place next to production splices and under the same conditions). A record shall be kept of all splices tested, showing the splice location, splice identification number, and whether the tested splice was a production or sister splice. Splice samples shall be subjected to tensile tests in accordance with the sampling frequency specified in Section 4.9.4 to determine conformance with the following acceptance standards:

(1) The tensile strength of each sample tested shall equal or exceed 125 percent of the minimum yield strength specified in ASTM A-615 using loading rates set forth in ASTM A-370.
(2) The average tensile strength of each group of 15 consecutive samples shall equal or exceed the ultimate tensile strength specified for the reinforcing bar.

Since curved reinforcing bars will not tensile test accurately, production splice samples should not be removed from curved reinforcing bars for tensile testing. Straight sister splice samples should be made for each of the required curved reinforcing bar production splices. Production samples should also not be cut from the structure where the mechanical splicing sleeve is welded to an anchorage in a region of high stress concentration, or at a leak tight barrier (e.g., embedded structural steel sections or liner plate). Representative sister splice samples shall be used in such cases. The sampling frequency specified in Section 4.9.4(2) should then be followed, except that all splices tested shall be sister splices.

4.9.4 Tensile Test Frequency. Separate test cycles shall be established for mechanical splices in horizontal, vertical, and diagonal bars, for each bar size, and for each splicing crew as follows:

(1) **Test Frequency for Production Splice Test Samples.** If only production splices are tested, the sample frequency shall be:
   (a) One of the first 10 splices.
   (b) One of the next 90 splices.
   (c) Two of the next and subsequent units of 100 splices.

(2) **Test Frequency for Combinations of Production and Sister Splices.** If production and sister splices are tested, the sample frequency shall be:
   (a) One production splice of the first 10 production splices.
   (b) One production and three sister splices for the next 90 production splices.
   (c) Three splices, either production or sister splices, for the next and subsequent units of 100 splices. At least 1/4 of the total number of splices tested shall be production splices.

4.10 WELDED REINFORCING BAR SPLICES

Welded reinforcing bar splices shall be subject to the requirements of Section 5.5, except that provisions of AWS D12.1 shall apply.
5. INSPECTION OF STEEL CONSTRUCTION

5.1 GENERAL

Inspection of steel construction in accordance with the AISC Manual of Steel Construction shall include inspection of assembly and erection operations, fastening or connecting operations such as high strength bolting, and welding and finishing operations to include cleaning and protective painting or coating.

Inspection of steel construction shall include inspection of related items, such as anchor bolts and base plates, which may be part of the supporting structure and installed as part of structural concrete work.

5.2 SUPPORTING STRUCTURES

Prior to erection of steel, anchor bolts and base plates and other structural embedments shall be checked for correct orientation, spacing, and elevation. Base plate surfaces and supporting concrete surfaces shall be checked to verify satisfactory condition for grouting.

Grouting of base plates, beam pockets, etc., shall be controlled to assure that only specified materials are used, proportioned properly, placed correctly, and cured properly to achieve the specified compressive strength.

5.3 ASSEMBLY AND ERECTION

Assembly and erection operations shall be inspected to verify compliance with installation procedures and work instructions. Alignment operations shall be carried out early enough and as often as is necessary as erection progresses to insure that specified requirements are met.

Particular attention shall be given to verification of the condition of contact surfaces of friction type connections and bolt hole alignment. Correction of fabrication errors shall be closely controlled to prevent correction of misaligned holes by reaming in excess of AISC tolerances. Burning of bolt holes is not permitted. All equipment used in connecting operations shall be inspected to verify conformance with specification requirements. For example, air compressors must be of sufficient capacity to maintain the required operating pressure for impact tools.

5.4 HIGH STRENGTH BOLTING

Bolt tightening shall be in accordance with the specified method, i.e., automatic cut-off impact wrench or turn-of-nut method. If the turn-of-nut
method is used, inspections shall be made to verify that the bolting crews understand the meaning of "snug tight" condition before the nut is turned through the required angle. If an automatic cut-off impact wrench is used, it shall be calibrated at least twice daily. The calibration of automatic cut-off impact wrenches shall be performed by tightening in a device capable of indicating actual bolt tension, using no less than three typical bolts of each diameter from the bolts being installed. Installation of bolts shall be done in accordance with "Specifications for Structural Joints Using ASTM A-325 or A-490 Bolts."

Inspection of bolting shall include visual inspections of bolting operations and torque wrench inspection of completed connections. All connection points shall be visually inspected for the following items:

1. Bolts are the correct length as indicated by at least two threads extending beyond the nut.
2. Correct type bolt is used as indicated by the manufacturer's marking on the head.
3. Torque has been applied as indicated by the burnishing or peening of the corners of the nut.
4. Turning elements are on the correct face; washers are used when required.

Hand torque wrenches used for inspection shall be controlled in accordance with Section 2.5.2 and must be calibrated at least weekly and more often if deemed necessary. Impact torque wrenches used for inspection must be calibrated at least twice daily. The schedule of bolt tension inspection shall be as specified in the latest edition of "Specification for Structural Joints Using ASTM A-325 or A-490 Bolts." In addition, at the beginning of tightening operations, all bolts tightened by each bolting crew shall be checked until the results are consistently acceptable.

5.5 WELDING

Inspection of structural steel welding shall be performed in accordance with the provisions of AWS D1.1, Section 6, entitled "Structural Welding Code," and supplemental addenda. This inspection shall include visual examination of preparations, welding processes, and post-welding operations. Prior to welding, verification of welding procedure and welder qualification shall be documented and shall include all essential variables identified in the procedure. In-process
inspections shall include joint fit up prior to start of welding, preheat and interpass temperature requirements, filler metal, control of distortion, and post-weld heat treatment and cleaning requirements. Procedures shall be established to control the purchase, receiving, distribution, storage, and use of welding electrode.

Weld repairs necessitated by visual or nondestructive examinations shall be made in accordance with the procedure used to perform the original weld or a qualified repair procedure and re-inspected by the same method which disclosed the repairable defect. All weld repairs necessitated by nondestructive examination shall be documented.
6. DATA ANALYSIS AND EVALUATION

6.1 GENERAL

Procedures shall be established for processing inspection and test data and their analysis and evaluation. These procedures shall provide for acquisition and preparation of inspection and test data for prompt evaluation against acceptance criteria, operating limits, and performance standards. The data processing procedures shall provide for "on-the-spot" evaluation to determine the validity of the inspection and test results, the appropriateness of continuing the inspection or test. The data shall be analyzed and evaluated to verify completeness of results, achievement of inspection and test objectives, and to identify additional inspection and tests required; and necessary changes to the installation inspection or test procedures. Inspection and test results that include inspection and test data, together with a report of data analysis and evaluation, shall be provided as specified in Section 8.

6.2 CONCRETE AND MECHANICAL (CADWELD) SPLICE TEST DATA EVALUATION AND ANALYSIS

6.2.1 Evaluation of Concrete Test Results. Standard deviation data shall be developed, evaluated, and maintained for permanent records in accordance with ACI 214. Concrete quality and acceptance criteria shall conform to the requirements of ACI 318, Chapter 4.

6.2.2 Evaluation of Mechanical (Cadweld) Splice Test Results. The following procedure shall be used for substandard tensile test results.

(1) If any production or sister splice tested fails to meet the tensile test specification of Section 4.9.3(1) and the observed rate of splices that fail the tensile test at that time does not exceed one for each 15 consecutive test samples, the sampling procedure shall be started anew. If any production or sister splice used for testing fails to meet the tensile test specification in Section 4.9.3(1) and the observed rate of splices that fail the tensile test exceeds one for each 15 consecutive test samples, mechanical splicing shall be stopped. In addition, the adjacent production splices on each side of the last failed splice and four other splices distributed uniformly throughout the balance of the 100 production splices under investigation shall be tested, and an independent laboratory analysis shall be made to
identify the cause of all failures. The results of these tests shall be evaluated by the responsible engineering organization to determine the required corrective action. The responsible engineering organization shall specify the extent of repairs necessary and the actions required to prevent further failures from the identified causes. If two or more splices from any of these six additional splice samples fail to meet the tensile test specification of Section 4.9.3(1) the balance of the 100 production splices under investigation shall be rejected and replaced. When mechanical splicing is resumed, the sampling procedure shall be started anew.

(2) If the average tensile strength of the 15 consecutive samples fails to meet the provisions of Section 4.9.3(2), the responsible engineering organization shall evaluate and assess the acceptability of the reduced average tensile strength with respect to the required strength of the location from which the samples were taken.

6.3 STEEL CONSTRUCTION TEST DATA EVALUATION AND ANALYSIS

This data shall be evaluated for conformance to project specifications, the AISC Manual of Steel Construction and AWS D1.1 and supplemental addenda.
7. RECORDS

Record copies of completed procedures, reports, personnel qualification records, test equipment calibration records, test deviation or exception records, and inspection and examination records shall be prepared. These shall be placed with other project records as required by code, standard, specification, or project procedures.

Collection, storage, and maintenance of records shall be in accordance with ANSI N45.2.9.
8. REVISIONS OF AMERICAN NATIONAL STANDARDS REFERRED TO IN THIS DOCUMENT

When the following standards referred to in this document are superseded by a revision approved by the American National Standards Institute, the revision shall apply:

N45.2   Quality Assurance Program Requirements for Nuclear Power Plants

N45.2.2 Packaging, Shipping, Receiving, Storage and Handling of Items for Nuclear Power Plants

N45.2.3 Housekeeping During the Construction Phase of Nuclear Power Plants

N45.2.6 Qualifications of Inspection, Examination and Testing Personnel for the Construction Phase of Nuclear Power Plants

N45.2.9 Requirements for Quality Assurance Records for Nuclear Power Plants

N45.2.10 Quality Assurance Terms and Definitions
APPENDIX

This Appendix is not a part of ANSI Standard N45.2.5 but is included for information purposes only.
APPENDIX

List of Reference Documents

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American Association of State Highway Officials

| T-26-70 | Method of Test for Quality of Water to be Used in Concrete |

American Institute of Steel Construction

| AISC, 7th Edition | Manual of Steel Construction |

American Society for Nondestructive Testing

| SNT-TC-1A, Third Edition | Recommended Practice |
National Ready Mix Concrete Association

Concrete Plant Standards of the Concrete Plant Manufacturers Bureau, 4th Revision, March 1, 1970

Truck Mixer and Agitator Standards of the Truck Mixer Manufacturers Bureau, 9th Revision, November 1, 1971

American Society for Testing and Materials

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ASTM C-142-71  Test for Friable Particles in Aggregates

ASTM C-143-71  Test for Slump of Portland Cement Concrete

ASTM C-150-71  Specification for Portland Cement

ASTM C-151-68  Autoclave Expansion of Portland Cement

ASTM C-171-69  Specification for Sheet Materials for Curing Concrete

ASTM C-172-71  Sampling Fresh Concrete

ASTM C-173-71  Test for Air Content of Freshly Mixed Concrete by the Volumetric Method

ASTM C-183-71  Standard Methods of Sampling Hydraulic Cement

ASTM C-191-70  Time of Setting of Hydraulic Cement by Vicat Needle

ASTM C-192-69  Making and Curing Concrete Test Specimen in the Laboratory

ASTM C-231-71-T  Test for Air Content of Freshly Mixed Concrete by the Pressure Method

ASTM C-235-68  Standard Method of Test for Scratch Hardness of Coarse Aggregate Particles

ASTM C-260-69  Standard Specification for Air Entraining Admixtures for Concrete

ASTM C-289-71  Standard Method of Test for Potential Reactivity of Aggregates (Chemical Method)

ASTM C-309-58  Specification for Liquid Membrane - Forming Compounds for Curing Concrete

ASTM C-311-68  Sampling and Testing Fly Ash for Use as an Admixture in Portland Cement Concrete

ASTM C-494-71  Standard Specification for Chemical Admixture for Concrete

ASTM C-535-69  Test for Resistance to Abrasion of Large Size Coarse Aggregate by Use of the Los Angeles Machine

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American National Standard
for
Reactor Plants and Their Maintenance

SUPPLEMENTARY QUALITY ASSURANCE REQUIREMENTS FOR INSTALLATION, INSPECTION AND TESTING OF MECHANICAL EQUIPMENT AND SYSTEMS FOR THE CONSTRUCTION PHASE OF NUCLEAR POWER PLANTS

ANSI N45.2.8 - 1974

Secretariat
The American Society of Mechanical Engineers
An American National Standard implies a consensus of those substantially concerned with its scope and provisions. An American National Standard is intended as a guide to aid the manufacturer, the consumer, and the general public. The existence of an American National Standard does not in any respect preclude anyone, whether he has approved the standard or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standard. American National Standards are subject to periodic review and users are cautioned to obtain the latest editions.

CAUTION NOTICE: This American National Standard may be revised or withdrawn at any time. The procedures of the American National Standards Institute require that action be taken to reaffirm, revise, or withdraw this standard no later than five years from date of publication. Purchasers of American National Standards may receive current information on all standards by calling or writing the American National Standards Institute.
This standard delineates requirements for the installation, inspection, and testing that assure the quality of important parts of a nuclear power plant during construction. The standard was developed by the American National Standards Committee N45 on Reactor Plants and Their Maintenance. This committee has been chartered to promote the development of standards for the location, design, construction, and maintenance of nuclear reactors and plants embodying nuclear reactors, including equipment, methods, and components.

In April 1970, the N45 Committee established a subcommittee N45-3 to guide the preparation of nuclear quality assurance standards. This subcommittee is responsible for establishing guidelines and policy to govern the scope and content of the various standards; monitoring the status of standards in process; recommending preparation of additional standards; and approving standards prior to their submittal to the N45 Committee for balloting.

In May 1969, the ASME Boiler and Pressure Vessel Committee's subcommittee on nuclear power expanded its scope of activities to include major components of the nuclear power system of a plant. A new edition of Section III of the Boiler and Pressure Vessel Code was published in 1971. Recognizing that other mechanical equipment and systems not covered by the Code are also important to the safe and reliable operation of nuclear power plants, the N45-3 Subcommittee established an ad hoc committee (N45-3.8) on Installation, Inspection and Testing of Mechanical Equipment. The purpose of this committee was to prepare a standard for general industry use that would define for these mechanical equipment items, the installation, inspection, and testing requirements that would result in or assure attainment of quality construction. The ad hoc committee was composed of representatives of key segments of the nuclear industry including utilities, reactor suppliers, equipment manufacturers, architect-engineers, constructors, consultants, and national laboratories. The standard contained herein was developed from this activity. The initial draft of this standard was prepared in June 1971.
The ASME Boiler and Pressure Vessel Code, as well as other ANSI standards, has been considered in the development of this standard, and this standard is intended to be compatible with its requirements. This standard applies to important mechanical items of nuclear power plants. The requirements and guidelines of this standard apply to the items and activities not covered by the Code. For items and activities to which the Code does apply, this standard provides guidance for the development of practices and procedures for activities in those areas not covered by the Code. In cases where conflict may exist, the requirements of the Code are controlling.

Working with the N45-3 Subcommittee and concurrently with the development of this standard, other ad hoc committees of N45 are developing a series of standards that set forth more detailed requirements for certain activities to assure quality of nuclear power plants. These requirements will be coordinated with the requirements of this standard as they are developed.

In September 1971, these ad hoc committees were changed to work groups. In October 1972, the N45-3 Subcommittee was renamed N45-2, and the work groups were renamed accordingly. As of November 1973, the following associated standards were in preparation or issued:

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Suggestions for improvement gained in the use of this standard will be welcomed. They should be sent to the Secretary, American National Standards Committee N45, The American Society of Mechanical Engineers, United Engineering Center, 345 East 47 Street, New York, New York 10017.

The Work Group on Installation, Inspection and Testing of Mechanical Equipment included the following personnel during the development of this standard.

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<td>United States Testing Company</td>
</tr>
<tr>
<td>F. B. Baldwin</td>
<td>Stone &amp; Webster Engineering Corporation</td>
</tr>
<tr>
<td>Gene Basile</td>
<td>F. L. Hannon, Secretary</td>
</tr>
<tr>
<td>Name</td>
<td>Company</td>
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<tr>
<td>D. W. Berger</td>
<td>Babcock &amp; Wilcox Company</td>
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<tr>
<td>L. R. Cunningham</td>
<td>Westinghouse Electric Corp.</td>
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<td>B. G. Good</td>
<td>Pacific Gas &amp; Electric Company</td>
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<tr>
<td>J. J. Gramsammer</td>
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<td>F. L. Hannon</td>
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<tr>
<td>L. K. Hooper</td>
<td>Crane Company</td>
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<td>J. P. Ittner</td>
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<td>K. E. Morgan</td>
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SUPPLEMENTARY QUALITY ASSURANCE REQUIREMENTS FOR INSTALLATION, 
INSPECTION AND TESTING OF MECHANICAL EQUIPMENT 
AND SYSTEMS FOR THE CONSTRUCTION PHASE OF 
NUCLEAR POWER PLANTS

1. INTRODUCTION

1.1 Scope. This standard contains requirements and guidelines to assure the quality of important items of nuclear power plants including structures, systems and components. The requirements and guidelines are intended to assure that these important items are installed, inspected and tested in a manner that will provide adequate confidence that they will perform satisfactorily in service.

The requirements and guidelines for installation, inspection and testing activities during construction are intended to assure the quality of mechanical items not covered by Section III of the ASME Boiler and Pressure Vessel Code. The requirements of this standard deal with the protection and control necessary to assure that the requisite quality of mechanical items of the plant are preserved from the time items are removed from storage or receiving until they are incorporated into the plant up to but not including fuel loading of PWR plants and the completion of cold functional testing of BWR and HTGR plants.

This standard is intended to be used in conjunction with ANSI N45.2.

