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REGULATORY GUIDE

OFFICE OF STANDARDS DEVELOPMENT

REGULATORY GUIDE 1.33

QUALITY ASSURANCE PROGRAM REQUIREMENTS (OPERATION)

A. INTRODUCTION

Appendix B, "Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants," to 10 CFR Part 50, "Licensing of Production and Utilization Facilities," establishes quality assurance requirements for the operation of nuclear power plant safety-related structures, systems, and components. This regulatory guide describes a method acceptable to the NRC staff for complying with the Commission's regulations with regard to overall quality assurance program requirements for the operation phase 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

Subcommittee ANS-3, Reactor Operations, of the American Nuclear Society Standards Committee developed ANSI N18.7-1972, which contained criteria for administrative controls for nuclear power plants during operation. This standard, along with ANSI N45.2-1971, "Quality Assurance Program Requirements for Nuclear Power Plants," was endorsed by Regulatory Guide 1.33. The dual endorsement was necessary in order for the guidance contained in the regulatory guide to be consistent with the requirements of Appendix B to 10 CFR Part 50; however, this dual endorsement caused some confusion among users. To clarify this situation, ANSI N18.7-1972 was revised so that a single standard would define the general quality assurance program "requirements" for the operation phase. This revised standard was approved by the American National Standards Committee N18, Nuclear Design Criteria. It was subsequently approved and designated N18.7-1976/ANS-3.2, "Administrative Controls and Quality Assurance for the Operational Phase of Nuclear Power Plants,"[1] by the American National Standards Institute on February 19, 1976.

There had been some uncertainty with regard to the NRC staff's position when a regulatory guide endorses, as an acceptable method, the "guidelines" as well as the "requirements" included in a standard. The NRC staff has evaluated the guidelines contained in N18.7-1976/ANS-3.2 with respect to importance to safety. Revision 1 of this regulatory guide clarified the NRC staff's position on the "requirements" and "guidelines" included in ANSI N18.7-1976/ANS-3.2. Where conformance to the recommendations of this regulatory guide is indicated in an application without further qualification, this indicates the applicant will comply with the "requirements" of ANSI N18.7-1976/ANS-3.2, as supplemented or modified by the regulatory position of this guide.

Section 1, "Scope," of ANSI N18.7-1976/ANS-3.2 states that this standard contains criteria for administrative controls and quality assurance for nuclear power plants during the operational phase of plant life and that this phase is generally considered to commence with initial fuel loading, except for certain preoperational activities. In this regard, a separate regulatory guide addressing the quality assurance program for the preoperational phase will be issued. Other regulatory guides may be issued or this regulatory guide may be revised, if necessary, to amplify the general requirements contained in this standard.

Appendix A to this guide has been further revised as a result of additional comments received on the guide and additional staff review.

*Lines indicate substantive changes from previous issue.

[1] Copies may be obtained from American Nuclear Society, 555 North Kensington Avenue, La Grange Park, Illinois 60525.

C. REGULATORY POSITION

The overall quality assurance program requirements for the operation phase that are included in ANSI N18.7-1976/ANS-3.2 are acceptable to the NRC staff and provide an adequate basis for complying with the quality assurance program requirements of Appendix B to 10 CFR Part 50, subject to the following:

1. ANSI N18.7-1976/ANS-3.2 requires the preparation of many procedures to carry out an effective quality assurance program. Appendix A, "Typical Procedures for Pressurized Water Reactors and Boiling Water Reactors," to this regulatory guide should be used as guidance to ensure minimum procedural coverage for plant operating activities, including related maintenance activities. Appendix A lists typical safety-related activities that should be covered by written procedures but does not provide a complete listing of needed procedures. Many other activities carried out during the operation phase of a nuclear power plant require written procedures not included in Appendix A. Appendix A may also contain procedures that are not applicable to an applicant because of the configuration of the nuclear power plant. The procedures listed in Appendix A may be combined, separated, or deleted to conform to the applicant's procedures plan.

