November 3, 1972

SAFETY GUIDE 33

QUALITY ASSURANCE PROGRAM REQUIREMENTS

(OPERATION)

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 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 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 that includes general requirements and guidance for the establishment and execution of quality assurance programs during the operation phase 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.

Subcommittee ANS-3, Reactor Operations, of the American Nuclear Society Standards Committee has prepared a proposed standard ANS-3.2 containing criteria for administrative controls for nuclear power plants during operation. Included in ANS-3.2 is a definition of "abnormal occurrence" for the purpose of delineating the type of occurrence that requires review by personnel performing independent review and audit functions, and that requires reporting to appropriate members of management the results of such reviews together with recommendations to prevent or reduce the probability of recurrence. As to the type of abnormal event that should be reported to the AEC, Safety Guide 16, "Reporting of Operating Information," provides appropriate guidance.

C. Regulatory Position

The requirements and recommendations for administrative controls necessary for safe and efficient operation of nuclear power plants included in proposed standard ANS-3.2, "Standard for Administrative Controls for Nuclear Power Plants,"[1] dated November 2, 1972, and the general requirements and guidelines for establishing and executing a quality assurance program during the operation phase of nuclear power plants included in ANSI N45.2-1971, "Quality Assurance Program Requirements for Nuclear Power Plants,"[2] are generally acceptable and provide an adequate basis for complying with the quality assurance program requirements of Appendix B to 10 CFR Part 50.

ANSI N45.2-1971 and ANS-3.2 require the preparation of many procedures to carry out an effective quality assurance program. Appendix A to this safety guide, "Typical Procedures for Pressurized Water Reactors and Boiling Water Reactors," should be used as guidance to assure minimum procedural coverage for plant operating activities, including related maintenance activities. Appendix A lists typical safety-related activities which should be covered by written procedures. Appendix A does not provide a complete listing of needed procedures since many other activities that are carried out during the operation phase of a nuclear power plant require written procedures that are not included in Appendix A. The procedures listed in Appendix A may be combined or separated to conform to the applicant's procedures plan.

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[1] Copies may be obtained from American Nuclear Society, 244 E. Ogden Avenue, Hinsdale, Illinois 60521.

[2] Copies may be obtained from American Society of Mechanical Engineers, United Engineering Center, 345 E. 47th Street, New York, New York 10017.

APPENDIX A

TYPICAL PROCEDURES FOR PRESSURIZED WATER REACTORS AND BOILING WATER REACTORS

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

A. Administrative Procedures

1. Security and Visitor Control
2. Authorities and Responsibilities for Safe Operation and Shutdown
3. Equipment Control (e.g., locking and tagging)
4. Procedure Adherence and Temporary Change Method
5. Procedure Review and Approval
6. Schedule for Surveillance Tests and Calibration
7. Shift and Relief Turnover
8. Log Entries and Record Retention
9. Access to Containment
10. Bypass of Safety Functions and Jumper Control
11. Recall of Standby Personnel to Plant

B. General Plant Operating Procedures

1. Startup—Cold to Hot (may include nuclear startup)
2. Nuclear Startup to Minimum Load
3. Scram Recovery
4. Operation at Hot Standby
5. Turbine Startup and Synchronization of Generator
6. Changing Load and Load Follow (including long and short term control of reactivity)
7. Power Operation and Process Surveillance
8. Power Operation with Less than Full Recirculation Flow
9. Shutdown
10. Preparation for Refueling, Refueling Equipment Operation, and Core Alterations

C. 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:

1. Reactor Coolant System
2. Control Rod Drive System (including part length rods)
3. Reactor Cleanup System
4. Shutdown Cooling System
5. Emergency Core Cooling System
6. Component Cooling Water System
7. Containment Cooling System
8. Containment
   a. Maintaining Containment Integrity
   b. Special Containment Systems
      (1) Atmospheric
      (2) Subatmospheric
      (3) Double-Wall Containment With Controlled Interspace
      (4) Ice Condenser
   c. Containment Cleanup System
9. Irradiated Fuel Storage Pool
10. Main Steam System
11. Pressurizer Pressure and Spray Control Systems
12. Feedwater System (feedwater pumps to steam generator)
13. Service Water System
14. Chemical and Volume Control System
15. Auxiliary Building Heating and Ventilation
16. Radwaste Building Heating and Ventilation
17. Fire Protection System
18. Instrument Air System
19. Electrical System
    a. Offsite (access circuits)
    b. Onsite
       (1) Emergency Power Sources (e.g., diesel generator, batteries)
       (2) A-C System
       (3) D-C System
20. Nuclear Instrument System

a. Source Range
b. Intermediate Range
c. Power Range
d. Incore System

21. Area Radiation Monitoring System
22. Process Radiation Monitoring System
23. Reactor Control and Protection System
24. Hydrogen Recombiner
25. Communications System