1.2 Applicability. The requirements and guidelines of this standard apply to the work of any individual or organization that participates in installation, inspection or testing of mechanical equipment during construction activities of nuclear power plants as discussed in Subsection 1.1. The extent to which the individual requirements of this standard apply will depend upon the nature and scope of the work to be performed and the importance of the item or service involved. Important mechanical items to be covered and the extent of coverage shall be identified by the individual or organization invoking this standard. The requirements are intended to assure that only proper materials, equipment, processes and procedures are utilized during the construction of power plants and that the quality of items is not degraded as a result of installation, inspection and testing practices and techniques during construction.
The ASME Boiler and Pressure Vessel Code, Section III, Division 1 (hereinafter referred to as the Code), as well as other American National Standards, has been considered in the development of this standard, and this standard is intended to be compatible with its requirements. This standard applies to important mechanical items of nuclear power plants. The requirements and guidelines of this standard apply to the items and activities not covered by the Code. For items and activities to which the Code does apply, this standard provides guidance for the development of practices and procedures for activities in those areas not covered by the Code. In cases where conflict may exist, the requirements of the Code are controlling.

1.3 Responsibility. The organization or organizations responsible for establishing the applicable requirements for the activities covered by this standard shall be identified and the scope of their responsibilities shall be documented. The work of establishing practices and procedures and providing the resources in terms of personnel, equipment and services necessary to implement the requirements of this standard may be delegated to other organizations and such delegation shall also be documented. It is the responsibility of each organization performing work covered by this standard to comply with the procedures and instructions issued for the project and to conform to the requirements of this standard applicable to this work.

It is the responsibility of the organization performing these activities to specify the detailed methods and procedures unless they are specified in the procurement documents.

1.4 Definitions. The following definitions are provided to assure a uniform understanding of select terms as they are used in this standard.

Acceptance Criteria - A limit or limits placed on the variation permitted in the characteristics of an item expressed in definitive engineering terms such as dimensional tolerances, chemical composition limits, density and size of defects, temperature ranges, time limits, operating parameters, and other similar characteristics.

Checks - The tests, measurements, verifications or controls placed on an activity by means of investigations, comparisons, or examinations to determine satisfactory condition, accuracy, safety or performance.
**Engineering Limitations** - Restrictions which, if disregarded, may result in damage to the item, shortening the life of the item, or preventing the item from functioning as intended.

**Examination** - An element of inspection consisting of investigation of materials, components, supplies or services to determine conformance to those specified requirements which can be determined by such investigation. Examination is usually nondestructive and includes simple physical manipulation, gaging and measurement.

**Inspection** - An element of quality control which by means of examination, observation or measurement determines the conformance of materials, supplies, components, parts, appurtenances, systems, processes or structures to predetermined quality requirements.

**Mechanical Items** - Parts, components, or systems that function primarily for pressure retaining, mass moving, or heat exchange purposes. Examples of mechanical items are rotating equipment (motors, pumps, blowers), handling equipment (cranes, hoists, conveyors), coolant systems, fuel handling systems, and waste effluent systems.

**Testing** - The determination or verification of the capability of an item to meet specified requirements by subjecting the item to a set of physical, chemical, environmental or operating conditions.

**Verification** - An act of confirming, substantiating and assuring that an activity or condition has been implemented in conformance with the specified requirements.

Other terms and their definitions are contained in ANSI N45.2.10.

1.5 **Referenced Documents.** Documents that are required to be included as a part of this standard are identified at the point of reference and described in Section 8 of this standard. The issue or edition of the referenced document that is required will be specified either at the point of reference or in Section 8 of this standard unless otherwise specified in the contract document.

2. **GENERAL REQUIREMENTS**

This section contains requirements that are to be fulfilled by the organization or organizations responsible for performing any segment of work described in Section 3 through 5 of this standard.
Measures shall be established and implemented for documenting the necessary installation, inspection and testing to verify conformance to specified requirements.

2.1 Planning. Activities shall be planned and documented to be consistent with engineering and design requirements including those which define the degree of importance to safety and reliability of the item. Planning shall define the operations to be used and the systematic, sequential progression of operations, the personnel responsibilities for each activity and the measures employed to preserve the quality of the item.

Planning shall take into account the need for the identification or preparation and control of procedures and work instructions and the need for trained personnel necessary to comply with requirements for installation, inspection and testing of components and systems.

Planning shall include a review of the system and component design specifications, procurement documents and drawings and of the construction work plans and schedules to assure that applicable installation, inspection, and testing activities have been identified; that they can be accomplished as specified; and that time and resources are sufficient to accomplish the required actions. Identified deficiencies disclosed during planning shall be brought to the attention of the responsible organization for correction.

2.2 Procedures and Instructions. Installation, inspection and test procedures and work instructions identified during planning shall be prepared and documented for those activities falling within the scope of this standard. Where the planning review identifies new procedures and inspections that are necessary, appropriate target dates and effort shall be scheduled for their preparation and approval. These documents shall be kept current and revised as necessary to assure that installation, inspections, and tests are performed in accordance with latest approved information and shall include as appropriate:

a. Prerequisites identified in Subsection 2.9.
b. Precautions to be observed.
c. Installation requirements.
d. Sequential actions to be followed.
e. Test objectives.
f. Special equipment required for installation, inspection and test.
g. Identification of inspection and test equipment.
h. Frequency of inspection or test.
i. Inspection and test acceptance criteria.
j. Specific document references where required.
k. Data report forms.
l. Approvals.

2.3 Results. Inspection and test results shall be documented in a suitable test report or data sheet. Each report shall identify the item to which it applies, the procedures or instruction followed in performing the task and include the following:

a. Pertinent inspection and test data.
b. Significant dates and times.
c. Signature or stamp of inspector or tester.
d. Measuring and test equipment used where required.
e. Identification of nonconformances and action taken on other conditions that were not anticipated.

Test reports and data sheets shall include an evaluation of the acceptability of inspection and tests results and provide for identifying the individual who performed the evaluation.

2.4 Cleaning. Cleaning activities required by this standard shall be performed in accordance with ANSI N45.2.1.

2.5 Receiving, Storage and Handling. Receiving, storage and handling activities required by this standard shall be performed in accordance with ANSI N45.2.2.

2.6 Housekeeping. In areas, facilities, and environments where installation, inspection and testing of mechanical items is performed in accordance with the requirements of this standard, the housekeeping requirements shall be in accordance with ANSI N45.2.3.

2.7 Personnel Qualifications. Those personnel who perform inspection and testing activities required by this standard shall be qualified in accordance with ANSI N45.2.6.

2.8 Measuring and Test Equipment.

2.8.1 Selection. Measuring and test equipment used to implement the requirements of this standard shall be selected to have range, type and accuracy sufficient to determine conformance to specified requirements.
2.8.2 **Calibration and Control.** Measuring and test equipment used to determine compliance with specifications, shall be adjusted and calibrated at prescribed intervals against certified equipment having known valid relationships to nationally recognized standards. If no national standards exist, the basis for calibration shall be documented. Records of calibrations shall be maintained and equipment suitably marked so that the calibration status can be determined. Records of calibration shall be included in inspection and test results where applicable.

Measures shall be taken to assure proper handling, storage, and care of the measuring and test equipment after calibration in order to maintain the required accuracy of such equipment.

When measuring and test equipment is found to be out of calibration, an evaluation shall be made of the validity of previous inspection or test results and the acceptability of mechanical items inspected or tested since the last calibration check. Where necessary to determine the acceptability of suspect items, the required original inspections or tests shall be repeated using properly calibrated equipment.

2.9 **Prerequisites.** The following minimum conditions shall have been met or evidence thereof shall be available as applicable before the requirements set forth in this standard are applied:

a. Qualification of individuals, organizations and procedures have been completed in accordance with the requirements of applicable codes and standards.

b. Systems have been designed and engineered in accordance with applicable codes, standards and specifications.

c. Materials have been selected and equipment has been fabricated and assembled in accordance with the design specifications and the applicable published codes and standards, the conformance to which has been demonstrated by the responsible organization.

d. Engineering limitations and requirements as applicable, have been provided for incorporation in the procedures and instructions. These limitations and requirements shall include, as a minimum, installation, testing, and on-site fabrication processes such as cleaning, welding, nondestructive examination and parameters such as pressure, flow, speed, load limits (static and dynamic), travel limits, physical clearances, control and alarm settings,
environmental and thermal limits which are included in design specifications, manufacturer's data sheets, instruction manuals and design reports.

e. To substantiate (b) and (c) above, the following documents relating to the specific stage of installation activity for the item shall be available at the construction site:

1. The latest approved-for-construction drawings.
2. Equipment specifications.
3. Manufacturer's installation instructions.
4. Installation specifications.
5. Evidence of compliance by manufacturer with purchase requirements, including quality assurance requirements.
6. Evidence that engineering or design changes are documented and approved prior to installation.
7. Records of inspections and tests during on-site receiving, storage and handling.
8. Release of mechanical items for installation.
9. Evidence that nonconformances have been satisfactorily resolved or controlled.

3. PRE-INSTALLATION VERIFICATION

3.1 General. Prior to the actual installation of mechanical items, there are certain preliminary inspections, checks and similar activities that shall be completed to verify that the item and the installation area conform to specified requirements and the necessary resources are available to assure that the quality of the mechanical item will be maintained as the installation proceeds.

The quality requirements and quality assurance actions that are necessary during installation shall be reviewed and planned so that they are understood by responsible individuals.

3.2 Identification. Checks shall be made to verify that the identity of received mechanical materials and equipment has been maintained and is in accordance with the latest approved-for-construction drawings, equipment lists, specifications and established procedures. If these checks disclose apparent loss of identification, the identity shall be reaffirmed prior to release for installation.
Checks shall be made to verify that a control system for maintaining identification of mechanical items throughout installation has been established including provisions for control of substitution or exchange of equipment or materials. The procedures for control of identification shall provide a system of traceability to drawings, specifications or other records when identification or markings must be destroyed, hidden or removed from an item.

3.3 Processes and Procedures. Consistent with the construction activities schedule, inspections or checks shall be performed to verify that processes and procedures are ready when needed for use in the installation of mechanical items. These inspections or checks shall include, but not be limited to, the following verifications:

a. Approved procedures, drawings, manuals or other work instructions are provided to the installer at the construction site.

b. Special instructions and check lists as required are available at the installation area or attached to the item.

c. Approved procedures and instructions for special processes such as coating, welding, heat treating and nondestructive examination are available at the site.

d. Where applicable, personnel, procedures and instructions shall have been qualified through the preparation of workmanship standards, samples, or mockups that simulate actual job conditions.

e. Installation preparations have been completed, including such tasks as removal of packaging, conditioning, cleaning, and preliminary positioning.

f. Jigs, fixtures and equipment for special processes, if required, are available at the site and conform to specified requirements.

g. Equipment for handling and placement of mechanical items is available at the site and is adequate to perform the work in accordance with specified requirements.

h. Warnings and safety notices, appropriate to the activity, are posted.
3.4 **Physical Condition.** Inspections or checks as appropriate shall be performed to verify that mechanical items at the installation site are in accordance with the specified requirements and that quality has been maintained.

These inspections or checks shall include, but not be limited to, the following verifications:

a. Protective measures and physical integrity during storage have been maintained in conformance with specified requirements.

b. Nonconformances have been satisfactorily resolved or controlled.

c. Items have been cleaned in accordance with ANSI N45.2.1 where applicable.

3.5 **Site Conditions.** Inspections or checks as appropriate shall be performed to verify that conditions of the installation area conform to specified requirements and precautions have been taken to prevent conditions that will adversely affect the quality of the item during installation. These inspections or checks shall include, but not be limited to, the following to verify that:

a. Protection from adjacent construction activities is being provided including implementation of appropriate exclusion and area cleanliness requirements.

b. Protection from inclement weather and other ambient conditions adverse to quality is being provided.

c. Materials that may be deleterious to the mechanical item being installed, are controlled.

d. Installation of the mechanical item will not adversely affect the subsequent installation of other materials and equipment and that repair or rework on any nonconforming items can be performed satisfactorily.

e. Nonconformances for adjacent items have been dispositioned or controlled.

f. Adequate permanent or approved temporary supports and mountings have been installed that will properly interface with the mechanical item.
g. Mating parts such as couplings and flanges are properly positioned and conditioned.

h. Servicing or maintenance activity related to installation has been performed.

4. CONTROL DURING INSTALLATION PROCESS

4.1 General. Checking, inspection, examination or testing activities shall be performed during the installation of mechanical items to assure that the required quality is being obtained in accordance with prescribed procedures. These activities shall be performed in a systematic manner to assure surveillance throughout the installation process. A procedure shall be provided for the coordination and sequencing of these activities at established inspection points in successive stages of installation.

A method shall be implemented to assure that engineering and design changes are documented and controlled during installation.

4.2 Process and Procedure Control. Checks shall be made to verify that a system of controls has been established and is being maintained at the construction site to assure the following:

a. The latest revision of approved procedures, drawings and instructions are being followed.

b. Qualified and approved special processes, materials, tools and other equipment are being used by qualified personnel.

c. The status of installation, inspections, examinations or tests is clearly indicated or identified in inspection records.

d. The installation, inspection and testing sequence is being maintained.

e. Identification, appropriate segregation, and disposition of non-conforming items are being controlled.

f. "As-built" information is being processed.

g. Inspection and test reports are current, accurate and complete.

4.3 Examination. Nondestructive examinations, when required, shall be performed to an approved procedure. Examples of these examinations are liquid penetrant, magnetic particle, ultrasonic, eddy current and radiography.
4.4 Inspection. Inspections of the work areas and the work in progress shall be performed to verify that mechanical items are being located, installed, assembled or connected in compliance with the latest approved-for-construction drawings, manufacturers' instructions, codes, installation instructions and procedures. Inspections performed shall include as appropriate, but not be limited to, the following:

a. Identification.
b. Location and orientation of components.
c. Levelling and alignment.
d. Clearances and tolerances.
e. Tightness of connections and fastenings.
f. Fluid levels and pressures.
g. Absence of leakage.
h. Physical integrity.
i. Cleanliness.
j. Welding operations including materials and process controls, adequate purging, and the removal of purge dams on completion.
k. Adequacy of protective measures to assure that the item will not be damaged during installation.
l. Adequacy of housekeeping, barriers and protective equipment to assure that items will not be damaged or contaminated as a result of adjacent construction activities.

4.5 Installation Checks. Checks shall be performed to verify that mechanical items have been correctly installed and will function properly so that the initial starting of items and preoperational testing can proceed with a minimum amount of problems and delays. If construction or associated activity affects the results of these checks, the checks shall be repeated if necessary to assure that the quality has not been adversely affected.

These activities shall include as appropriate, but not be limited to, the following:

a. Checkout procedures are prepared and approved to verify correctness of installation and ability to function.
b. Proper greasing or lubrication has been completed.
c. Lubricating and cooling water systems are in service.
d. Protection strainers are installed where necessary.
e. Rotation of prime movers is correct.

f. Electrical circuits, controls and relay settings are correct.

h. Instrumentation is calibrated and in service as required.
i. Item is correctly valved and isolated.
j. Casings, reservoirs, etc., are primed, vented and filled.
k. Proper communications are established for control.
l. Tags are issued, where appropriate, for isolation and control.
m. Piping alignment is correct.
n. Pipe hanger placement is correct and hangers will function properly.
o. Valve glands and packing are installed.
p. Pneumatic lines have been blown.
q. Valve stroking, actuation and settings are proper.
r. Pump seals and packing are properly installed.
s. Handling limit switches, interlocks and stops are checked.

4.5.1 Cleaning. Installed systems and components shall be cleaned, flushed and conditioned according to the requirements of ANSI N45.2.1. Special attention shall be given to the following requirements:

a. Chemical Conditioning. Procedures shall be prepared including the scope, acceptance criteria, sequence, temperatures, soak periods and neutralizing solutions to be used. Checks shall be made to verify that the proper chemicals at the designated strength and temperature are being used in the conditioning operations.

Other operations shall be performed as specified in Paragraph 4.5.1.c.

b. Flushing. Procedures shall be prepared including routes, boundaries, velocities, acceptance criteria, restoration, and layup for high integrity systems where appropriate. Checks shall be made to verify that mechanical items are being flushed in accordance with specified requirements so that contaminants or flow velocities will not adversely affect subsequent operations.

Other operations shall be performed as specified in Paragraph 4.5.1.c.

c. Process Controls. Checks shall be performed to verify that controls are functioning for the following:
(1) Removal and installation of parts or components such as metering devices, orifice plates and valve internals that are removed from the system to facilitate flushing.

(2) Installation and removal of temporary strainers, blind flanges, and piping.

(3) Isolation of sensitive instrumentation.

(4) Water and chemical quality.

(5) Acceptance data, specimens, or progressive samples if required.

Where appropriate for disassembly and reassembly of components, procedures or instructions shall be prepared or manufacturer's technical manuals shall be used to assure adherence to match marks, protection of seats and proper reassembly and to preclude damage to the component.

4.5.2 Hydrostatic Testing. Checks shall be made to verify that mechanical items are being hydrostatically tested in accordance with specified requirements to assure that the strength and integrity of the installed systems or portions thereof conform to specified requirements. The purpose of the test, scope, test boundary, duration for inspection, acceptance criteria, restoration, and layup shall be clearly established and documented. Checks shall include, but not be limited to, the following:

a. Appropriate pressures, temperatures, water chemistry, and hydrostatic test cycles are established.

b. Sufficient time at test pressure is specified to determine acceptance.

c. Provisions for control of protection and isolation of instrumentation is established and maintained.

d. Items external to test boundary are protected to prevent inadvertent overpressurization.

e. Relief device(s) are controlled to prevent system overpressurization.

f. Gaging and ungaging of relief valves.

4.6 Care of Items. Items on which inspection and testing activities are being performed shall be protected from personnel traffic, weather, and adjacent construction activities such as sandblasting, acid cleaning, welding, jack hammering, chipping, burning and stress relieving that would adversely affect the quality of the item or test results. Such protection shall be
provide through good cleanliness and housekeeping practices, temporary packaging, erection of barriers, protective covers, and walkways as required in accordance with Subsection 2.6.

Temporary use of equipment or facilities to which this standard applies that are to become part of the completed project may be desirable. Authorization for such usage shall be as provided for in the contract or by written approval from the responsible organization. Such temporary use shall not subject the equipment or systems to conditions for which they are not designed.

The temporary use authorization shall include: (1) conditions of use or operation; (2) maintenance requirements; and (3) inspections and tests as required to maintain operability and quality during period of temporary use of the item. When temporary use is completed, conditions of temporary use shall be evaluated to verify that the used equipment continues to satisfy the specified requirements.