2. Throughout ANSI N18.7-1976/ANS-3.2, other documents required to be included as a part of this standard are identified at the point of reference. The specific acceptability of these standards listed in ANSI N18.7-1976/ANS-3.2 has been addressed in the latest revision of the following regulatory guides:

ANSI Standard	Regulatory Guide
N45.2	1.28
N45.2.1	1.37
N45.2.2	1.38
N45.2.3	1.39
N45.2.4	1.30
N45.2.5	1.94
N45.2.6	1.58
N45.2.8	1.116
N45.2.9	1.88
N45.2.10	1.74
N45.2.11	1.64
N45.2.13	1.123
N18.1	1.8
N18.17	1.17
N101.4	1.54

Note: N45.2.12 is discussed in NRC documents WASH-1283, "Guidance on Quality Assurance Requirements During Design and Procurement Phase of Nuclear Power Plants," (Grey Book) and WASH-1309, "Guidance on Quality Assurance Requirements During the Construction Phase of Nuclear Power Plants," (Green Book) and will be endorsed by a regulatory guide upon its approval as an ANSI standard.

3. Section 4.3.4, "Subjects Requiring Independent Review," Item (3) states, in part, that changes to the technical specifications or license amendments related to nuclear safety are required to be reviewed by the independent review body prior to implementation. It should be noted that proposed changes to technical specifications or license amendments should be reviewed by the independent review body prior to their submittal to the Commission for approval.

4. Section 4.5, "Audit Program," of ANSI N18.7-1976/ANS-3.2 states that audits of selected aspects of operational phase activities shall be performed with a frequency commensurate with their safety significance and in such a manner as to ensure that an audit of all safety-related functions is completed within a period of 2 years. In amplification of this requirement, the following program elements should be audited at the indicated frequencies:

a. The results of actions taken to correct deficiencies that affect nuclear safety and occur in facility equipment, structures, systems, or method of operation—at least once per 6 months.

b. The conformance of facility operation to provisions contained within the technical specifications and applicable license conditions—at least once per 12 months.

c. The performance, training, and qualifications of the facility staff—at least once per 12 months.

5. The guidelines (indicated by the verb "should") of ANSI N18.7-1976/ANS-3.2 contained in the following sections have sufficient safety importance to be treated the same as the requirements (indicated by the verb "shall") of the standard:

a. Section 4.4—The guidelines concerning review activities of the onsite operating organization, except the guideline that refers to screening subjects of potential concern.

b. Section 5.2.3—The guideline concerning review and updating of standing orders.

c. Section 5.2.4—The guideline concerning review, updating, and cancellation of special orders.

d. Section 5.2.7.1—The guidelines that address adequate design and testing of replacement parts.

e. Section 5.2.13.4—The guideline concerning special handling tools and equipment.

f. Section 5.2.19(2)—The guideline for checking plant operating procedures during the testing program.

g. Section 5.2.19.1—The guidelines for preoperational tests, except the guideline that refers to a

run-in period for equipment. In addition to these guidelines, the prerequisite steps for each equipment test should be completed prior to the commencement of the preoperational test.

h. Section 5.3.2—The guidelines that describe the content (excluding format) of procedures, except for the guidelines that address (1) a separate statement of applicability in Section 5.3.2(2), (2) inclusion of references in procedures, as applicable, in Section 5.3.2(3), and (3) inclusion of quantitative control guides in Section 5.3.2(6).

i. Section 5.3.9—The guideline concerning emergency procedures requiring prompt implementation of immediate operator actions when required to prevent or mitigate the consequences of a serious condition.

j. Section 5.3.9.1—The guidelines that describe the content (excluding format) for: the title in Section 5.3.9.1(1); the inclusion of symptoms to aid in identification in Section 5.3.9.1(2); automatic actions in Section 5.3.9.1(3); immediate operator action, excluding those guidelines contained in the examples, in Section 5.3.9.1(4); and subsequent operator actions in Section 5.3.9.1(5).