D. 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:

1. Nuclear Steam Supply System (Vessel and Recirculating System)
2. Control Rod Drive System
3. Reactor Cleanup System
4. Liquid Poison System (Standby Liquid Control System)
5. Shutdown Cooling and Reactor Vessel Head Spray System
6. Reactor Core Isolation Cooling System
7. Emergency Core Cooling System
8. Closed Cooling Water System
9. Primary Containment Cooling and Ventilation System
10. Containment
    a. Maintaining Integrity
    b. Equipment Hatch Opening
    c. Handling Drywell Head
    d. Inerting and Deinerting
11. Irradiated Fuel Storage Pool
12. Main Steam System (reactor vessel to turbine)
13. Turbine-Generator System
14. Condensate System (hotwell to feedwater pumps including demineralizers and resin regeneration)
15. Feedwater System (feedwater pumps to reactor vessel)
16. Makeup System (filtration, purification, and water transfer)
17. Service Water System
18. Circulating Water System
19. Reactor Building Heating and Ventilation Systems
20. Radwaste Building Heating and Ventilation Systems
21. Standby Gas Treatment System
22. Fire Protection System
23. Instrument Air System
24. Electrical System
    a. Offsite (access circuits)
    b. Onsite
        (1) Emergency Power Sources (e.g., diesel generator, batteries)
        (2) A-C System
        (3) D-C System
25. Nuclear Instrument System
    a. Source Range
    b. Intermediate Range
    c. Local Power Range
    d. Average Power Range
    e. TIP System
26. Area Radiation Monitoring System
27. Process Radiation Monitoring System
28. Reactor Protection System
29. Rod Worth Minimizer
30. Reactor Head Seal Detection System
31. Communications System

E. Procedures for Correcting Abnormal, Offnormal, or Alarm Conditions

Since these procedures may number between 500 and 1,000 to correspond to the number of alarm annunicators, the procedures are not individually listed. Each safety-related annunciator should have its own written procedure which should normally contain the alarm setpoints and up to five or six items of corrective action per alarm.

F. Procedures for Combating Emergencies and Other Significant Events

1. Loss of Coolant (including significant PWR steam generator leaks) (inside and outside primary containment) (large and small, including leak rate determination)
2. Loss of Instrument Air
3. Loss of Electrical Power (and/or degraded power sources)
4. Loss of Coolant Flow
5. Loss of Condenser Vacuum
6. Loss of Containment Integrity
7. Loss of Service Water
8. Loss of Shutdown Cooling
9. Loss of Component Cooling System and Cooling to Individual Components
10. Loss of Feedwater or Feedwater System Failure
11. Loss of Flux Indication
12. Mispositioned Control Rod or Rods (and rod drops)

13. Inability to Drive Control Rods
14. Conditions Requiring Use of Emergency Boration or Standby Liquid Control System
15. Fuel Cladding Failure or High Activity in Reactor Coolant or Offgas
16. Fire in Control Room or Forced Evacuation of Control Room
17. Turbine and Generator Trips
18. Expected Transients
19. Malfunction of Automatic Reactivity Control System
20. Malfunction of Pressure Control System
21. Emergency Shutdown
22. Reactor Trip
23. Plant Fires
24. Acts of Nature (e.g., tornado, flood, dam failure, earthquakes, etc.)
25. Irradiated Fuel Damage While Refueling
26. Low and High BWR Water Level
27. Abnormal Releases of Radioactivity

G. Procedures for Control of Radioactivity

(For Limiting Materials Released to Environment and Limiting Personnel Exposure)