5. INSTALLED SYSTEMS INSPECTION AND TESTS

5.1 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 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 "as-built" documents reflect field modifications and other changes made and controlled during installation activities.

Controls shall be provided for the identification, documentation, and resolution of nonconformances disclosed by inspection 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 procedure 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 the 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 has been preserved with provisions for traceability throughout the installed systems.

h. Safety features such as interlocks, cable separation, 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 by-pass lines and temporary trip points of control equipment are identified and documented so that their final condition can be verified.

j. System fluid chemistry is appropriate for operational testing.

k. External surface chemistry requirements have been maintained.

l. Permits and authorizations have been obtained.

5.2 Preoperational Testing. This testing involves the operation of all items in a system, partial systems or systems 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, and handling adaptors, and accessories.
h. Containment systems.
i. Air handling systems.
j. Fuel storage and handling systems.
k. Reactor components handling systems.
l. Instrument air systems.
m. Fluid services systems.
n. Waste effluent systems.
o. 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.

For additional information on inspections, tests and procedures, see Section 6 of ANSI N18.7.

5.3 Cold Functional Tests. These tests follow preoperational testing of individual systems including reactor coolant systems. This testing shall be performed to obtain operational data of equipment with maximum allowable simultaneous operation of interfacing systems and equipment and final verification of functional performance of these systems.

5.3.1 Reactor Coolant System Hydrostatic Tests. As applicable to the reactor system type, hydrostatic tests to verify conformance to specified requirements when performed on the reactor coolant system, shall include all or parts of connected systems which cannot be isolated from the test
pressure. The description of the pressure test boundary shall include parts of systems which can be isolated from the test pressure but which have not been successfully tested. In conducting the pressure test, temperature and pressure cycle limitations and requirements for coordinated primary and secondary balancing pressure or steam generation shall be considered.

5.3.2 Functional and Flow Testing. When practicable, 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 tests 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. Systems 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.

5.4 Hot Functional Tests. These tests are not applicable to BWR and HTGR nuclear plants because these plants use nuclear heat to produce the system temperatures. Hot functional tests for PWR plants follow cold functional tests and simulate plant operation conditions at elevated temperatures and pressures. All auxiliary and support systems exclusive of those required for pre-criticality testing must be available for these tests. If any of these systems are not available, the responsible organization shall specifically authorize exclusion of these systems or subsystems from testing and document those exceptions.

These tests shall include the following as a minimum:

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. Systems stability.
h. Adequacy of pipe and equipment support settings.
i. Heat runs on rotating equipment.
j. Verification of heat exchanger performance.
k. Verification of boron control system performance.
l. Thermal insulation effectiveness.
m. Set points of temperature, pressure and level devices.
n. System heatup tests.
o. System cooldown tests.
p. Hot flow tests.
q. Setting protective devices.
r. Hot clearances.
s. Vibration measurements for major equipment and piping, as applicable.

6. DATA ANALYSIS AND EVALUATION

Procedures shall be established for processing inspection and test data and their analysis, evaluation, and final acceptance. These procedures shall identify individuals or organizations responsible for the acquisition and reduction of inspection and test data and evaluation against acceptance criteria, operating limits, and performance standards. The data processing procedure should provide for preliminary evaluation to determine the validity of the inspection and test results, and the appropriateness of continuing the inspection or test. The data shall be analyzed and evaluated to verify completeness of results, achievement of inspection and test objectives, and operational proficiency of equipment and systems; to identify additional inspection or test requirements or both; and to identify necessary changes to the installation inspection or test procedures. Inspection and test results supported by the inspection and test data, together with a report of data analysis and evaluation, shall be provided as specified in Section 7.
7. RECORDS

Record copies of completed procedures; reports; required qualification records; test equipment calibration records; test deviation or exception records; and inspection, examination and check records shall be prepared. These shall be placed with other project records as required by code, standard, specification or project procedures.

Collection, storage and maintenance of quality assurance records shall be in accordance with ANSI N45.2.9.

8. REVISION OF AMERICAN NATIONAL STANDARDS REFERRED TO IN THIS DOCUMENT

When the following standards referred to in this document are superseded by a revision approved by the American National Standards Institute, the revision shall apply.

N18.7 Standard for Administrative Controls for Nuclear Power Plants
N45.2 Quality Assurance Program Requirements for Nuclear Power Plants
N45.2.1 Cleaning of Fluid Systems and Associated Components During the Construction Phase of Nuclear Power Plants
N45.2.2 Packaging, Shipping, Receiving, Storage and Handling of Items for Nuclear Power Plants (During the Construction Phase)
N45.2.3 Housekeeping During the Construction Phase of Nuclear Power Plants
N45.2.6 Qualifications of Inspection, Examination and Testing Personnel for the Construction Phase of Nuclear Power Plants
N45.2.9 Requirements for Collection, Storage, and Maintenance of Quality Assurance Records for Nuclear Power Plants
N45.2.10 Quality Assurance Terms and Definitions
American National Standard
for
Reactor Plants and Their Maintenance

Requirements for Collection, Storage, and Maintenance of
Quality Assurance Records
for
Nuclear Power Plants

ANSI N45.2.9 - 1974

Secretariat
The American Society of Mechanical Engineers

15th Draft - Rev 0
4/3/74
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FOREWORD

(This Foreword is not a part of ANSI Standard Requirements for Quality Assurance Records for Nuclear Power Plants N45.2.9 - 1973.)

This standard provides requirements and guidelines for the collection, storage, and maintenance of quality assurance records associated with the design, construction, and operation phase activities related to structures, systems, and components of nuclear power plants. This standard was developed under sponsorship of the American Society of Mechanical Engineers (ASME) as an effort by the American National Standards Institute (ANSI) Standards Committee N45, Reactor Plants and Their Maintenance. This committee is chartered to promote the development of standards for the location, design, construction, and maintenance of nuclear reactors and plants embodying nuclear reactors, including equipment, methods, and components specifically for this purpose.

In May, 1969, the ASME Boiler and Pressure Vessel Committee's subcommittee on nuclear power expanded its scope of activities to include major components of the nuclear power system of a plant. New Sections III and XI of the Boiler and Pressure Vessel Code were prepared and was published as the 1971 Edition of the Code. The quality assurance provisions of the Code apply directly to owners, manufacturers, and installers of nuclear power system components and include provisions for the establishment and execution of a quality assurance program including requirements for records on activities covered by the Code.

In April of 1970, the N45 Committee of ANSI established a subcommittee N45-3 to guide the preparation of nuclear quality assurance standards. This subcommittee is responsible for establishing guidelines and policy to govern the scope and content of the various standards; monitoring the status of standards in process; recommending preparation of additional standards; and final approval of standards prior to their submittal to the N45 Committee for balloting.

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In December 1970, the N45-3 Subcommittee of ANSI established an ad hoc subcommittee, which was subsequently designated the N45-3.9 Working Group, on Quality Assurance Records. The purpose of this Working Group was to prepare a standard for general industry use that would define requirements for the collection, storage, and maintenance of records related to and associated with the location, design, construction, and operation phase activity of nuclear power plant systems and components. The Working Group was composed of representatives of key segments of the nuclear industry, including utilities, reactor suppliers, architect-engineer constructors, and the AEC. The standard contained herein was developed from this activity. The initial draft was prepared in August 1971.

The ASME Boiler and Pressure Vessel Code (Hereafter referred to as the Code) as well as other ANSI Standards, have been considered in the development of this standard, and this standard is intended to be compatible with their requirements.

However, this standard does not apply to activities covered by Section III Division 1 and 2 and Section XI of the Code for those activities covered by the Code.

Working with the N45-3 Subcommittee and concurrently with the Quality Assurance Records Working Group's development of this standard, other ad hoc Committees of N45 are developing a series of standards that set forth more detailed requirements for certain activities to assure quality of nuclear power plants. These will be coordinated with the requirements of this standard as they are developed.

In September 1971, these ad hoc Committees were changed to working groups. In November 1972 the N45-3 Subcommittee was renamed N45-2 and the working groups were changed to N45-2.1 etc. At this time these working groups had the following associated standards in preparation:
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<td>A. Breed</td>
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<td>J. W. Hallowell</td>
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<td>J. I. Martone*</td>
<td>Long Island Lighting Company</td>
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<td>W. M. Morrison</td>
<td>U. S. Atomic Energy Commission</td>
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<tr>
<td>D. A. Quinn</td>
<td>Stone &amp; Webster Engineering Corporation</td>
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*Signed 1973

Suggestions for improvement gained in the use of this standard will be welcomed. They should be sent to American National Standards Institute, 1430 Broadway, New York, New York 10018.

The following personnel are members of this group:

R. S. Bain, Chairman
A. Breed, Secretary

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REQUIREMENTS FOR COLLECTION, STORAGE, AND MAINTENANCE OF
QUALITY ASSURANCE RECORDS
FOR NUCLEAR POWER PLANTS

1. INTRODUCTION

1.1 Scope. The standard provides general requirements and guidelines for the
collection, storage, and maintenance of quality assurance records associated with
manufacture, the design, construction, and operation phase activities of nuclear power plants.
It is not intended to cover the preparation of the records, nor to include working
documents not yet designated as quality assurance records.

1.2 Applicability. The requirements of this standard apply to the work of any
individual or organization that participates in collection, storage, or maintenance
of quality assurance records associated with nuclear power plants. The extent to
which the individual or total requirements of this standard apply will depend upon
the nature and scope of the work to be performed and the importance of the item or
service involved, and shall be specified in the procurement documents. The re-
quirements are intended to assure that records are available when needed for their
intended purpose.

The ASME Boiler and Pressure Vessel Code (Hereafter referred to as the Code)
as well as other ANSI Standards, has been considered in the development of this
standard, and this standard is intended to be compatible with their requirements.
However, this standard does not apply to activities covered by Section III
Division 1 and 2 and Section XI of the Code for those activities covered by the
Code.

This standard is intended to be used in conjunction with ANSI N45.2.
1.3 Responsibility. The organization or organizations responsible for establishing the applicable requirements for the activities covered by this standard shall be identified and the scope of their responsibilities shall be documented. The work of establishing practices and procedures and providing the resources in terms of personnel, facilities, and services necessary to implement the requirements of this standard may be delegated to other organizations and such delegation shall also be documented. It is the responsibility of each organization performing work covered by this standard to comply with requirements of this standard applicable to its work.

1.4 Definitions. The following definitions are provided to assure a uniform understanding of select terms as they are used in this standard.

Quality Assurance Records. Those records which furnish documentary evidence of the quality of items and of activities affecting quality. For the purposes of this standard a document is considered a quality assurance record when the document has been completed.

Other terms and their definitions are contained in ANSI N45.2.10.

1.5 Referenced Documents. Other documents that are required to be included as a part of this standard are either identified at the point of reference or described in Section 8 of this standard. The issue or edition of the referenced document that is required will be specified either at the point of reference or in Section 8 of this standard.
2. GENERAL REQUIREMENTS

This section sets forth general requirements for the control of quality assurance records. The requirements include collection, filing, storing, maintenance and disposition of records required by other codes, standards, specifications, or regulatory requirements. The procedures to be employed to perform the required activities shall be planned and documented.

2.1 Quality Assurance Record System. A quality assurance records system shall be established by the organization responsible at the earliest practicable time, consistent with the schedule for accomplishing work activities and in compliance with the general requirements of this standard. The quality assurance records system shall be defined, implemented and enforced in accordance with written procedures, instructions and other documentation.

2.2 Categories. Two categories of quality assurance records are established - lifetime and nonpermanent.

2.2.1 Lifetime Quality Assurance Records. Lifetime records are those which meet one or more of the following criteria:

(1) Those which would be of significant value in demonstrating capability for safe operation.

(2) Those which would be of significant value in maintaining, reworking, repairing, replacing, or modifying the item.

(3) Those which would be of significant value in determining the cause of an accident or malfunction of an item.
(4) Those which provide required baseline data for inservice inspection.

Lifetime quality assurance records are required to be maintained by or for the plant owner for the life of the particular item while it is installed in the plant or stored for future use.

2.2.2 Nonpermanent Quality Assurance Records. Nonpermanent records are those which meet all of the following criteria:

(1) Those of no significant value in demonstrating capability for safe operation.

(2) Those of no significant value in maintaining, reworking, repairing, replacing, or modifying the item.

(3) Those of no significant value in determining the cause of an accident or malfunction of an item.

(4) Those which do not provide baseline data for inservice inspection.

Nonpermanent records are required to show evidence that an activity was performed in accordance with the applicable requirements but need not be retained for the life of the item.

3. TECHNICAL REQUIREMENTS

3.1 General. This section provides requirements for the retention and control of those records generated during the various phases of the project.
3.2 Records Administrations

3.2.1 Generation of Quality Assurance Records. It is not the intent of this standard to specify the preparation of the quality assurance records to be generated. The applicable design specifications, procurement documents, test procedures, operational procedures or other documents shall specify the quality assurance records to be generated by, supplied to, or held for the owner. All such quality assurance records shall be legible, completely filled out and adequately identifiable to the item involved.

The applicable quality assurance records shall be considered valid only if stamped or initialed or signed or otherwise authenticated and dated by authorized personnel. These records may be either the original or a reproduced copy.

3.2.2 Index. The quality assurance records shall be listed in an index. The index shall indicate, as a minimum, record retention times, where the records are to be stored and the location of the records within the storage area. The index should be established prior to receipt of the records. Index systems used by organizations for the retention of project records should include sufficient identifying information to be compatible with the index system used by the Owner for final storage of records.

3.2.3 Distribution. The quality assurance records shall be distributed and handled in accordance with written procedures.

3.2.4 Identification. Quality assurance records shall provide sufficient information to permit identification between the record and the item or items or activity to which it applies.

3.2.5 Classification. Quality assurance records shall be classified as "Lifetime" or "Nonpermanent" in accordance with Section 2 of this standard.
3.2.6 Supplemental Information to Quality Assurance Records. Quality assurance records may be corrected or supplemented in accordance with procedures which provide for appropriate review or approval by the originating organization. The correction or supplement shall include the date and the identification of the person authorized to issue such corrections or supplements.

3.2.7 Retention of Records. Types of quality assurance records with minimum recommended retention periods are listed in Appendix A of this standard. It should be recognized that the nomenclature of these records may vary. For records not listed in Appendix A, the type most nearly describing the record in question should be followed with respect to its retention period.

For records generated prior to commercial operation, the retention period begins on the date of commercial operation. For records generated on items installed after commercial operation, the retention period begins on the date upon which satisfactory operation of the item, as part of a system, has been demonstrated. For periodic maintenance, inspection and test records, such as calibration records, generated after the date of commercial operation, the retention time begins on the date of their generation. When a record is generated as a result of an operational phase activity, the classification of those records will be the same as those types of records generated during the initial construction period.

The organization responsible shall establish in writing the retention times of records not listed in Appendix A.

4. RECEIPT OF RECORDS

4.1 General. This section defines requirements for receipt of documentation during the design, procurement, manufacturing, installation, startup and operation of a nuclear power plant.

The designated authority or authorities for receiving quality assurance records shall be aware of the value of such records and shall control their safety during the time that the records are in their possession.
4.2 **Timeliness.** To assure their availability, a specific submittal plan shall be established for quality assurance records by agreement between the purchaser and supplier.

4.3 **Receipt Control.** Each organization responsible for the receipt of quality assurance records shall designate a person or agency responsible for receiving the records. The designated authority shall be responsible for organizing and implementing a system of receipt control of quality assurance records. This system shall apply to the receipt of records into a temporary working file and the permanent storage file.

As a minimum, a receipt control system shall include:

1. A records check list designating the required quality assurance records.
2. A record of Quality Assurance records received.
3. Procedures for receipt and inspection of incoming records.

4.4 **Status.** Each receipt control system shall be structured to permit a current and accurate assessment of the status of quality assurance records during the receiving process.

5. **STORAGE, PRESERVATION AND SAFEKEEPING**

5.1 **General.** This section establishes storage requirements for the maintenance, preservation and protection of quality assurance record files from the time of receipt until their ultimate disposal.
5.2 Location of Facilities. The quality assurance record files shall be stored in predetermined locations as necessary to meet the requirements of applicable standards, codes, and regulatory agencies.

5.3 Storage. Prior to storage of records in a quality assurance record file, a written storage procedure shall be prepared and a custodian shall be designated with the responsibility to enforce the procedure. This procedure shall include the following as a minimum:

(1) A description of the storage area.
(2) The filing system to be used.
(3) A method for verifying that the records received are in agreement with the transmittal document and that the records are in good condition.
(4) A method of verifying that the records agree with the pre-established records check list (see Subsection 4.3 of this standard).
(5) The rules governing access to and control of the files.
(6) A method for maintaining control of and accountability for records removed from the storage facility.
(7) A method for filing supplemental information (see paragraph 3.2.6) and disposing of superseded records.
5.4 Preservation. Records shall be stored in a manner approved by the organization or organizations responsible for the files. In order to preclude deterioration of the records the following requirements shall apply:

(1) Condensation. Provisions shall be made in the storage arrangement to prevent damage from condensation.

(2) Loose Records. Records shall not be stored loose. They shall be firmly attached in binders or placed in folders or envelopes for storage on shelving in containers. Steel file cabinets are preferred.

(3) Special Processed Records. Special processed records (such as radiographs, photographs, negatives, and microfilm) which are light-sensitive, pressure sensitive or temperature sensitive shall be packaged and stored as recommended by the manufacturer of these materials.
5.5 Safekeeping. A full time security system shall be established to preclude the entry of unauthorized personnel into the storage area. This system shall guard against larceny and vandalism.

5.6 Facility. Permanent and temporary record storage facilities shall be so constructed or located as to protect contents from possible destruction by causes such as fire, flooding, tornadoes, insects, rodents and from possible deterioration by a combination of extreme variations in temperature and humidity conditions.

A satisfactory alternative to the establishing of a record storage facility is maintenance of duplicate records stored in a separate remote location.