D. IMPLEMENTATION

The purpose of this section is to provide information to applicants and licensees regarding the NRC staff's plans for using this regulatory guide.

This guide reflects current NRC practice. Therefore, except in those cases in which the applicant proposes an acceptable alternative method for complying with the specified portions of the Commission's regulations, the method described herein is being and will continue to be used in the evaluation of submittals for operating license applications until this guide is revised as a result of suggestions from the public or additional staff review.

APPENDIX A

TYPICAL PROCEDURES FOR PRESSURIZED WATER REACTORS AND BOILING WATER REACTORS

The following are typical safety-related activities that should be covered by written procedures. This appendix is not intended as an inclusive listing of all needed procedures since many other activities carried out during the operation phase of nuclear power plants should be covered by procedures not included in this list.

1. Administrative Procedures

a. Security and Visitor Control
b. Authorities and Responsibilities for Safe Operation and Shutdown
c. Equipment Control (e.g., locking and tagging)
d. Procedure Adherence and Temporary Change Method
e. Procedure Review and Approval
f. Schedule for Surveillance Tests and Calibration
g. Shift and Relief Turnover
h. Log Entries, Record Retention, and Review Procedures
i. Access to Containment
j. Bypass of Safety Functions and Jumper Control
k. Maintenance of Minimum Shift Complement and Call-In of Personnel
l. Plant Fire Protection Program
m. Communication System Procedures

2. General Plant Operating Procedures

a. Cold Shutdown to Hot Standby
b. Hot Standby to Minimum Load (nuclear startup)
c. Recovery from Reactor Trip
d. Operation at Hot Standby
e. Turbine Startup and Synchronization of Generator
f. Changing Load and Load Follow (if applicable)
g. Power Operation and Process Monitoring
h. Power Operation with less than Full Reactor Coolant Flow
i. Plant Shutdown to Hot Standby
j. Hot Standby to Cold Shutdown
k. Preparation for Refueling and Refueling Equipment Operation
l. Refueling and Core Alterations

3. Procedures for Startup, Operation, and Shutdown of Safety-Related PWR Systems

Instructions for energizing, filling, venting, draining, startup, shutdown, and changing modes of operation should be prepared, as appropriate, for the following systems:

a. Reactor Coolant System
b. Control Rod Drive System (including part-length rods)
c. Shutdown Cooling System
d. Emergency Core Cooling System
e. Component Cooling Water System
f. Containment
   (1) Maintaining Containment Integrity
   (2) Special Containment Systems
      (a) Atmosphere
      (b) Subatmospheric
      (c) Double-Wall Containment with Controlled Interspace
      (d) Ice Condenser
   (3) Containment Ventilation System
   (4) Containment Cooling System
g. Atmosphere Cleanup Systems
h. Fuel Storage Pool Purification and Cooling System
i. Main Steam System
j. Pressurizer Pressure and Spray Control Systems
k. Feedwater System (feedwater pumps to steam generator)
l. Auxiliary Feedwater System
m. Service Water System
n. Chemical and Volume Control System (including Letdown/Purification System)
o. Auxiliary or Reactor Building Heating and Ventilation
p. Control Room Heating and Ventilation
q. Radwaste Building Heating and Ventilation
r. Instrument Air System
s. Electrical System
   (1) Offsite (access circuits)
   (2) Onsite
      (a) Emergency Power Sources (e.g., diesel generator, batteries)
      (b) A.C. System
      (c) D.C. System
t. Nuclear Instrument System
   (1) Source Range
   (2) Intermediate Range
   (3) Power Range
   (4) Incore System
u. Reactor Control and Protection System
v. Hydrogen Recombiner