Records discussed in this standard are appropriately classified for fire protection purposes as National Fire Protection Association Class I and as such should be afforded the equivalent protection of a NFPA Class A, four hour minimum rated facility.

Where a single record storage facility is maintained, at least the following features should be considered in its construction:

(1) Reinforced concrete, concrete block, masonry, or equal construction.
(2) Concrete floor and roof with sufficient slope for drainage; if a floor drain is provided, a check valve (or equal) shall be included.
(3) Structure, doors, frames and hardware should be Class A fire-rated with a recommended four hour minimum rating.
(4) Sealant applied over walls as a moisture or condensation barrier.
(5) Surface sealant on floor providing a hard-wear surface to minimize concrete dusting.
(6) Foundation sealant and provision for drainage.
(7) Forced-air circulation with filter system.
(8) Adequate fire protection system.
(9) No pipe other than those providing fire protection to the storage facility is to be located within the facility.

For storage of film and other special processed records, humidity and temperature controls shall be provided to maintain an environment as recommended by the manufacturer.

5.7 Audits. An audit system shall be established to assure that the quality assurance records' storage system is effective. The following shall be performed as a minimum:

(1) Periodic surveys to assure that records logged in are available and have been placed in their proper location within the files, and to assure that the control system is adequate.

(2) Periodic audits to assure that the facilities are in good condition and that the temperature/humidity controls and protective devices are functioning properly.

(3) Periodic audits of the records to assure that the documents are not deteriorating due to improper storage practices or rough handling.

6. RETRIEVAL

6.1 General. This section is intended to establish requirements for the retrieval of documents that are stored within the quality assurance record files.
6.2 **Accessibility.** Storage systems shall provide for the accurate retrieval of information without undue delay.

A list shall be generated designating those personnel who shall have access to the files.

Quality Assurance records maintained by a manufacturer at his facility or other location shall be accessible to the Buyer or Owner, in the case of lifetime records for the life of the items involved or for the designated retention periods for nonpermanent records.

7. **DISPOSITION**

7.1 **General.** This section is intended to provide requirements for the transfer of quality assurance records to the Owner, who has ultimate responsibility for these documents, and their disposition.

7.2 **Accumulation and Transfer of Records.** Quality assurance records accumulated at various locations prior to final transfer to the Owner shall be made accessible to the Owner directly, or through the procuring organization. Examples of such records are vendor manufacturing records, construction documentation, and startup data. Upon final transfer, the Owner shall inventory the submittals, acknowledge receipt and process these records in accordance with this Standard.

7.3 **Disposition of Nonpermanent Records.** Records classified as nonpermanent should be retained for at least the minimum period of time as recommended in Appendix A. After this time, these records may be disposed of by or with concurrence of the Owner.
8. REVISIONS OF REFERENCED ANSI STANDARDS

When the following standards referred to in this document are superseded by a revision approved by the American National Standards Institute, the revision shall apply.

N45.2 Quality Assurance Requirements for Nuclear Power Plants

N45.2.10 Quality Assurance Terms and Definitions
APPENDIX A

The following is a list of types of records with the retention periods indicated (see Subsection 3.2.7 of this standard). For definition of lifetime records see paragraph 2.2.1, and for nonpermanent records see paragraph 2.2.2. In the nonpermanent column the number indicates the retention period in years after which the record need not be maintained.

/recommended

The 0 years minimum retention period is intended to permit dispositioning of the records on the day following the date of commercial operation. One year retention is intended to require maintenance of the record for the customary periods of warranty. Two year retention is intended to require maintenance of the record through the first overhaul or reload. Five and six year retention is intended to achieve compliance with the regulatory requirements.
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4 User's Tensile Test Reports on Reinforcing

5 Steel Splices

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7 A.4.3 Welding.

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9 Ferrite Test Procedures

10 Ferrite Test Results X

11 Heat Treatment Procedures

12 Heat Treatment Records X

13 Liquid Penetrant Test Procedures

14 Liquid Penetrant Test Final Results X

15 Magnetic Particle Test Procedures

16 Magnetic Particle Test Final Results X

17 Major Weld Repair Procedures and Results X

18 Radiographic Test Procedures

19 Radiographic Test Final Results X

20 Ultrasonic Test Procedures

21 Ultrasonic Test Final Results X

22 Weld Fit-Up Reports

23 Weld Location Diagrams

24 Weld Procedures X

25 Weld Procedures Qualifications and Results

26 Welding Filler Metal Material Reports X

27 Welding Materials Control Procedures

28 Welding Personnel Qualifications

29

30 A.4.4 Mechanical.

31

32 Chemical Composition User's Test

33 (Grab Samples) for Thermal Insulation

34 Chemical Tests of Water Used for Mixing

35 Insulation Cement

36 Cleaning Procedures and Results

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A.4.6 General.

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| Field Audit Reports                                                      |          | 6            |
| Field Quality Assurance Manuals                                           |          | 2            |
| Final Inspection Reports and Releases                                     | X        |              |
| Nonconformance Reports                                                    |          | X            |
| Special Tool Calibration Records                                          |          | (Until Recalibrated) |
| Specifications and Drawings                                               |          | X            |</p>
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Caution Notice - This standard is being prepared or reviewed and has not been approved by The American National Standards Institute. It is subject to revision or withdrawal before issue.

American National Standard for Reactor Plants and Their Maintenance

REQUIREMENTS FOR AUDITING OF QUALITY ASSURANCE PROGRAMS FOR NUCLEAR POWER PLANTS

ANSI N45.2.12 - 1974

Sponsor

The American National Standards Institute

Draft 3 Rev 4
February 22, 1974
An American National Standard implies a consensus of those substantially concerned with its scope and provisions. An American National Standard is intended as a guide to aid the manufacturer, the consumer, and the general public. The existence of an American National Standard does not in any respect preclude anyone, whether he has approved the standard or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standard. American National Standards are subject to periodic review and users are cautioned to obtain the latest editions.

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FOREWORD

(This foreword is not a part of American National Standard Requirements for Auditing of Quality Assurance Programs for Nuclear Power Plants)

This standard delineates requirements for establishing and implementing a system of internal and external audits that would apply to quality assurance programs for nuclear power plants. The standard was developed under sponsorship of the American National Standards Institute's Committee N45 on Reactor Plants and their Maintenance. This committee has been chartered to promote the development of standards for the location, design, construction, and maintenance of nuclear reactors and plants embodying nuclear reactors, including equipment, methods, and components.

In April 1970, the N45 Committee of the American National Standard Institute established a subcommittee N45-3 to guide the preparation of nuclear quality assurance standards. This subcommittee is responsible for establishing guidelines and policy to govern the scope and content of the various standards; monitoring the status of standards in process; recommending preparation of additional standards; and approval of standards prior to their submittal to the N45 Committee for balloting.

In February 1972, the N45-3 Subcommittee of the American National Standards Institute established a work group N45-3.12 on Audits. The purpose of this work group was to prepare a standard for general industry use that would define an auditing practice applicable to quality assurance program activities used to assure attainment of quality construction. The work group was composed of representatives of key segments of the nuclear industry, including utilities, reactor suppliers, equipment manufacturers, architect-engineers, constructors, and insurance agencies. The standard contained herein was developed from this activity. The initial draft of this standard was prepared in January 1973.

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Working with the N45.3 Subcommittee and concurrently with the development of this standard, other working groups of N45 are developing a series of standards that set forth more detailed requirements for certain activities to assure quality of nuclear power plants. These requirements will be coordinated with the requirements of this standard as they are developed.

In October 1972, the N45.3 Subcommittee was numbered N45-2, and the work groups were renumbered accordingly. As of April 1973, the following associated standards were in preparation or issued:

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<td>N45-2.5</td>
<td>Supplementary Quality Assurance Requirements for Installation and Testing of Structural Concrete and Structural Steel During the Construction Phase of Nuclear Power Plants</td>
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Quality Assurance Requirements for the Design of Nuclear Power Plants

Supplementary Quality Assurance Requirements for Preparation of Procurement Documents for Nuclear Power Plants

Supplementary Quality Assurance Requirements During the Manufacture of Class IE Instrumentation and Electric Equipment for Nuclear Power Generating Stations

Suggestions for improvement gained in the use of this standard will be welcomed. They should be sent to American National Standards Institute, 1430 Broadway, New York, New York 10018.

The Work Group on Audits included the following personnel during the development of this standard:

<table>
<thead>
<tr>
<th>Name of Representative</th>
<th>Organization Represented</th>
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<tr>
<td>F. W. Knight, Chairman</td>
<td>G. R. Hosack, Secretary</td>
</tr>
<tr>
<td>H. R. Banks</td>
<td>Carolina Power and Light</td>
</tr>
<tr>
<td>J. N. Babcock</td>
<td>United Engineers and Constructors</td>
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<td>T. L. Bonnough</td>
<td>Offshore Power Systems</td>
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<td>A. W. Crevasse</td>
<td>Tennessee Valley Authority</td>
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<td>A. E. Henderson, Jr.</td>
<td>Louisiana Power and Light</td>
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<td>G. R. Hosack</td>
<td>General Electric Company</td>
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<td>A. K. Hasija</td>
<td>Nuclear Energy Liability Insurance Association/Mutual Atomic Energy Liability Underwriters</td>
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<tr>
<td>F. W. Knight</td>
<td>Westinghouse Electric Corporation</td>
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<td>F. J. Long</td>
<td>U. S. Atomic Energy Commission</td>
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<td>J. H. Marshall</td>
<td>Niagara Mohawk Power Corporation</td>
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REQUIREMENTS FOR AUDITING
OF QUALITY ASSURANCE PROGRAMS
FOR NUCLEAR POWER PLANTS

1. INTRODUCTION

1.1 Scope. This standard provides requirements and guidance for establishing and implementing a system of internal and external audits of quality assurance programs for nuclear power plants, including the preparation, performance, reporting, and followup of audits of quality assurance programs for nuclear power plants. The activities covered by this standard include designing, purchasing, fabricating, handling, shipping, storing, cleaning, erecting, installing, inspecting, testing, maintaining, repairing, and modifying of Nuclear Power Plants.

This standard amplifies the audit requirements of American National Standard N45.2 and shall be used in conjunction with that standard.

1.2 Applicability. The requirements of this standard apply to both internal and external audits performed by or for the plant owner, contractors, and other organizations participating in activities affecting the quality of structures, systems, and components of nuclear power plants which are subject to audit in accordance with requirements of ANSI N45.2. This standard is not applicable to surveillance or inspections for the purpose of process control or product acceptance.
1.3 Responsibility. The organization or organizations responsible for implementation of the applicable requirements of this standard shall be identified and the scope of their responsibilities and authorities shall be documented. The work of establishing practices and procedures and providing the resources in terms of personnel, equipment and services necessary to meet the requirements of this may be delegated to other organizations and such delegation shall also be documented. It is the responsibility of each organization performing any activity covered by this standard to comply with the procedures and instructions issued for the project and to conform to the requirements of this standard applicable to his work these activities.

The organizational structure, functional responsibilities, levels of authority, and lines of internal and external communication for management direction of audits of the Quality-Assurance quality assurance program, shall be documented. Where multiple organizational arrangements exist, the interface responsibilities of each organization shall be clearly defined and documented. In no way shall the performance of audits by an organization diminish the responsibility of the audited organization or contractor for audit of his designated portion of the Quality-Assurance quality assurance program.

1.4 Definitions. The following definitions are provided to assure a uniform understanding of select terms as they are used in this standard:

Audit - A documented activity performed in accordance with written procedures or checklists to verify, by examination and evaluation of objective evidence, that applicable elements of the quality assurance Quality-Assurance program have been developed, documented and effectively implemented in accordance with specified requirements. An audit does not include surveillance or inspection for the purpose of process control or product acceptance.
1 Internal Audits - Audits of those portions of an organization's Quality Assurance program retained under its direct control and within its organizational structure.

External Audits - Audits of those portions of an organization's Quality Assurance program not retained under its direct control and not within its organizational structure.

Other terms and their definitions are contained in ANSI N45.2.10.

NOTE: N45.2.12 Work Group has petitioned N45.2.10 Work Group to change the definitions as indicated above.

1.5 Referenced Documents. Documents that are required to be included as a part of this standard are identified at the point of reference and described in Section 6 of this standard. The issue or edition of the referenced document that is required will be specified either at the point of reference or in Section 6 of this standard unless otherwise specified in the contract document.

2. PERSONNEL

2.1 General. The responsible auditing organization shall select and assign qualified auditors who are independent of any direct responsibility for performance of the activities which they will audit.

In the case of internal audits, the persons having direct responsibility for performance of the activities being audited shall not be involved in the selection of the audit team.

2.2 Personnel Qualification. The responsible auditing organization shall establish the audit personnel qualifications and the requirements for the use of technical specialists to accomplish the auditing of the Quality Assurance Quality Assurance programs. Personnel shall be selected for Quality Assurance quality assurance auditing assignments based on experience or training which establish that their qualifications are commensurate with the complexity or...
special nature of the activities to be audited. In selecting personnel for
auditing assignments, consideration shall be given to special abilities,
specialized technical training, prior pertinent experience, personal
characteristics and education.

2.3 Training. Auditing personnel, including technical specialists, shall have,
or be given, appropriate training or orientation to develop their competence
for performing required audits. Competence of personnel for performance
of the various auditing functions shall be developed by one or more of the
following methods:

2.3.1 Orientation to provide personnel with a working knowledge and
understanding of both American National Standard N45.2 and
this standard.

2.3.2 Training programs designed to provide general and specialized
training in audit performance. General training shall include
fundamentals, objectives, characteristics, organization, perfor­
mance, and results of quality auditing. Specialized training
shall include methods of examining, questioning, evaluating, and
documenting specific audit items and methods of closing out
audit findings.

2.3.3 On-the-job training, guidance, and counseling under the direct
supervision of an experienced, qualified auditor. Such training
shall include planning, performing, reporting, and followup
action involved in conducting audits.

2.4 Maintenance of Proficiency. Individuals regularly performing as Qualified
auditors shall maintain their proficiency through one or more of the
following methods:

2.4.1 Regular, active participation in the audit process.
2.4.2 Review and study of codes, standards, procedures, instructions, and other documents related to Quality-Assurance programs and program auditing.

2.4.3 Participation in training or orientation programs as described in Section 2.3.

3. AUDIT SYSTEM

3.1 General. This section establishes requirements for a comprehensive audit system which shall be planned, documented, and implemented to verify compliance with the elements of a quality assurance program. The audit system shall be described in approved, written policies, plans, procedures, instructions, or such other documents as appropriate.

The objectives of the audit system performing audits of the quality assurance program are:

3.1.1 To determine that a quality assurance program has been developed and documented in accordance with specified requirements;

3.1.2 To verify by examination and evaluation of objective evidence that the documented program has been implemented;

3.1.3 To assess the effectiveness of the quality assurance program;

3.1.4 To identify program nonconformances; and

3.1.5 To verify correction of identified nonconformances.

3.2 Essential Elements of the Audit System. An effective audit system shall be established and maintained and shall include the following essential elements:

3.2.1 A management policy statement or procedure which establishes organizational independence and authority and commits the organization to an audit system meeting the requirements of this standard.

3.2.2 Manpower, funding, and facilities to implement the audit system of audits.
3.2.3 Identification of those responsible for the audit system, including a delineation of their authorities and responsibilities, and organizational independence.

3.2.4 Provisions for reasonable and timely access of audit personnel to facilities, documents, and personnel necessary in the planning and performance of the audits.

3.2.5 Provisions for reporting on the effectiveness of the Quality-Assurance quality assurance program to the responsible management.

3.2.6 Provision for access by audit teams to levels of management of the auditing and audited organizations that have the responsibility and authority to assure corrective action.

3.2.7 Provision for verification of corrective action on a timely basis.

3.3 Audit Planning. The audit system, including both internal and external audits, shall be planned, documented, and conducted to assure coverage of the applicable Quality-Assurance quality assurance program, and overall coordination and scheduling of audit activities. Areas of activity, coverage, and scheduling of audits shall be documented. The audit system shall be periodically reviewed and revised as necessary to assure that coverage and schedule reflect current activities.

3.4 Scheduling.

3.4.1 Auditing shall be initiated as early in the life of the activity as practicable, consistent with the schedule for accomplishing the activity, to assure timely implementation of Quality-Assurance quality assurance requirements. In any case, auditing shall be initiated early enough to assure effective Quality-Assurance quality assurance during the design, procurement and contracting activities.
3.4.2 Audits shall be regularly scheduled on the basis of the status and importance of the activities to assure the adequacy of, and conformance with, the program. Applicable elements of the Quality Assurance quality assurance program shall be audited at least annually or at least once within the life of the activity, whichever is shorter.

3.4.3 Regularly scheduled audits should be supplemented by audits conducted of one or more of the following conditions:

3.4.3.1 When it is necessary to determine the capability of a contractor's Quality Assurance quality assurance program prior to awarding of a contract or purchase order.

3.4.3.2 When, after award of a contract, sufficient time has elapsed for implementing the Quality Assurance quality assurance program and it is appropriate to determine that the organization is adequately performing the functions as defined in the Quality Assurance quality assurance program description, codes, standards, and other contract documents.

3.4.3.3 When significant changes are made in functional areas of the Quality Assurance quality assurance program such as significant reorganization or procedure revisions.

3.4.3.4 When it is suspected that the quality of the item is in jeopardy due to nonconformances in the Quality Assurance quality assurance program.

3.4.3.5 When a systematic, independent assessment of program effectiveness is considered necessary.

3.4.3.6 When it is necessary to verify implementation of required corrective actions.
4. AUDIT IMPLEMENTATION

4.1 General. Individual audits shall be implemented as scheduled and planned in Section 3. The mechanics involved in implementation of an audit are preparation, performance, reporting, and followup.

4.2 Preparation. Preparation includes the development of a written audit plan, the selection and orientation of the auditor(s), and notification of the organization to be audited.

4.2.1 Written Plan. An individual audit plan describing the audit to be performed shall be developed and documented by the auditing organization. This plan shall identify the audit scope, the requirements, the activities to be audited, organizations to be notified, the applicable documents, the schedule, and written procedures or checklists.