4. Procedure for Startup, Operation, and Shutdown of Safety-Related BWR Systems

Instructions for energizing, filling, venting, draining, startup, shutdown, and changing modes of operation should be prepared, as appropriate, for the following systems:

a. Nuclear Steam Supply System (Vessel and Recirculating System)
b. Control Rod Drive System
c. Reactor Cleanup System
d. Liquid Poison System (Standby Liquid Control System)
e. Shutdown Cooling and Reactor Vessel Head Spray System
f. High Pressure Coolant Injection
g. Reactor Core Isolation Cooling System
h. Emergency Core Cooling Systems
i. Closed Cooling Water System
j. Containment

(1) Maintaining Integrity
(2) Containment Ventilation System
(3) Inerting and deinerting

k. Fuel Storage Pool Purification and Cooling System
l. Main Steam System (reactor vessel to turbine)
m. Turbine-Generator System
n. Condensate System (hotwell to feedwater pumps, including demineralizers and resin regeneration)
o. Feedwater System (feedwater pumps to reactor vessel)
p. Makeup System (filtration, purification, and water transfer)
q. Service Water System
r. Reactor Building Heating and Ventilation Systems
s. Control Room Heating and Ventilation Systems
t. Radwaste Building Heating and Ventilation Systems
u. Standby Gas Treatment System
v. Instrument Air System
w. Electrical System

(1) Offsite (access circuits)
(2) Onsite

(a) Emergency Power Sources (e.g., diesel generator, batteries)
(b) A.C. System
(c) D.C. System

x. Nuclear Instrument System

(1) Source Range
(2) Intermediate Range
(3) Power Range
(4) TIP System

y. Reactor Protection System
z. Rod Worth Minimizer

5. Procedures for Abnormal, Offnormal, or Alarm Conditions

Since these procedures are numerous and correspond to the number of alarm annunciators, the procedures are not individually listed. Each safety-related annunciator should have its own written procedure, which should normally contain (1) the meaning of the annunciator, (2) the source of the signal, (3) the immedate action that is to occur automatically, (4) the immediate operation action, and (5) the long-range actions.

6. Procedures for Combating Emergencies and Other Significant Events

a. Loss of Coolant (including significant PWR steam generator leaks) (inside and outside primary containment) (large and small, including leak-rate determination)
b. Loss of Instrument Air
c. Loss of Electrical Power (and/or degraded power sources)
d. Loss of Core Coolant Flow
e. Loss of Condenser Vacuum
f. Loss of Containment Integrity
g. Loss of Service Water
h. Loss of Shutdown Cooling
i. Loss of Component Cooling System and Cooling to Individual Components
j. Loss of Feedwater or Feedwater System Failure
k. Loss of Protective System Channel
l. Mispositioned Control Rod or Rods (and rod drops)
m. Inability to Drive Control Rods
n. Conditions Requiring Use of Emergency Boration or Standby Liquid Control System
o. Fuel Cladding Failure or High Activity in Reactor Coolant or Offgas
p. Fire in Control Room or Forced Evacuation of Control Room
q. Turbine and Generator Trips
r. Other Expected Transients that may be Applicable
s. Malfunction of Automatic Reactivity Control System
t. Malfunction of Pressure Control System
u. Reactor Trip
v. Plant Fires
w. Acts of Nature (e.g., tornado, flood, dam failure, earthquakes)
x. Irradiated Fuel Damage While Refueling
y. Abnormal Releases of Radioactivity
z. Intrusion of Demineralizer Resin Into Primary System (BWR Plants)

7. Procedures for Control of Radioactivity (For limiting materials released to environment and limiting personnel exposure)

a. Liquid Radioactive Waste System

(1) Collection, Demineralizing, Filtering, Evaporating and Concentrating, and Neutralizing