4.2.2 Team Selection. One or more individuals comprise an audit team; however, it is preferable that a team of at least two qualified individuals perform an audit. One of the members shall be appointed as the leader for each audit team. His responsibilities include orientation of the team, coordinating the audit process, establishing the pace of the audit, assuring communications within the team and with the organization being audited, participation in the audit performance, and coordinating the preparation and issuance of reports.

4.2.3 Team Orientation. The team leader shall assure that the audit team is prepared prior to initiation of the audit. Pertinent policies, procedures, standards, instructions, codes, regulatory requirements and prior audit reports, shall be made available for information and review by the auditors. Each auditor shall be provided with the audit plan and the procedures or checklists which are necessary to assure orderly accomplishment of the audit. During the familiarization phase of the audit, particular attention shall be directed toward an understanding of internal and external organizational and contractual interfaces and responsibilities of the organization to be audited.
4.2.4 Audit Notification. Involved organizations shall be notified of a scheduled audit a reasonable time before the audit is to be performed. This notification should be in writing and include general information on as the scope and schedule of the audit schedule of meetings and method of audit, and the name of the audit team leader. Unannounced audits may be performed with prior agreement of the parties involved.

4.3 Performance.

4.3.1 Pre-audit Conference. A brief pre-audit conference shall be conducted at the audit site with cognizant organization management. The purpose of the conference shall be to confirm the audit scope, present the audit plan, introduce auditors, meet counterparts, discuss audit sequence and plans for the post-audit conference, and establish channels of communication.

4.3.2 Audit Process.

4.3.2.1 Checklists or procedures shall be used to ensure depth and continuity of audits. The audit checklist is intended for use as a guide and should not restrict the audit investigation when findings raise further questions that are not specifically included in the checklist.

4.3.2.2 Objective evidence shall be examined for compliance with quality assurance program requirements.

4.3.2.3 Selected elements of the quality assurance program shall be audited to the depth necessary to determine whether or not they are being implemented effectively.

4.3.2.4 When a nonconformance is identified as a result of an audit, further investigation shall be conducted by the audited organization in an effort to identify the cause and effect of the nonconformance and to determine the extent of the corrective action required.
4.3.2.5 Elements found to be nonconforming should be acknowledged by a member of the audited organization.

4.3.2.6 Nonconformances shall be reported at the post-audit conference. Requiring immediate corrective action shall be reported immediately to management immediately of the audited organization.

4.3.2.7 Specific attention should be given to corrective action of nonconformances identified during previous audits.

4.3.3 Post Audit Conference. At the conclusion of the audit a post-audit conference shall be held with management of the audited organization to present audit findings and clarify misunderstandings. The detailed observations of the auditors should be reviewed and an understanding reached as to the facts determined during the audit. This understanding should be recorded and signed by both parties.

4.4 Reporting. An audit report shall be written and signed by the audit team leader which provides:

1. Description of the audit scope
2. Identification of the auditors
3. Persons contacted during pre-audit, audit, and post-audit activities.
4. A summary of audit results, including an evaluation statement regarding the effectiveness of the QA quality assurance program elements which were audited.
5. Details of nonconformances. Identify and prepare a description of each nonconformance in sufficient detail to assure that required corrective action can be effectively carried out by the audited organization.
6. Recommendations for correcting nonconformances or improving the QA quality assurance program as appropriate.

Distribution of the report shall include responsible management of both the audited and auditing organizations. The audit report shall be issued within
thirty days after the audit.

4.5 Followup.

4.5.1 By Audited Organization. Management of the audited organization or activity shall review and investigate any adverse audit findings to determine and schedule appropriate corrective action including action to prevent recurrence and shall respond to the report in writing within thirty days after receipt, giving results of the review and investigation. The response shall clearly state the corrective action taken to prevent recurrence. In the event that corrective action cannot be completed within thirty days, the audited organization reply shall include a scheduled date for the corrective action. The audited organization shall provide a followup report stating the corrective action taken and the date corrective action was completed. They shall also take appropriate action to assure that corrective action is accomplished as scheduled.

4.5.2 By Auditing Organization. Followup action shall be performed by the audit team leader or management of the auditing organization to:

4.5.2.1 Assure that Obtain the written reply to the audit report, is received.

4.5.2.2 Evaluate the adequacy of the response.

4.5.2.3 Assure that corrective action is identified and scheduled for each nonconformance.

4.5.2.4 Confirm that corrective action is accomplished as scheduled.

Followup action may be accomplished through written communication, reaudit, or other appropriate means.

5. RECORDS

5.1 General. Records shall be retained by the auditing organizations responsible for activities associated with implementation of this standard. These records shall be collected, stored, and maintained in accordance with American National Standard N45.2.9.
5.2 Audit Records. Records shall be generated and retained for all audits. Records shall include audit program plans, system plan, individual audit plans, audit reports, written replies, the record of completion of corrective actions, and documents associated with the conduct of audits which support audit findings and corrective actions as appropriate.

5.3 Personnel Records. Records shall be maintained of all personnel actively performing audits and those who have previously performed audits within the same project or activity. Records shall include the qualifications and training of auditors and shall be retained for the same period of time as required for the audit report with which the auditors are associated.

6. REVISION OF AMERICAN NATIONAL STANDARDS REFERRED TO IN THIS DOCUMENT

When the following standards referred to in this document are superseded by a revision approved by the American National Standards Institute, the revision shall apply:

N45.2 Quality Assurance Program Requirements for Nuclear Power Plants

N45.2.9 Requirements for Collection, Storage and Maintenance of Quality Assurance Records

N45.2.10 Quality Assurance Terms and Definitions
DRAFT

CAUTION NOTICE - This Standard is being prepared or reviewed and has not been approved by ANSI. It is subject to revision or withdrawal before issue.

American National Standard for
Reactor Plants and Their Maintenance

QUALITY ASSURANCE REQUIREMENTS FOR CONTROL OF PROCUREMENT OF ITEMS AND SERVICES FOR NUCLEAR POWER PLANTS

ANSI N45.2.13 - 1974

Sponsor
American National Standards Committee N45
QUALITY ASSURANCE REQUIREMENTS FOR CONTROL OF PROCUREMENT OF ITEMS AND SERVICES FOR NUCLEAR POWER PLANTS

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Appendix
An American National Standard implies a consensus of those substantially concerned with its scope and provisions. An American National Standard is intended as a guide to aid the manufacturer, the consumer, and the general public. The existence of an American National Standard does not in any respect preclude anyone, whether he has approved the standard or not, from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standard. American National Standards are subject to periodic review and users are cautioned to obtain the latest editions.

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FOREWORD

This foreword is not a part of American National Standard Quality Assurance Requirements for Control of Procurement of Items and Services for Nuclear Power Plants.

This standard deals with the control of activities that must be exercised for the procurement of items and services for nuclear power plants. The standard was developed by the American National Standards Committee N45 on Reactor Plants and Their Maintenance. This committee has been chartered to promote the development of standards for the location, design, construction, and maintenance of nuclear reactors and plants embodying nuclear reactors, including equipment, methods, and components specifically for this purpose.

In April of 1970, the N45 Committee of ANSI established a subcommittee N45-2, to guide the preparation of nuclear quality assurance standards. The subcommittee is responsible for establishing guidelines and policy to govern the scope and content of the various standards; monitoring the status of standards in process; recommending preparation of additional standards; and final approval of standards prior to their submittal to the N45 Committee for balloting.

In September of 1971, the N45-2 Subcommittee of ANSI established a working group Committee N45.2.13 on Quality Assurance Requirements for Control of Procurement of Items and Services. The purpose of this committee was to prepare a standard for industry use that would define requirements and guidelines for procurement planning; procurement document preparation, review, and change control; selection and surveillance of Suppliers; and the control of purchased items and services.
Working with the N45-2 Subcommittee and concurrently with the development of this standard by the N45.2.13 working group, other working groups of N45 are developing a series of standards that set forth both general and detailed technical provisions for certain activities to assure quality during the design, construction, and maintenance of nuclear power plants.

As of April 1974 these working groups had the responsibility for the following associated standards.

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<th>Work Group</th>
<th>Standard in Preparation or Issued</th>
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<td>N45-2.8</td>
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<td>N45-2.10</td>
<td>N45.2.8 Supplementary Quality Assurance Requirements for Installation, Inspection and Testing of Mechanical Equipment and Systems for the Construction Phase of Nuclear Power Plants</td>
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</table>
Suggestions for improvement gained in the use of this standard will be welcomed. They should be sent to American National Standards Institute, 1430 Broadway, New York, New York 10018.

The working group on Quality Assurance Requirements for Control of Procurement of Items and Services for Nuclear Power Plants included the following personnel:

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D. L. Leone - Sargent & Lundy Engineers
P. R. Matthews - US Atomic Energy Commission
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1 QUALITY ASSURANCE REQUIREMENTS FOR CONTROL OF
PROCUREMENT OF ITEMS AND SERVICES FOR
NUCLEAR POWER PLANTS

1. INTRODUCTION

1.1 Scope

This standard describes requirements and provides guidelines for the
control of activities to be exercised during procurement of items and
services for nuclear power plants. These requirements and guidelines
apply to procurement activities affecting the quality of the plant which
include designing, purchasing, fabricating, handling, shipping, storing,
cleaning, erecting, installing, inspecting, testing, maintaining,
repairing, initial fueling, refueling, and modifying. This standard
provides guidelines for application of quality assurance program
requirements listed in ANSI N45.2 for various types of procurement such
as; total system supply, hardware, services, or a combination thereof.

This standard applies to the work of any individual or organization
participating in the procurement of those items and services from which
satisfactory performance is required -
a. to prevent accidents that could cause undue risk to the health and
   safety of the public; or
b. to mitigate the consequences of such accidents if they were to occur.

The extent to which the individual requirements of this standard shall apply
will depend upon the nature and scope of the work to be performed and the
importance to nuclear safety of the items or services purchased. The
1.2 Responsibility

1.2.1 Purchaser's Responsibility

a. Establishment and implementation of a procurement control process consistent with the requirements and guidelines of this standard.

b. Incorporation of quality assurance program requirements, appropriate to the scope of work, into procurement documents.

c. Evaluate Supplier's quality assurance program to assure that it is appropriate and satisfies the requirements for the items or services being purchased.

d. Where interfacing, but separate, procurement actions are initiated by a single Purchaser to purchase the design, manufacture, shop assembly and test, field installation and field test of equipment or a system (such as where one Supplier has responsibility for design, manufacture, shop assembly and test; another Supplier has responsibility for field assembly; and a third Supplier has responsibility for field tests), the single Purchaser shall assure that the quality assurance requirements incorporated in separate procurement documents will collectively satisfy the requirements of ANSI N45.2 and applicable supplementary standards as applicable to the total items and services procured.
1.2.2 Supplier's Responsibility

a. Establish and implement a documented quality assurance program that complies with Purchaser's requirements.

b. Permit Purchaser review of his quality assurance program.

c. Incorporate appropriate quality assurance program requirements in sub-tier procurement documents.

1.3 Definitions

The following definitions are provided to assure a uniform understanding of select terms as they are used in this standard. Other terms and their definitions are contained in ANSI N45.2.10.

Designated Representative - An individual or organization authorized by the Purchaser to perform functions in the procurement process.

Lower Tier Procurement - Procurement by a Supplier from a subsupplier of items or services.

Purchaser - The organizations responsible for issuance or administration or both of procurement documents.

Quality Assurance - Those individual requirements listed in ANSI N45.2 which when invoked in total or in part establish the requirements of a quality assurance program.

Quality Assurance Records - Those records which furnish documentary evidence of the quality of items and of activities affecting quality.
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<thead>
<tr>
<th>No.</th>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Right of Access</td>
<td>The right of a Purchaser or designated representative to enter the premises of a Supplier for the purpose of inspection, surveillance, or quality assurance audit.</td>
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<tr>
<td>2</td>
<td>Services</td>
<td>The performance by a Supplier of activities such as design, fabrication, inspection, non-destructive examination, repair, or installation.</td>
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<tr>
<td>3</td>
<td>Supplier</td>
<td>Any individual or organization under contract for furnishing items or services, including the terms Vendor, Seller, Contractor, Subcontractor, Fabricator, Consultant, and lower tier levels.</td>
</tr>
<tr>
<td>4</td>
<td>Surveillance</td>
<td>The physical presence to monitor by observation the designated activities to assure that they are performed in a specified manner.</td>
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</tbody>
</table>

1.4 Referenced Documents

Documents that are required to be included as part of this standard are identified at the point of reference and described below. The issue or edition of the referenced document that is required will be specified in this section unless otherwise specified in the procurement document.
<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>N45.2</td>
<td>- Quality Assurance Program Requirements for Nuclear Power Plants</td>
<td>1971</td>
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<tr>
<td>N45.2.2</td>
<td>- Packaging, Shipping, Receiving, Storage and Handling of Items for Nuclear Power Plants (During the Construction Phase)</td>
<td>1972</td>
</tr>
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<td>N45.2.6</td>
<td>- Qualification of Inspection, Examination, and Testing Personnel for the Construction Phase of Nuclear Power Plants</td>
<td>1973</td>
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<tr>
<td>N45.2.9</td>
<td>- Requirements for Collection, Storage and Maintenance of Quality Assurance Records for Nuclear Power Plants</td>
<td>1974</td>
</tr>
<tr>
<td>N45.2.10</td>
<td>- Quality Assurance Terms and Definitions</td>
<td>1973</td>
</tr>
<tr>
<td>N45.2.11</td>
<td>- Quality Assurance Requirements for the Design of Nuclear Power Plants</td>
<td>1974</td>
</tr>
<tr>
<td>N45.2.12</td>
<td>- Requirements for Auditing of Quality Assurance Programs for Nuclear Power Plants</td>
<td>1974</td>
</tr>
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</table>
2. PLANNING

Measures established for the control of the procurement of items or services shall include planning. Control of the procurement process requires the identification of organizations involved in the execution of the activity and the delineation of each organization's responsibility. Planning shall determine:

a. What is to be accomplished.
b. Who is to accomplish it.
c. How is it to be accomplished.
d. When is it to be accomplished.

This shall be accomplished as early as practicable and no later than the start of those procurement activities which are required to be controlled, to assure interface compatibility and a uniform approach to the procurement process. Planning shall result in the documented identification of methods to be used in procurement activities; sequence of actions and milestones indicating the completion of these activities; and the preparation of procedures prior to the initiation of procurement activities listed below.

Planning shall provide for the integration of the following:

b. Selection of Procurement Sources.
c. Bid Evaluation and Award.
d. Purchaser's Control of Supplier's Performance.
e. Verification (Surveillance, Inspection, or Audit) Activities by Purchaser.
f. Purchaser's Control of Nonconforming Items.
g. Acceptance of Item or Service.
h. Quality Assurance Records.
i. Purchaser's Audit of Procurement Process.

j. Corrective Action With Regard to the Procurement Process.

Subsequent sections discuss these activities and their control in accordance with the general requirements of ANSI N45.2 (and this standard) in greater detail. These activities shall be capable of being verified and their effectiveness determined by audit. Where any of the procurement activities are delegated or applicable to lower tier Suppliers, the appropriate controls and requirements of this standard shall also apply.
3. PROCUREMENT DOCUMENT PREPARATION, REVIEW AND CHANGE CONTROL

3.1 General

The Purchaser shall establish measures to assure that applicable regulatory requirements, design bases, and other requirements (including specific issue dates and applicable addenda) which are necessary to assure adequate quality are included or invoked by reference in the documents for procurement of items and services. Procurement document changes shall be subject to the same degree of control as utilized in the preparation of the original documents.

3.2 Content of the Procurement Documents

Procurement documents issued at all tiers of procurement shall include provisions for the following, as applicable:

3.2.1 Scope of Work

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

3.2.2 Technical Requirements

Technical requirements shall be specified in the procurement documents by reference to the specific drawings, specifications, codes, regulations, procedures or instructions including revisions thereto that describe the items or services to be furnished. The procurement documents shall identify the test, inspection and acceptance requirements, and any special instructions and requirements for such activities as designing, identification, fabrication, cleaning, erecting, packaging, handling, shipping and extended storage. All such technical
requirement documents shall have been prepared, reviewed
and released under the requirements established by ANSI N45.2.11,

3.2.3 Quality Assurance Program Requirements

Procurement documents shall require that the Supplier have a
documented quality assurance program that implements portions
or all of ANSI N45.2 as well as applicable quality assurance
program requirements of other nationally recognized codes and
standards. (Explanation and examples of logic and considerations
necessary to decide how and to what extent quality assurance
program requirements should be specified in procurement documents
are contained in the Appendix to this standard.)

The procurement documents shall require the Supplier to
incorporate appropriate quality assurance program requirements
in lower tier procurement documents.

3.2.4 Right of Access

At each tier of a procurement, the procurement document shall
provide, as appropriate, for access to the Supplier's plant
facilities and records for inspection or audit by the Purchaser,
or Purchaser's designated representative, and/or other parties
authorized by the Purchaser such as regulatory agencies. The
provisions should include a statement of the minimum time of
advance notice, the method of communication of such notice,
and identification of the events such as witness and hold points
established or considered appropriate for the Purchaser's
presence at the Supplier's facility.
3.2.5 Special Quality Assurance Requirements

As applicable, provisions shall be made at the appropriate tiers of a procurement for the delineation of special quality assurance requirements.

3.2.6 Documentation Requirements

The procurement documents at all tiers shall identify the documentation required to be submitted, including quality assurance records, for the information, review, or approval of the Purchaser. The time of submittal shall also be established.

The retention and disposition of quality assurance records of compliance not to be delivered to the Purchaser shall be prescribed.

ANSI N45.2.9 provides guidance for retention and disposition of quality assurance records.

3.2.7 Nonconformances

The procurement documents shall include Purchaser's requirements for reporting and approving disposition of nonconformances.

Section 8 of this standard provides further guidelines on handling nonconformances.

3.3 Procurement Document Review

A review of the procurement documents shall be made to assure that documents transmitted to the prospective Suppliers for bid or contract purposes include appropriate provisions to assure items or services meet the specified requirements.
1. Such reviews shall be performed prior to release for bid or contract award and shall assure that the documents are complete and contain the applicable requirements specified in 3.2 of this standard.

b. Changes made in the procurement documents as a result of the bid evaluations or precontract negotiations shall require a review of such changes and their effects, prior to contract award. This review shall include the following considerations:

1) Appropriate requirements specified in 3.2.

2) Determination of any additional or modified design criteria imposed after preparation of the procurement documents.

3) 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.

c. 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.

d. Performance of reviews shall be documented to provide objective evidence of accomplishment.

3.4 Document Control

3.4.1 Release and Distribution

Measures shall be established to control the release and distribution of documents.
Changes

Changes to documents shall be subjected to the same degree of review and controls required for the original documents unless otherwise specified.
4. SELECTION OF PROCUREMENT SOURCES

4.1 General

The selection of Suppliers shall be based on evaluation of their capability to provide items or services in accordance with the requirements of the procurement documents.

4.2 Selection Measures

Procurement source evaluation and selection measures shall be adopted by the Purchaser and shall provide for identification of the Purchaser's organizational responsibilities for determining Supplier capability. This may require integrated action involving, for example; Engineering, Construction, Manufacturing, Operations, Purchasing, or Quality Assurance organizations, or a combination of these, based upon the item or service being procured.

Documented methods to be utilized in evaluation of Supplier sources shall include any or all of the following:

a. Evaluating the Supplier's history of providing a quality product which performs satisfactorily in actual use. Information which should be evaluated should include:

1) Experience of users of identical or similar products of the prospective Supplier.

2) Purchaser's records that have been accumulated in connection with previous procurement actions and product operating experience.

The success of quality performance is highly dependent upon the Supplier's personnel capabilities, physical conditions of the manufacturing facility and equipment, and management attitude towards quality. Historical data should be representative of the Supplier's
current capability. If there has been no recent experience with
the Supplier, or if he is a new Supplier, the prospective Supplier
shall be requested to submit information on a similar item or
service (such as applicable drawings or data) for evidence of his
capabilities.

b. The Supplier's current quality records supported by documented
qualitative and quantitative information which can be objectively
evaluated. This would include review and evaluation of the Supplier's
Quality Assurance Program, Manual, and Procedures, as appropriate.

c. The Supplier's technical and quality capability as determined by a
source evaluation.
5. BID EVALUATION AND AWARD

5.1 General

Procurement documents are prepared to define specified items or services of required quality which meet or exceed specifications at the lowest evaluated cost, and on schedule. These procurement documents may be used to obtain bids from prospective Suppliers. A documented system for reviewing and evaluating the bids and/or awarding of contracts shall be established.

5.2 Conformance to Procurement Document

The Purchaser shall establish measures to assure that the bid conforms to the procurement document requirements.

The bid evaluation shall be made by individuals or organizations designated to evaluate the following subjects, as applicable to the type of procurement:

a. Technical considerations.
b. Quality assurance requirements.
c. Research and development effort.
d. Suppliers' personnel.
e. Suppliers' production capability.
f. Suppliers' past performance.
g. Alternates.
h. Exceptions.

Other considerations such as warranties, schedule, price, price adjustments, commercial terms and conditions, although not quality related, are recognized as factors affecting bid evaluation.
5.3 Preaward Evaluation

Prior to the award of the contract, the Purchaser shall have performed a preaward evaluation of the Supplier as described in Section 4.2 of this standard.
6. PURCHASER CONTROL OF SUPPLIER PERFORMANCE

6.1 General

Purchasers at all tiers shall retain the responsibility of monitoring and evaluating Supplier performance to the specified requirements of the procurement document. In exercising this responsibility, the Purchaser of items and services shall establish measures to control Supplier's performance. These methods and procedures shall include provisions for:

a. Establishing understanding between Purchaser and Supplier of the provisions and specifications of the procurement documents.

b. The identification by the Supplier of his planning techniques and processes to be utilized in fulfilling procurement document requirements.

c. Controlling documents which are generated or processed during activities fulfilling procurement requirements.

d. Identifying and processing necessary change information.

e. Control and Documentation of information exchange between Purchaser and Supplier.

6.2 Control of Supplier Planning

Depending on the complexity or scope of the item or service, the Purchaser shall initiate pre- and post-award activities in the form of meetings or other forms of communication to establish an understanding between the Purchaser and Supplier of the procurement requirements, the intent of the Purchaser in monitoring and evaluating the Supplier's performance and the planning, manufacturing techniques, tests, inspections, and processes to be employed by the Supplier in meeting procurement requirements. These activities shall be implemented as early as practicable in the procurement
1 process. Purchaser notification points, including hold and witness
2 points, should be identified and documented based upon mutual agreement
3 between Purchaser and Supplier at this time. The depth and necessity
4 of pre- and post-award communication depends on the uniqueness, complexity,
5 procurement frequency with the same Supplier and past Supplier performance
6 for the specific items or services covered by the procurement document.
7
8 6.3 Control of Supplier Generated Documents
9 The Purchaser and Supplier shall assure that established measures for
10 the control, handling and approval of Supplier generated documents
11 are implemented, and that the submittal time and frequency for these
12 documents is accomplished in accordance with the procurement documents.
13 These measures shall provide for the acquisition, processing and recorded
14 evaluation of inspection and test data against acceptance criteria.
15
16 6.4 Control of Changes in Items or Services
17 The Purchaser and Supplier shall assure that measures to control changes
18 in procurement documents are established, implemented and documented.
19 (See Section 3.4.2)
7. VERIFICATION ACTIVITIES BY PURCHASER

7.1 General

Measures shall be established and implemented for verification activities (surveillance, inspection, and audit) as appropriate, to assure conformance of procured items and services to identified requirements. Verification activities shall be accomplished by qualified personnel assigned to check, inspect, audit or witness the activities of Suppliers. Verification activities shall be conducted as early as practicable to preclude subsequent activities from preventing disclosure of deficiencies.

7.2 Planning

Planning shall be an integral part of verification activities. The extent of verification activities, including planning, shall be a function of the relative importance and complexity of the item procured and the Supplier's quality performance. See Section 10.2.1 and 10.2.2 of this standard for guidance in selecting verification methods.

7.2.1 Source Verification Planning

The verification activity plans shall, relative to fabrication sequence and assembly processes, identify the appropriate: inspections and tests; prerequisites and inspection sequence, including hold and witness points; acceptance criteria; and the documentation required by the procurement document.

7.2.2 Receiving Inspection Planning

The receiving inspection plan shall identify the characteristics to be verified and documentation to be reviewed at receiving inspection. Characteristics to be considered during receiving inspection shall include, as appropriate, cleanliness, dimensions;
7.3 Implementation

7.3.1 Source Verification Activities

When planning requires source surveillance, it shall be implemented to monitor, witness or observe activities. Similarly source inspection shall be implemented in accordance with plans to perform inspections, examinations, or tests at predetermined points.

Source surveillance and inspection may require the assignment of personnel to a Supplier's facilities. When the quality of an item is verified by audit, such audits shall be conducted in accordance with Section 12 of this standard.

7.3.2 Receiving Inspection

When planning requires receiving inspection, it shall be implemented and coordinated with source verification. During receiving inspection, emphasis shall be placed on assuring that items have not sustained damage in shipment that would influence subsequent fabrication, construction or end use.

When receiving inspection planning identifies performance of examination or tests upon arrival, they shall be performed by qualified personnel. Sampling may be utilized during receiving inspection when conducted in accordance with established procedures or recognized standards. Receiving inspection measures shall include provisions for receiving documentation.
such as drawings, certifications, test results and other materials offered as objective evidence in satisfaction of requirements and for dispositioning and handling of received items and services. For additional receiving inspection considerations, see ANSI N45.2.2.

7.4 Measuring and Test Equipment

7.4.1 Selection

Inspection, examination, and testing equipment utilized to implement the requirements of this Standard shall be selected to have accuracy and tolerance sufficient to determine conformance to specified requirements.

7.4.2 Calibration and Control

As appropriate, measuring and test equipment shall be adjusted and calibrated at prescribed intervals against certified equipment having known valid relationships to nationally recognized standards. If no standards exist, the basis for calibration shall be documented. Records shall be maintained and equipment suitably marked to indicate calibration status or the records shall be traceable to the equipment.

7.5 Personnel Qualifications

Personnel responsible for performing verification activities shall be qualified in accordance with ANSI N45.2.6 or ANSI N45.2.12 as applicable.

7.6 Reporting

Measures shall be established to provide for the reporting of activities performed to verify conformance to requirements of procurement documents.
These measures shall include reporting of source surveillances and inspections, audits, receiving inspections, nonconformances, dispositions, waivers, and corrective actions.

In addition, the Purchaser shall assure that these reports are evaluated to determine the Supplier's quality assurance program effectiveness.
8. CONTROL OF NONCONFORMANCES

8.1 General

The Purchaser and Supplier shall establish and document measures for the identification, control, and disposition of items and services that do not meet procurement document requirements.

8.2 Disposition

These measures shall contain provision for the following:

a. Review of nonconforming items.

b. Submittal of nonconformance notice to Purchaser by Supplier as appropriate. These submittals shall include Supplier recommended disposition (such as "accept-as-is" or "repair") and technical justification. Nonconformances that consist of one or more of the following shall be submitted to the Purchaser for approval of the recommended disposition:

1) Technical requirement is violated.

2) Supplier procedure approved by the Purchaser is violated.

3) Nonconformance cannot be corrected by continuation of the original manufacturing process or by rework.

4) An item can be restored to a condition such that the capability of the item to function is unimpaired even though the item may not conform to the original requirement.

c. Purchaser disposition of Supplier recommendation.

d. Verification of repair.

e. Maintenance of records of Supplier nonconformances.
9. CORRECTIVE ACTION

The Purchaser and Supplier shall establish and document measures to assure that conditions adverse to quality such as deficiencies, deviations, defective items and nonconformances are promptly identified and corrected. In the case of significant conditions adverse to quality, these measures shall assure that the cause of the condition is determined and corrective action taken to preclude repetition. The identification of the adverse condition, the cause of the condition, and the corrective action taken shall be documented and reported to the appropriate levels of management.

As a guideline, corrective action should include measures for:

a. Providing early indication of design, procurement control, and fabrication deficiencies so that corrective and preventive action can be initiated.

b. Providing dissemination of corrective action information in a minimum time to pertinent organizations.

c. Determining the adequacy of inspection and test procedures, process controls, and sampling plans.

d. Determining if specific training is required.

e. Assuring that data reported for failure analysis includes as applicable: identification of the part, component, or system; purpose of test, condition and type of test; detailed description of failure or unsatisfactory operation; numerical test results; operating or test time; photographs; graphs; oscillograms; and corrective action recommendations.
10. ACCEPTANCE OF ITEM OR SERVICE

10.1 General

The Purchaser shall establish the method of acceptance of an item or service being furnished by the Supplier. The Supplier shall verify that the item or service being furnished, as well as the Purchaser's conditions of acceptance, has been complied with prior to offering the item or service for acceptance.

10.2 Methods of Acceptance, Selection and Implementation

Purchaser methods used to accept an item or service from a Supplier are source verification, receiving inspection, Supplier certificate of conformance, post installation test, or a combination thereof. The procurement document should specify which of these methods shall be used.

10.2.1 Certificate of Conformance

Where required by code, regulation or contract requirement, regardless of acceptance methods, documentary evidence that items conform to procurement documents shall be available at the nuclear power plant site prior to installation or use of such items. Where not precluded by other requirements, such documentary evidence may take the form of written certificates of conformance which identify the requirements met by the items, providing means are available to verify the validity of such certificates, such as during audits or independent inspection or test of the items.

Where certificates of conformance are used, the following minimum criteria shall be met:
a. The certificate should be sufficient to specifically identify the purchased material or equipment, such as by the purchase order number.

b. The certificate should identify the specific procurement requirements met by the purchased material or equipment, such as codes, standards, and other specifications. This may be accomplished by including a list of the specific requirements or by providing, onsite, a copy of the purchase order and the procurement specifications or drawings, together with a suitable certificate. The procurement requirements identified should include any approved changes, waivers, or deviations applicable to the subject material or equipment.

c. The certificate should identify any procurement requirements that have not been met, together with an explanation and the means for resolving the nonconformances.

d. The certificate should be attested to by a person who is responsible for this quality assurance function and whose function and position are described in the Purchaser's or Supplier's quality assurance program.

e. The certification system, including the procedures to be followed in filling out a certificate and the administrative procedures for review and approval of the certificates, should be described in the Purchaser's or Supplier's quality assurance program.
f. Means should be provided to verify the validity of
certificates and to determine the effectiveness of the
certification system when desired, such as during the
performance of audits.

(Section 7 of this Standard provides requirements and guidance relative
to the conduct of source and receiving inspections.)

10.2.2 Acceptance by Source Verification

Acceptance by source verification should be considered when
the item or service is:

a. vital to plant safety, or
b. difficult to verify quality characteristics after delivery, or
c. very complex in design, manufacture, and test.

The source verification activities should include but not be
limited to the following as applicable:

a. Documentation has been submitted as required and provides
   verification of approvals, material, applicable inspections,
   and tests.

b. Fabrication procedures and processes have been approved
   and complied with and the applicable qualifications,
   process records, and certifications are available.

c. Components and assemblies have been inspected, examined,
   and tested as required and applicable inspection, test
   and certification records are available.

d. Nonconformances have been dispositioned as required.
e. Components and assemblies are cleaned, preserved, packed and identified in accordance with specified requirements.

Upon Purchaser acceptance by source verification, documented evidence of acceptance shall be furnished to the receiving destination of the item, to the Purchaser, and to the Supplier.

10.2.3 Acceptance by Receiving Inspection

Acceptance by receiving inspection is satisfactory when the items or services are:

a. Relatively simple and standard in design, manufacture, and test.

b. Adaptable to standard or automated inspections and/or tests of the end product to verify quality characteristics after delivery.

c. Such that when receiving inspection does not require operations which could adversely affect the integrity, function, or cleanliness of the item.

Receiving inspection should be coordinated with review of Supplier documentation when procurement documents require such documentation to be furnished prior to receiving inspection.

10.2.4 Acceptance by Supplier Certificate of Conformance

In certain procurement actions which do not involve direct inspection by the Purchaser, the Purchaser may accept an item or service from a Supplier based only on a Supplier's certificate of conformance that the specified requirements have been met.
However, specific supplemental documentation, such as material
certificates or reports of tests performed, may be required by
the procurement documents. Acceptance by this method is
satisfactory when the item or service is of simple design; involves
standard materials, processes and tests; or easily replaced.
Such items should have passed qualification testing and may be
fabricated subject to selected sample or batch testing to
establish or maintain a minimum quality confidence level.

10.2.5 Acceptance by Post Installation Test

Acceptance by post installation test is satisfactory only when –
a. it is difficult to verify the quality characteristics
   of the item without it being installed and in use; or
b. the item requires an integrated system checkout or test
   with other items to verify its quality characteristics; or
   
c. the item cannot demonstrate its ability to perform its
   intended function except when in use.

Post installation test requirements and acceptance documentation
should be mutually established by the Purchaser and Supplier.

10.2.6 Acceptance of Services Only

The guidelines outlined in 10.2.2 through 10.2.5 primarily deal
with hardware items and related services. In certain cases
involving procurement of services only, such as third party
inspection; consulting services; and installation, repair,
overhaul or maintenance work; the Purchaser may accept the
service by any or all of the following methods:
1. Technical verification of data produced.
2. Surveillance and/or audit of the activity.
3. Review of objective evidence for conformance to the procurement document requirements such as certifications, stress reports, etc.
11. QUALITY ASSURANCE RECORDS

Measures shall be established and implemented for the control of:

a. Supplier - generated documents and records that are required to be submitted to the Purchaser or retained by the Supplier as specified by the procurement documents.

b. Purchaser - generated quality related documents and records.

The collection, storage, and maintenance of quality assurance records shall be in accordance with ANSI N45.2.9.
12. AUDIT OF PROCUREMENT PROGRAM

Periodic or random unscheduled audits shall be performed to verify compliance with procurement activities described in this standard. The scope of planned auditing activity may cover individual operations, events, processes, or the complete quality assurance program. When deemed necessary by the Purchaser, audits of sub-tier vendors shall be carried out to assure that their quality assurance programs on procurement adequately translate the necessary requisites of the governing procurement documentation to the items or services involved. The audits shall be conducted in accordance with ANSI N45.2.12.
There are various methods for specifying quality assurance program requirements depending on the type and scope of procurement action being undertaken. The following sections of this Appendix discuss:

a. Typical scope of procurement effort.
b. Categorization of procurement actions.
c. General logic or factors to be considered in specifying quality assurance program requirements in a procurement document.
d. Logic chart.
e. Methods of specifying quality assurance program requirements.

2. Typical Scope of Procurement Effort

The complexity of a nuclear power plant dictates the need for a multitude of tasks which must be performed during various phases of design, construction, testing and operations. Among these tasks is the procurement of items and services. Each major phase requires a procurement effort which will be responsive to the special needs of that phase and which will provide items and services which meet code, regulatory, and special requirements. Examples of the types of procurements required during each phase are as follows:

a. Design - Construction Phase
   1) Design and engineering services.
   2) Site investigations such as investigations to determine the engineering requirements for the structure (i.e., soil investigation, environmental studies, both field work and laboratory effort).
3) Long-lead items such as the nuclear steam supply, including major equipment fabrication and test.

4) Construction of the main structure of the plant, including structural steel erection and concrete production and placement.

5) Specific site erection and installation tasks, such as piping, mechanical and electrical equipment.

6) Services for non-destructive examination and required laboratory tests.

7) Hardware such as valves, piping, tanks and miscellaneous materials.

8) Software such as development of plant operating procedures, technical manuals and computer codes.

9) Services of various consultants to assist in setting up management systems (i.e., quality assurance program and operator training).

10) Preoperational and startup tests.

11) Preservice base line inspection equipment and/or services.

b. Operational Phase

1) Reload fuel, equipment and services for refueling operations.

2) In-service inspection equipment or services.

3) Items and services for plant maintenance, modifications or changes.