(2) Sampling and Monitoring

(3) Discharging to Effluents

b. Solid Waste System

(1) Spent Resins and Filter Sludge Handling

(2) Baling Machine Operation

(3) Drum Handling and Storage

c. PWR Gaseous Effluent System

(1) Collection, Storage, and Discharge

(2) Sampling and Monitoring

(3) Air Ejector and Stack Monitoring

(4) Ventilation Air Monitoring

d. BWR Air Extraction, Offgas Treatment, and Other Gaseous Effluent Systems

(1) Mechanical Vacuum Pump Operation

(2) Air Ejector Operation

(3) Packing Steam Exhauster Operation

(4) Sampling

(5) Air Ejector, Ventilation, and Stack Monitor

e. Radiation Protection Procedures

(1) Access Control to Radiation Areas Including a Radiation Work Permit System

(2) Radiation Surveys

(3) Airborne Radioactivity Monitoring

(4) Contamination Control

(5) Respiratory Protection

(6) Training in Radiation Protection

(7) Personnel Monitoring

(8) Bioassay Program

(9) Implementation of ALARA Program

f. Area Radiation Monitoring System Operation

g. Process Radiation Monitoring System Operation

h. Meteorological Monitoring

8. Procedures for Control of Measuring and Test Equipment and for Surveillance Tests, Procedures, and Calibrations

a. Procedures of a type appropriate to the circumstances should be provided to ensure that tools, gauges, instruments, controls, and other measuring and testing devices are properly controlled, calibrated, and adjusted at specified periods to maintain accuracy. Specific examples of such equipment to be calibrated and tested are readout instruments, interlock permissive and prohibit circuits, alarm devices, sensors, signal conditioners, controls, protective circuits, and laboratory equipment.

b. Specific procedures for surveillance tests, inspections, and calibrations should be written (implementing procedures are required for each surveillance test, inspection, or calibration listed in the technical specifications):

(1) Pressurized Water Reactors

(a) Containment Leak-Rate Tests

(b) Containment Isolation Tests

(c) Containment Local Leak Detection Tests

(d) Containment Heat and Radioactivity Removal Systems Tests

(e) Containment Tendon Tests and Inspections

(f) Service Water System Functional Tests

(g) Main Steam Isolation Valve Tests

(h) Fire Protection System Functional Tests

(i) Boric Acid Tanks—Level Instrumentation Calibrations

(j) Emergency Core Cooling System Tests

(k) Control Rod Operability and Scram Time Tests

(l) Reactor Protection System Tests and Calibrations

(m) Permissives—Tests and Calibrations

(n) Refueling System Circuit Tests

(o) Emergency Boration System Functional Tests

(p) DNB Checks and Incore-Excore Flux Monitor Correlations

(q) Emergency Power Tests

(r) Auxiliary Feedwater System Tests

(s) NSSS Pressurization and Leak Detection

(t) Inspection of Reactor Coolant System Pressure Boundary

(u) Inspection of Pipe Hanger Settings

(v) Control Rod Drive System Functional Tests

(w) Heat Balance—Flux Monitor Calibrations

(x) Pressurizer and Main Steam Safety Valve Tests

(y) Leak Detection Systems Tests

(z) Axial and Radial Flux Pattern Determinations

(aa) Area, Portable, and Airborne Radiation Monitor Calibrations

(bb) Process Radiation Monitor Calibrations

(cc) Environmental Monitor Calibrations

(dd) Safety Valve Tests

(ee) Turbine Overspeed Trip Tests

(ff) Water Storage Tanks—Level Instrumentation Calibration

(2) Boiling Water Reactors

(a) Containment Leak-Rate and Penetration Leak-Rate Tests

(b) Containment Isolation Tests

(c) Containment Vacuum Relief Valve Tests

(d) Containment Spray System Tests

(e) Standby Gas Treatment System Tests (including filter tests)