4) Special services such as environmental monitoring, radioactive waste disposal, and plant decontamination.
The above mentioned examples are not meant to be all inclusive but rather to provide an appreciation of the wide variety of procurements for the above phases. Similarly, it should be realized that the phases and types of procurements listed above are not distinct in scope and timing and that there may be considerable overlapping depending upon the needs of a particular situation.

3. **Categorization of Procurement Actions**

The types of procurements listed above may also be categorized in terms of what is supplied by the Supplier, i.e., hardware, services, installation, and total system supply or combinations thereof. Such a categorization wherein the procurement efforts are grouped by what is supplied can be of assistance in identifying the logical steps which must be performed in properly specifying the quality assurance requirements in the procurement documents. For example, the procurement of services, whether for soil investigations or pipe stress calculations, have certain quality assurance program features in common which may be different from the program feature of a pure hardware procurement.

4. **General Logic Considerations**

The quality assurance requirements shall be compatible to the particular type of item or service which is to be supplied. Certain items and services may require extensive controls throughout all stages of development, while others will require only a limited quality assurance effort in selected phases of development. The factors which determine the extent of a quality assurance effort are as follows:
a. **The importance of malfunction or failure of the item to plant safety**

Each item to be procured must be evaluated to determine whether or not it is important to plant safety. For those items which are important to plant safety, applicable requirements of ANSI N45.2 should be specified in the procurement document. This safety determination should be made by the engineering staff of the appropriate organization having primary responsibility for specifying the design requirements for the item.

b. **The complexity or uniqueness of the item**

In developing specific quality assurance requirements for a particular item, the complexity and uniqueness should be considered. The extent of controls needed to assure the quality of those characteristics which are necessary for proper functionality and long term performance may depend heavily upon the item's complexity and the industry experience, or lack of, in accomplishing the quality related activity. Obviously, if a design effort is required to develop the item or accomplish the activity, design quality assurance requirements should be included in the procurement document. Items which require a complex manufacturing plan may require extensive control over important characteristics. The control over important characteristics should extend beyond the manufacturing phase when it is necessary to preclude damage to those characteristics during packaging, shipping, handling and storage. In determining the extent of quality assurance to be applied, past experience in the development of similar items must be
considered. An item being developed for the first time will probably require much more control over important characteristics than one which has had a past history of successful performance. The complexity or uniqueness of the item may also affect the extent of personnel training and indoctrination required.

c. **The need for special controls and surveillance over process and equipment**

Certain work operations may require the use of special processes such as welding, non-destructive examination, passivation, brazing and soldering, hardness and tensile testing, protective coating and heat treatment. Special processes may also include certain in-process operations such as chemical batch process, plating operations, and electric insulation impregnation. These processes shall be accomplished under specially controlled conditions. Controlled conditions include the use of appropriate equipment, suitable environmental conditions, definitive procedures, qualified personnel and assurance that prerequisites have been satisfied.

d. **The degree to which functional compliance can be demonstrated by inspection and test**

It may be possible to demonstrate the quality of certain characteristics of an item by an appropriate inspection or test. In such cases, the in-process control effort may be reduced if an appropriate inspection and test will be sufficient to provide an assurance of quality. A limiting case is an end-product test which can properly assess the degree of compliance to quality requirements, thereby eliminating the need for in-process control.
The quality, history, and degree of standardization of the item
The ability to use historical data in evaluating the quality posture of an item is based in part upon the degree of standardization of the item. If a manufacturer has been producing a particular standard item for a long period of time and if the operational quality history of the item indicates that its significant characteristics perform satisfactorily, the quality assurance program may be tailored to reflect this satisfactory performance history. Conversely, if certain characteristics are determined to be unsatisfactory based upon operational data, additional quality assurance effort may be required to correct these deficiencies.

The general logic considerations outlined above should be applied for each procurement action. If all or most of these considerations apply to a particular procurement action, the overall method of paragraph 6.1 of this Appendix, should be applied in specifying the quality assurance requirements in the procurement document. However, if these considerations have only limited applicability to a particular procurement action, the unique order method of paragraph 6.2 of this Appendix, may be used to specify the quality assurance requirements of the procurement document.

5. Logic Chart
The attached chart provides a pictorial illustration of the logic process described in paragraph 4 of this Appendix. This chart illustrates an example for procurement of hardware items only; however, a similar logic flow can also be used for other types of procurements such as design, inspection, test, and installation services or total system supply.
It should be noted that this chart is provided for guidance and illustration only, and does not necessarily present all considerations which have to be made for this type of procurement.

6. Methods of Specifying Quality Assurance Program Requirements

There are various ways in which the Purchaser can specify and obtain suitable Supplier quality assurance program requirements. Two of the most prevalent methods are:

a. Overall Method

The Purchaser may incorporate into the procurement documents a complete quality assurance program standard, such as ANSI N45.2, and shall require the Supplier to apply the requirements of the quality assurance standard as appropriate to the items or services being procured. The Supplier's quality assurance program shall be evaluated by the Purchaser to assure that it is appropriate to the items or services being purchased.

b. Unique Order Method

The Purchaser may incorporate into the procurement documents selected portions of a quality assurance program standard, such as ANSI N45.2, that are unique to the items or services being procured. For example, when Purchaser's order is limited to design work only, selected requirements of ANSI N45.2 or ANSI N45.2.11 would be applied. Supplier's quality assurance program shall be reviewed by the Purchaser to assure that it is appropriate to the items or services being purchased. Purchaser may also incorporate requirements equivalent to those referred to in ANSI N45.2 which are unique to the items or services being purchased.
6.1 Example of Specifying the Overall Method

For procurement actions where the scope of work requires a broad range of skills and facilities to be furnished by the Supplier, most or all of the requirements of ANSI N45.2 will apply in varying degree to the item or service being purchased. An example would be the procurement of a major primary coolant pump or valve which requires the Supplier to design, manufacture, inspect, and test the equipment in accordance with the Purchaser's engineering specification.

For the above example, the overall method could be used to specify the quality assurance program required of the Supplier by use of the following provisions:

a. Supplier shall establish and maintain a quality assurance program conforming to the applicable sections and elements of ANSI N45.2.

b. Sections and elements of ANSI N45.2 are applicable only to the extent that Purchaser's order requires work that is governed by the sections and elements. For example, when Purchaser's order does not require design work of Supplier, the requirements of ANSI N45.2, paragraph 4, Design Control, do not apply.

c. Supplier shall document a quality assurance program sufficient to conform to the applicable requirements of ANSI N45.2 and to Purchaser's technical and administrative requirements contained in the purchase order and referenced documents.

d. Supplier shall submit a description of his quality assurance program to Purchaser with Supplier's bid response for Purchaser's review. If Supplier's description of his quality assurance program
has been previously submitted, Supplier shall update it or submit a statement that the quality assurance program has not changed since the last evaluation. Where the Supplier holds a valid Certificate of Authorization for ASME Code, Section III, Supplier's ASME Quality Assurance Manual, containing a copy of the Certificate of Authorization, may be submitted to satisfy the requirements for a documented quality assurance program description. The Supplier's ASME Quality Assurance Manual shall be supplemented, as appropriate, to satisfy the Purchaser's procurement requirements.

e. Purchaser shall evaluate the program of the successful bidder and will provide comments, if modifications to the program are required. Supplier shall resolve Purchaser's comments and implement them prior to the start of any work affected by the comments. Subsequent changes to Supplier's program shall be subject to the same degree of Purchaser control.

f. The Supplier shall identify and pass on to lower tier Suppliers all applicable quality assurance program requirements.

6.2 Example of Specifying the Unique Order Method

For procurement actions where the scope of work requires only limited, even though specialized, skills and facilities to be furnished by the Supplier, only part of the requirements of ANSI N45.2 may apply to the item or service being purchased. An example of such a scope of work might be as follows:
Supplier Scope of Work

a. Perform independent design review of -
   1) the equipment described by the drawings and specifications of enclosure (1) of this purchase order, and
   2) the equipment design and stress calculations contained in enclosure (2) of this purchase order.

The purpose of this design review is to verify that equipment meets the design rules of ASME Section III Class 1, 1971 Edition plus Addendum through Winter 1972.

b. Establish a procedure and technique, and conduct, subject to Purchaser's approval, an experimental test to determine stress levels at representative locations of the equipment under conditions corresponding to 100% system design pressure and coolant temperature of 100°-200°F. Purchaser will provide Supplier with the equipment to be tested.

c. Prepare a complete report describing the work performed in a. and b. above. The report shall confirm whether the equipment meets the specified design requirements and make recommendations as to further investigations or design requirements considered necessary.

For the above example, the unique order method could be used to specify the quality assurance program required of the Supplier by use of the following provisions:

a. Supplier shall establish and maintain a documented quality assurance program conforming to those sections and elements of ANSI N45.2, "Quality Assurance Program Requirements for Nuclear Power Plants"
which are listed below. These sections and elements should be applied to the extent that Purchaser's order requires work that is governed by the sections and elements.

Section 1 - Introduction
Section 2 - Quality Assurance Program
Section 3 - Organization
Section 4 - Design Control
Section 6 - Instructions, Procedures, and Drawings
Section 7 - Document Control
Section 12 - Test Control
Section 13 - Control of Measuring and Test Equipment
Section 17 - Corrective Action
Section 18 - Quality Assurance Records
Section 19 - Audits

b. Supplier shall submit his quality assurance program description to Purchaser with Supplier's bid response for Purchaser's review. If Supplier's quality assurance program description has been previously submitted, Supplier shall update it or submit a statement that the quality assurance program has not changed since the last evaluation.

c. Purchaser shall evaluate the program of the successful bidder and will provide comments, if changes or supplements are required. Supplier shall resolve Purchaser's comments and implement them prior to the start of any work affected by the comments.

d. Supplier shall, during the performance of the order, submit all
proposed changes of his quality assurance program to Purchaser for
review prior to implementing the changes to Purchaser's order.
e. The Supplier shall identify and pass on to Supplier's lower tier 
Suppliers all applicable quality program requirements.
There is an alternate approach which can be considered for specifying 
the required Supplier quality assurance program for the above work 
example, which is basically a "design and test only" scope of work. 
This alternate approach would be to utilize a different ANSI quality 
assurance standard such as ANSI N45.2.11, "Quality Assurance Requirements 
for the Design of Nuclear Power Plants". This standard may be applicable 
to the above work example in greater degree than all portions of ANSI N45.2. 
Consequently, ANSI N45.2.11 could be incorporated into the procurement 
documents by provisions similar to paragraphs a. through e. above except 
that ANSI N45.2.11 would be referred in its entirety rather than referring 
to parts of ANSI N45.2.
A. INTRODUCTION

In October 1972, the Commission issued Revision 1 of the "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants."* This document provides a standard format for the safety analysis reports required by the Commission's regulations and identifies the principal information needed by the Regulatory staff in order to conduct its safety evaluations.

In its review of recent applications for construction permits and operating licenses, the Regulatory staff has identified information that has often been missing from these safety analysis reports. To obtain the information needed to perform its evaluation, the staff has had to request this information by directing written questions to each applicant. The Foreword of the Standard Format states: "Any revisions of the Commission's needs for information will be conveyed to the industry and the public in various ways such as (1) amendments to the Standard Format,

*The "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants" has been designated as Regulatory Guide 1.70.
(2) in the Information Guide series, (3) as part of future Safety Guides, or (4) in Public Announcements." This guide identifies information related to quality assurance during design and construction that is required at the construction permit stage of review of the safety analysis report. This guide can also be used by applicants and their major contractors such as nuclear steam systems suppliers, architect-engineers, constructors, and major equipment manufacturers in preparing "topical" reports describing their Quality Assurance (QA) Programs.

The Commission plans to revise the Standard Format within the next year to include this modification. In the interim, the information requested here should be included in safety analysis reports submitted for AEC review.

B. ADDITIONAL INFORMATION

The additional information requested should be incorporated into sections of the Preliminary Safety Analysis Report (PSAR) as indicated below:

1. The entire Section 17.0 of the Standard Format, "Quality Assurance" should be replaced with the following:
17.0 QUALITY ASSURANCE

In order to provide assurance that the design, construction, and operation of the proposed nuclear power plant are in conformance with applicable regulatory requirements and with the design bases specified in the license application, it is necessary that a Quality Assurance Program (QA Program) be established by the applicant. In this chapter of the SAR, the applicant should provide a description of the QA Program to be established and executed during the design and construction of the nuclear power plant. In addition, the FSAR should describe the QA Program to be established and executed during operation of the nuclear power plant. The QA Program must be established at the earliest practical time consistent with the schedule for accomplishing the activity. Where some portions of the QA Program have not yet been established at the time the SAR is prepared because the activity will be performed in the future, the description should also provide a schedule for implementation. The program must meet the requirements of Appendix B to 10 CFR Part 50. The inspection and survey systems required by Section 50.55a of 10 CFR Part 50 (Codes and Standards Rule) may be used in partial fulfillment of these requirements to the extent that they are shown by the description of the QA Program to satisfy the applicable requirements of Appendix B.
In order to facilitate the presentation of the information, the QA Program for each of the major organizations involved in executing the QA Program should include the information described (either separately for each organization or integrally for all organizations) in accordance with the following outline. It is not intended to dictate the format of any QA Program Manual; that is left to the discretion of the applicant. It is required, however, that the description in the SAR address, at a minimum, each of the criteria in Appendix B in sufficient detail to enable the reviewer to determine whether and how all the requirements of the Appendix will be satisfied in accordance with Section 50.34 of 10 CFR Part 50. Reference to appropriate portions of other sections of the SAR may suffice.

AEC Regulatory Guides, "Guidance on Quality Assurance Requirements During Design and Procurement Phase of Nuclear Power Plants," Revision 1 dated May 1974 (Gray Book - Revision 1), "Guidance on Quality Assurance Requirements During Construction Phase of Nuclear Power Plants" Revision 0 dated May 1974 (Green Book - Revision 0) and "Guidance on Quality Assurance Requirements During the Operations Phase of Nuclear Power Plants, Revision 0 dated October 1973 (Orange Book - Revision 0) contain guidance on acceptable methods of implementing portions of the quality assurance program. The PSAR should specifically indicate whether this guidance will be complied with. If such guidance will not
complied with, the PSAR should describe specific alternate methods that will be used and the manner of implementing them and should identify the organizations responsible for their implementation.

Where a portion of the QA Program to be implemented will conform to guidance provided by a Regulatory Guide, the Gray Book - Revision 1, the Green Book - Revision 0, or the Orange Book - Revision 0 the Program description may consist of a statement that the guidance will be complied with for that portion of the QA Program. When these documents are used in describing the QA Program, the applicant should indicate how the guidance documents will be applied to portions of the QA Program and should delineate the organizational element responsible for implementing various provisions of the respective guidance documents within each major organization in the project, including that of the applicant, the architect-engineer, the nuclear steam system supplier, the constructor and construction manager (if different than the constructor).

2. The entire Section 17.1 of the Standard Format, "Quality Assurance During Design and Construction" should be replaced with the following:
17.1 Quality Assurance During Design and Construction

17.1.1 Organization

17.1.1.1 The PSAR should describe clearly the authority and duties of persons and organizations performing quality assurance (QA) functions of assuring that the QA Program is established and executed and of verifying that an activity has been correctly performed. The PSAR should provide organization charts and functional responsibility descriptions that denote the lines of responsibility and areas of authority within each of the major organizations in the project, including those of the applicant, the architect-engineer, the nuclear steam system supplier, the constructor and construction manager (if different from the constructor). These charts and descriptions should present the structure of QA organizations involved as well as other functional organizations performing activities affecting quality in design, procurement, manufacturing, construction and installation, testing, inspection and auditing with clear delineation of their responsibility, authority, and relationship to corporate management. In addition, a single overall project organization chart should be included showing how each of the major organizations or companies working directly for the applicant on the project interrelate with one another.
The PSAR should describe those measures which assure that persons and organizations performing QA functions have sufficient authority and organizational freedom to (1) identify quality problems; (2) initiate, recommend, or provide solutions; and (3) verify implementation of solutions. The PSAR should describe the measures which assure that persons and organizations assigned the responsibility for checking, auditing, inspecting, or otherwise verifying that an activity has been correctly performed report to a management level such that this required authority and organizational freedom, including sufficient independence from the pressures of production, are provided. Irrespective of the organizational structure, the PSAR should describe how the individual responsible for directing and managing the QA Program at any location where activities subject to the control of the QA Program are being performed has direct access to such levels of management as may be necessary to achieve effective implementation of the QA Program. The PSAR should indicate from whom the persons performing QA functions receive technical direction for performing QA tasks and administrative control (salary review, hire/fire, position assignment). The PSAR should identify those positions or organizations which have written delegated responsibility and authority to stop work or control further processing, delivery, installation, or use of nonconforming items until proper disposition of the deficiency has been approved.
The PSAR should describe how requirements will be imposed on contractors and subcontractors to assure that individuals or groups within their organizations performing QA functions have sufficient authority and organizational freedom to effectively implement their respective QA Programs.

17.1.1.3 The PSAR should describe the extent to which the applicant will delegate to other contractors the work of establishing and executing the QA Program, or any part thereof. A clear delineation of those QA functions which are implemented within the applicant's QA organization(s) and those which are delegated to other organizations should be provided in the PSAR. The PSAR should describe the method by which the applicant will retain responsibility for and maintain control over those portions of the QA Program delegated to other organizations and identify the organization responsible for verifying that delegated QA functions are properly carried out. The PSAR should identify major work interfaces for activities affecting quality and describe how clear and effective lines of communication exist between the applicant and his principal contractors to assure necessary coordination and control of the QA Program.

17.1.2 Quality Assurance Program

17.1.2.1 The QA Program in the PSAR should cover each of the criteria in
Appendix B to 10 CFR Part 50 in sufficient detail to permit a
determination as to whether and how all of the requirements of
Appendix B will be satisfied. The PSAR should (1) describe the
extent to which the QA Program will conform with and (2) should
identify the organizational element responsible for implementing
various provisions of the Gray Book - Revision 1, the Green Book
- Revision 0 and AEC Regulatory Guides which provide guidance
on acceptable methods of implementing portions of the QA Program.
If the applicant elects not to follow the above guidance, the
PSAR should describe in detail equivalent to that furnished in the
AEC guidance the alternate methods that will be used and the
manner of implementing them and should indicate the organizations
responsible for their implementation.

17.1.2.2 The PSAR should identify the safety related structures, systems, and
components to be controlled by the QA program.

17.1.2.3 The PSAR should describe the measures that assure the QA Program is
being established at the earliest practicable time consistent with
the schedule for accomplishing activities affecting quality for
the project. That is, the PSAR should describe how the QA Program,
is being established in advance of the activity to be controlled
and will be implemented as the activity proceeds. Those activities
affecting quality initiated prior to the submittal of the PSAR, such as establishing information required to be included in the PSAR, design and procurement, and safety related site preparation activities should be identified in the PSAR. The PSAR should describe how these activities are controlled by a QA Program which complies with Appendix B to 10 CFR Part 50.

17.1.2.4 The PSAR should describe how the QA Program is documented by written policies, procedures, or instructions and will be implemented in accordance with these policies, procedures, or instructions. The PSAR should include a listing of QA Program procedures or instructions which will be used to implement the QA Program for each major activity such as design, procurement, construction, etc. The procedure list should identify which criteria of Appendix B to 10 CFR Part 50 each procedure implements. In the event certain required procedures are not yet established, a schedule for their preparation should be provided in the PSAR.

17.1.2.5 The PSAR should describe the program which provides adequate indoctrination and training of personnel performing activities affecting quality to assure that suitable proficiency is achieved and maintained. The PSAR should describe how the indoctrination and training program will provide that:
(1) Personnel performing activities affecting quality are appropriately trained in the principles and techniques of the activity being performed;

(2) Personnel performing activities affecting quality are instructed as to purpose, scope, and implementation of governing manuals, policies, and procedures;

(3) Appropriate training procedures are established.

The qualification requirements for the position responsible for directing and managing the QA Program of the applicant and of his major contractors.

17.1.2.6 The PSAR should describe the measures which assure that activities affecting quality will be accomplished under suitable controlled conditions, including (1) the use of appropriate equipment; (2) suitable environment for accomplishing the activity, such as adequate cleanliness; and (3) compliance with necessary prerequisites for the given activity.

17.1.2.7 The PSAR should describe the measures which assure that there is regular management review of the QA Program to assess the adequacy of its scope, implementation, and effectiveness. The PSAR should describe the provisions for reviews by management above or outside
the QA organization to assure achieving an objective program assessment.

The PSAR should describe the measures which assure that the QA organization of the applicant will (1) review and document concurrence with the QA Program of his principal contractors and (2) conduct or have conducted audits of the contractors' QA Program activities.

17.1.3 Design Control

17.1.3.1 The PSAR should describe the design control measures which assure that (1) applicable regulatory requirements and design bases for safety-related structures, systems, and components are correctly translated into specifications, drawings, procedures, and instructions and (2) appropriate quality standards are specified in design documents and that deviations from such standards are controlled.

17.1.3.2 The PSAR should describe measures which assure that adequate review and selection for application suitability is conducted for materials, parts, equipment, and processes that are essential to safety-related functions of the structures, systems, and components. The PSAR should describe provisions which assure that standard commercial or so-called "off the shelf" materials, parts, and equipment also receive adequate application review and selection.
17.1.3.3 The PSAR should describe the program for applying design control measures to various aspects of design such as reactor physics; stress, thermal, hydraulic, and accident analysis; materials compatibility; accessibility for maintenance, in-service inspection, and repair; and describe measures for delineation of acceptance criteria for inspections and tests.

17.1.3.4 The PSAR should describe measures which assure verification or checking design adequacy, such as by design reviews, by use of alternate calculational methods, or by performance of a qualification testing program under the most adverse design conditions. The PSAR should identify the positions or organizations responsible for design verification or checking and should describe measures which assure that the verifying or checking process is performed by individuals or groups other than those who performed the original design, but who may be from the same organization.

17.1.3.5 The PSAR should describe measures for identifying and controlling design interfaces, both internal and external, and for coordination between participating design organizations. The PSAR should describe measures in effect between participating design organizations for review, approval, release, distribution, collection, and storage of documents and changes thereto involving design interfaces. The PSAR should describe how these measures will assure that these design documents are controlled in a timely manner to prevent inadvertent use of superseded design information.
17.1.3.6 The PSAR should describe the measures that will be employed to assure that design changes, including field changes, are subject to the same design controls that were applied to the original design and are reviewed and approved by the organization that performed the original design unless the originating organization designates another organization.

17.1.4 Procurement Document Control

17.1.4.1 The PSAR should describe measures which assure that documents and changes thereto for procurement of material, equipment, and services, whether purchased by the applicant or by his contractors or subcontractors, correctly include or reference the following as necessary to achieve required quality:

(1) Applicable regulatory, code, and design requirements;
(2) Quality assurance program requirements;
(3) Requirements for supplier documents such as instructions, procedures, drawings, specifications, inspection and test records, and supplier QA records to be prepared, submitted, or made available for purchaser review or approval;
(4) Requirements for the retention, control, and maintenance of supplier QA records;
(5) Provision for purchaser's right of access to suppliers' facilities and work documents for inspection and audit;
(6) Provision for supplier reporting and disposition of non-conformances from procurement requirements

17.1.4.2 The PSAR should describe (1) measures which clearly delineate the control responsibilities and action sequence to be taken in the preparation, review approval, and issuance by competent personnel of procurement documents and (2) measures which assure that changes or revisions to procurement documents are subject to the same review and approval requirements as the original documents.

17.1.4.3 The PSAR should describe measures which assure (1) that procurement documents require suppliers to have and implement a documented QA Program for purchased materials, equipment, and services to an extent consistent with their importance to safety; (2) that the Purchaser evaluate the supplier before the award of the procurement order or contract to assure that the supplier can meet the procurement requirements; and (3) that procurement documents for spare or replacement items will be subject to controls at least equivalent to those used for the original equipment.

17.1.5 Instructions, Procedures, and Drawings

17.1.5.1 The PSAR should describe measures that assure that activities affecting quality such as design, procurement, manufacturing, construction and installation, testing, inspection, and auditing
are prescribed by appropriately documented instructions, procedures, or drawings and that these activities will be conducted in accordance with the documented instructions and procedures.

17.1.5.2 The PSAR should describe the system whereby the documented instructions and procedures will include appropriate quantitative (such as dimensions, tolerances, and operating limits) and qualitative (such as workmanship samples, weld radiographic acceptance standards) acceptance criteria for determining that prescribed activities have been satisfactorily accomplished.

17.1.6 Document Control

17.1.6.1 The PSAR should describe those measures established to control the issuance of documents such as instructions, procedures, and drawings, including changes thereto, which prescribe all activities affecting quality. The description should cover control measures which assure that:

(1) Documents are reviewed for adequacy (i.e., information is clearly and accurately stated) and are approved by authorized personnel for issuance and use at locations where the prescribed activity will be performed prior to commencing the activity;

(2) Means such as use of updated master document lists exist to assure that obsolete or superseded documents are replaced in
a timely manner by updated applicable document revisions; and

(3) Document changes are reviewed and approved by the same organizations that performed the original review and approval unless delegated by the originating organization to another responsible organization.

17.1.6.2 The PSAR should identify the types of documents to be controlled and the group responsible for review, approval, and issuance of documents and changes thereto.

17.1.7 Control of Purchased Material, Equipment, and Services

17.1.7.1 The PSAR should describe those measures that assure that material, equipment, and services purchased directly by the applicant or by his contractors and subcontractors will conform to procurement document requirements. The PSAR should describe the measures that provide, as appropriate, for:

(1) Evaluation and selection of sources of supply;

(2) Surveillance at the supplier's facility by the purchaser or his representative in accordance with written procedures during design, manufacture, inspection, and test of the procured item or service to verify compliance with quality
requirements;

(3) Source and/or receipt inspection in accordance with written procedures and acceptance criteria of procured items furnished by the supplier;

(4) Documentary evidence to the site from the supplier that procured items meet procurement quality requirements such as codes, standards or specifications. The PSAR should describe measures established by the purchaser to (a) examine and indicate acceptance of this documented evidence during source or receipt inspection and (b) assure that this documented evidence is available at the nuclear power plant site prior to installation or use of the procured item and that the documentation will be retained at the plant site.

17.1.7.2 The PSAR shall describe measures whereby the applicant or its designated representative will audit and evaluate the effectiveness of control of quality related activities of contractors and subcontractors at frequencies or to an extent consistent with the importance to safety, complexity, and quantity of the item or service being furnished.

17.1.8 Identification and Control of Materials, Parts, and Components
The PSAR should describe measures established to identify and control items such as materials, parts, and components, including partially fabricated assemblies, to prevent use of incorrect or defective items. The PSAR should describe measures which assure (1) that identification of the item, such as heat number, part number, serial number, or other appropriate marking is maintained, either on the item or on records traceable to the item, and verified as required throughout fabrication, erection, installation and use of the item; (2) that the method and location of the identification does not affect the function or quality of the item being identified.

17.1.9 Control of Special Processes

The PSAR should describe measures established to control special processes such as welding, heat treating, nondestructive testing, electrochemical machining and to assure they are accomplished by qualified personnel using written procedures qualified in accordance with applicable codes, standards, specifications, or other special requirements. The PSAR should describe those measures which assure that qualifications of special processes, personnel performing special processes, and equipment are kept current and record files thereof are maintained.

17.1.10 Inspection
17.1.10.1 The PSAR should describe the measures which assure a program
for inspection is established and implemented by or for the
organization performing the activity to verify conformance with
the documented instructions, procedures, and drawings for
accomplishing the activity. The PSAR should describe measures
which assure that (1) inspection personnel are appropriately
qualified and are independent of the individual or group performing
the activity being inspected; (2) inspections or tests are performed
for each work operation as necessary to verify quality; and
(3) indirect control by monitoring processing methods, equipment,
and personnel is used if direct inspection of processed material
or products is impossible or disadvantageous, (4) both inspection
and process monitoring is used when control is inadequate without
both. The PSAR should describe measures which assure that (1)
inspection procedures and instructions are made available with
necessary drawings and specifications for use prior to performing
the inspection; (2) inspectors' qualifications or certifications
are kept current; and (3) replacement of rework items are inspected
in accordance with original inspection requirements and modification
or repair items are inspected by methods which are equivalent to the
original inspection method.

17.1.10.2 The PSAR should describe the system whereby appropriate documents
will identify mandatory inspection hold points which require
witnessing or inspecting by the applicant's designated representative
and beyond which work shall not proceed without the consent of its
designated representative.

17.1.11 Test Control

17.1.11.1 The PSAR should describe the measures that establish a test program which (1) identifies all testing required to demonstrate that structures, systems, and components will perform satisfactorily in service, (2) is conducted by trained or appropriately qualified personnel in accordance with written test procedures which incorporate the requirements and acceptance limits contained in applicable design documents, and (3) includes testing that will be performed under the construction permit.

17.1.11.2 The PSAR should describe the measures which assure that test procedures have provisions that assure that:

(1) All prerequisites for the given test have been met;
(2) Adequate test instrumentation and equipment are available;
(3) The test is performed under suitable environmental conditions and with adequate test methods.

17.1.11.3 The PSAR should describe the system whereby test results are documented and evaluated to assure that test requirements have been satisfied.
17.1.12 Control of Measuring and Test Equipment

1.12.1 The PSAR should describe the measures established to assure that tools, gages, instruments, and other measuring and testing devices used in activities affecting quality are properly identified, controlled, adjusted, and calibrated at specified periods to maintain accuracy within necessary limits. The PSAR should describe measures which assure (1) that these devices are adjusted and calibrated against certified equipment or reference or transfer standards having known valid relationships to nationally recognized standards or (2) that if no national standards exist, the basis for calibration shall be documented. The PSAR should describe the measures which assure that the error of calibration standards is less than the error of production measuring and test equipment. The PSAR should describe provisions that will be used if measuring and test equipment is found out of calibration, for evaluating the validity of previous inspection or test results and the acceptability of items inspected or tested since the last calibration check and, where necessary to establish acceptability of suspect items, for repeating original inspections or tests using calibrated equipment. The PSAR should describe measures which assure the maintenance of records which indicate the calibration status of all items under the calibration system and which identify the measuring and test equipment.
17.1.13 Handling, Storage, and Shipping

17.1.13.1 The PSAR should describe the measures established to control the handling, storage, shipping, cleaning, and preservation of material and equipment in accordance with work and inspection instructions to prevent damage or deterioration. The PSAR should describe the measures for specifying and providing, when necessary for particular products, special protective environments, such as inert gas atmosphere, specific moisture content levels, and temperature levels.

17.1.14 Inspection, Test and Operating Status

17.1.14.1 The PSAR should describe measures established to indicate by the use of markings such as stamps, tags, labels, routing cards, or other suitable means the status of inspections and tests performed upon individual items of the nuclear power plant throughout fabrication, installation, and test. The PSAR should describe measures which provide for the identification of items which have satisfactorily passed required inspections and tests, where necessary to preclude inadvertent bypassing of such inspections and tests. The PSAR should describe the measures established for indicating the operating status of structures, systems, and components of the nuclear power plant such as by tagging valves and switches to prevent inadvertent operation.
17.1.15.1 The PSAR should describe the measures established to control materials, parts, or components which do not conform to requirements in order to prevent their inadvertent use or installation. The PSAR should describe measures which provide for as appropriate identification, documentation, segregation, disposition, and notification to affected organizations. The PSAR should describe measures which assure that nonconforming items are reviewed and accepted, rejected or repaired or reworked in accordance with documented procedures. The PSAR should describe measures which control further processing, delivery, or installation pending proper disposition of the deficiency. The PSAR should describe measures established by the applicant (1) for contractors to report to him those nonconformances concerning departures from design requirements that are dispositioned "use as is" or "repair" and (2) to make such nonconformance reports part of the documentation required at the nuclear plant site or to include a description of the nonconformance and its disposition on certificates of conformance that are provided to the site prior to installation use of material or equipment at the site. The PSAR should state whether periodic analysis of nonconformance reports are performed to show quality trends and whether such analysis are forwarded to management.
17.1.16 Corrective Action

17.1.16.1 The PSAR should describe the measures which assure that conditions adverse to quality such as failures, malfunctions, deficiencies, deviations, defective material and equipment, and nonconformances are promptly identified and corrected.

17.1.16.2 The PSAR should describe how, in the case of significant conditions adverse to quality, the cause(s) of the condition is determined, corrective action is taken to preclude repetition, and the problem with its determined cause(s) and corrective action is documented and reported to appropriate levels of management.

17.1.17 Quality Assurance Records

17.1.17.1 The PSAR should describe the measures which assure that sufficient records are maintained to furnish evidence of activities affecting quality. The PSAR should describe how the content of such records (1) includes at least test logs; results of reviews, inspections, tests, audits, monitoring of work performance and materials analysis; and such data as qualifications of personnel, procedures, and equipment; (2) identifies the type of operation, the inspector or data recorder, the results, the acceptability, and action taken in connection with any deficiencies noted; and (3) provides sufficient information to permit identification of the record with the item(s) or activity to which it applies.
17.1.17.2 The PSAR Should describe the measures which assure that records will be identifiable and retrievable.

17.1.17.3 The PSAR should describe the measures which establish requirements, consistent with regulatory requirements and responsibilities concerning record submittal and retention, security, and storage facilities, to protect records from destruction by fire, flooding, tornadoes, insects, and rodents and from deterioration by extremes in temperature and humidity.

17.1.18 Audits

17.1.18.1 The PSAR should describe the program of the applicant and of his principal contractors for conducting comprehensive, planned, and periodic audits to verify compliance with all aspects of the quality assurance program and to determine the effectiveness of the program.

The PSAR should identify the positions or organizations which perform the functions below and should describe the program features which cover:

(1) External audits to be performed by the applicant and his principal contractors on their respective suppliers.
(2) Internal audits to be performed by the applicant and his principal contractors within their respective organizations.

(3) The planning and scheduling of audits to assure that they are regularly scheduled on the basis of the status and safety importance of the activities being performed and are initiated early enough to assure effective quality assurance during design, procurement, manufacturing, construction and installation, inspection and test.

(4) Conduct of audits in accordance with written procedures or check lists by appropriately trained and qualified personnel not having direct responsibility in the area being audited.

(5) Documentation of audit results with review by management responsible for the area audited and, where indicated, follow up action taken, including re-audit of deficient areas.
D. Regulatory Staff Comments and Supplementary Guidance

Section C contains AEC regulations, regulatory guides, and draft N45.2 standards that establish requirements and provide guidance on the quality assurance program during the construction phase. In addition to the guidance presented in Section C, the AEC Regulatory staff has provided herein additional comments and supplementary guidance on applicable N45.2 series standards.

1. Draft Standard ANSI N45.2.5 - Supplementary Quality Assurance Requirements for Installation, Inspection, and Testing of Structural Concrete and Structural Steel During the Construction Phase of Nuclear Power Plants (Draft 3, Rev. 1 – January 1974)

Table B, "Required In-Process Tests," requires that samples for slump and temperature tests for concrete be taken with the first batch produced each day and every 50 cu. yd. placed thereafter. ACI Standard 301-72, "Specifications for Structural Concrete for Buildings," requires that samples for slump and temperature tests for concrete be taken with every 100 cu. yd. placed. It is considered acceptable to decrease the sampling frequency for slump and temperature tests for concrete to 100 cu. yd. intervals. In this regard, these tests should be coordinated with the compressive strength and air content tests for concrete which are based on 100 cu. yd. intervals.

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2. Draft Standard N45.2.13 - Quality Assurance Requirements for Control of Procurement of Items and Services for Nuclear Power Plants (Draft 2, Rev. 4 - April 1974)

Subsection 10.2.1, Certification of Conformance, states "Regardless of acceptable methods, where required by code, regulation, or contract requirement, documentary evidence that items conform to procurement documents shall be available at the nuclear power plant prior to installation or use of such items. Where not precluded by other requirements, such documentary evidence may take the form of written certifications of conformance which identify the requirements met by the items, providing means are available to verify the validity of such certifications, such as during audits or independent inspection or test of the items." Verification of certificate validity should be conducted periodically to assure that the certificates from the various suppliers are meaningful.