(f) Service Water System Functional Tests
(g) Main Steam Isolation Valve Tests
(h) Fire Protection System Functional Tests
(i) Nitrogen Inerting System Tests
(j) Emergency Core Cooling System Tests
(k) Control Rod Operability and Scram Time Tests
(l) Reactor Protection System Tests and Calibrations
(m) Rod Blocks—Tests and Calibrations
(n) Refueling System Circuit Tests
(o) Liquid Poison System Tests
(p) Minimum Critical Heat Flux Checks and Incore Flux Monitor Calibrations
(q) Emergency Power Tests
(r) Isolation Condenser or RCIC Tests
(s) NSSS Pressurization and Leak Detection
(t) Inspection of Reactor Coolant System Pressure Boundary
(u) Inspection of Pipe Hanger Settings
(v) Control Rod Drive System Functional Tests
(w) Heat Balance
(x) Autoblowdown System Tests
(y) Leak Detection System Tests
(z) Axial and Radial Flux Pattern Determinations
(aa) Area, Portable, and Airborne Radiation Monitor Calibrations
(bb) Process Radiation Monitor Calibrations
(cc) Environmental Monitor Calibrations
(dd) Safety Valve Tests
(ee) Turbine Overspeed Trip Test
(ff) Water Storage Tanks—Level Instrumentation Calibrations
(gg) Reactor Building Inleakage Tests

9. Procedures for Performing Maintenance

a. Maintenance that can affect the performance of safety-related equipment should be properly preplanned and performed in accordance with written procedures, documented instructions, or drawings appropriate to the circumstances. Skills normally possessed by qualified maintenance personnel may not require detailed step-by-step delineation in a procedure. The following types of activities are among those that may not require detailed step-by-step written procedures:

(1) Gasket Replacement
(2) Trouble-Shooting Electrical Circuits
(3) Changing Chart or Drive Speed Gears or Slide Wires on Recorders

b. Preventive maintenance schedules should be developed to specify lubrication schedules, inspections of equipment, replacement of such items as filters and strainers, and inspection or replacement of parts that have a specific lifetime such as wear rings.

c. Procedures for the repair or replacement of equipment should be prepared prior to beginning work. Such procedures for major equipment that is expected to be repaired or replaced during the life of the plant should preferably be written early in plant life. The following are examples of such procedures for major equipment:

(1) Repair of PWR Steam Generator Tubes
(2) Replacement and Repair of Control Rod Drives
(3) Replacement of Recirculation Pump Seals
(4) Replacement of Important Strainers and Filters
(5) Repair or Replacement of Safety Valves
(6) Repair of Incore Flux Monitoring System
(7) Replacement of Neutron Detectors

d. Procedures that could be categorized either as maintenance or operating procedures should be developed for the following activities. Instructions for these activities may be included in systems procedures.

(1) Exercise of equipment that is normally idle but that must operate when required
(2) Draining and Refilling Heat Exchangers
(3) Draining and Refilling Recirculation Loop
(4) Draining and Refilling the Reactor Vessel
(5) Draining and Refilling Steam Generators
(6) Removal of Reactor Head
(7) Disconnection and Reconnection of Wiring Penetrating Reactor Vessel Head
(8) Demineralizer Resin Regeneration or Replacement

e. General procedures for the control of maintenance, repair, replacement, and modification work should be prepared before reactor operation is begun. These procedures should include information on areas such as the following:

(1) Method for obtaining permission and clearance for operation personnel to work and for logging such work and
(2) Factors to be taken into account, including the necessity for minimizing radiation exposure to workmen, in preparing the detailed work procedures.

10. Chemical and Radiochemical Control Procedures

Chemical and radiochemical control procedures should be written to prescribe the nature and frequency of sampling and analyses, the instructions maintaining water quality within prescribed limits, and the limitations on concentrations of agents that may cause corrosive attack or fouling of heat-transfer surfaces or that may become sources of radiation hazards due to activation. These procedures should specify laboratory instructions and calibration of laboratory equipment. Extreme importance must be placed on laboratory procedures used to determine

concentration and species of radioactivity in liquids and gases prior to release, including representative sampling, validity of calibration techniques, and adequacy of analyses.

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