1. Liquid Radioactive Waste System
   a. Collection, Demineralizing, Filtering, Evaporating and Concentrating, and Neutralizing
   b. Sampling and Monitoring
   c. Discharging to Effluents
2. Solid Waste System
   a. Spent Resins & Filter Sludge Handling
   b. Baling Machine Operation
   c. Drum Handling and Storage
3. PWR Gas Systems
   a. Collection, Storage, and Discharge
   b. Sampling and Monitoring
   c. Air Ejector and Stack Monitoring
   d. Clean Air Monitoring
4. BWR Air Extraction and Offgas System
   a. Mechanical Vacuum Pump Operation
   b. Air Ejector Operation
   c. Packing Steam Exhauster Operation
   d. Sampling
   e. Air Ejector and Stack Monitoring
5. Personnel Monitoring and Special Work Permit
   a. Restrictions and Activities in Radiation Areas and High Radiation Areas
   b. Respirator Equipment
   c. Surveys and Monitoring
   d. Protective Clothing
   e. Radiation Work Permit Procedure

H. Procedures for Control of Measuring and Test Equipment

1. Procedures of a type appropriate to the circumstances should be provided to assure 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.
2. Specific procedures for surveillance tests, inspections, and calibrations should be written (implementing procedures are required for each surveillance test, inspection, or calibration listed in technical specifications):
   a. Pressurized Water Reactors
      (1) Containment Leak Rate Tests
      (2) Containment Isolation Tests
      (3) Containment Local Leak Detection Tests
      (4) Containment Heat and Radioactivity Removal Systems Tests
      (5) Containment Tendon Tests and Inspections
      (6) Service Water System Functional Tests
      (7) Main Steam Stop Valves Tests
      (8) Fire Protection System Functional Tests
      (9) Boric Acid Tanks–Level Instrumentation Calibrations
      (10) Emergency Core Cooling System Tests
      (11) Control Rod Operability and Scram Time Tests
      (12) Reactor Protection System Tests and Calibrations
      (13) Permissives–Tests and Calibrations
      (14) Refueling System Circuit Tests

(15) Emergency Boration System Functional Tests
(16) DNB Checks and Incore-Excore Flux Monitor Correlations
(17) Emergency Power Tests
(18) Auxiliary Feedwater System Tests
(19) NSSS Hydro Tests
(20) Infrequent Inspection of Reactor Coolant System Pressure Boundary
(21) Inspection of Pipe Hanger Settings
(22) Control Rod Drive System Functional Tests
(23) Heat Balance–Flux Motor Calibrations
(24) NDT Recalculation
(25) Pressurizer and Main Steam Safety Valve Tests
(26) Leak Detection System Tests
(27) Axial and Radial Flux Pattern Determinations
(28) Area Radiation Monitoring Calibrations
(29) Process Radiation Monitoring Calibrations
(30) Environmental Monitoring Calibrations

b. Boiling Water Reactors
(1) Containment Leak Rate and Penetration Leak Rate Tests
(2) Containment Isolation Tests
(3) Containment Vacuum Relief Valve Tests
(4) Containment Spray System Tests
(5) Standby Gas Treatment System Tests Including Filter Tests
(6) Main Steam Isolation Valve Tests
(7) Nitrogen Inerting System Tests
(8) Reactor Building Inleakage Tests
(9) Emergency Core Cooling System Tests
(10) Control Rod Operability and Scram Time Tests
(11) Reactor Protection System Tests and Calibrations
(12) Rod Blocks–Tests and Calibrations
(13) Refueling System Circuit Tests
(14) Liquid Poison System Tests
(15) Minimum Critical Heat Flux Checks and Incore Flux Monitor Calibrations
(16) Emergency Power Tests
(17) Isolation Condenser or RCIC Tests
(18) NSSS Hydro Tests
(19) Infrequent Inspection of Reactor Coolant System Pressure Boundary
(20) Inspection of Pipe Hanger Settings
(21) Control Rod Drive System Functional Tests
(22) Heat Balance
(23) NDT Recalculation
(24) Safety Valve Tests
(25) Turbine Overspeed Trip Test
(26) Leak Detection System Tests
(27) Autoblowdown System Tests
(28) Axial and Radial Flux Pattern Determinations
(29) Area Radiation Monitoring Calibrations
(30) Process Radiation Monitoring Calibrations
(31) Water Storage Tanks–Level Instrumentation Calibrations
(32) Fire Protection System Functional Tests

I. Procedures for Performing Maintenance

1. Maintenance which 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:
   a. Gasket Replacement
   b. Trouble-Shooting Electrical Circuits
   c. Seal Replacement on Small Pumps
   d. Changing Chart or Drive Speed Gears or Slide Wires on Recorders
2. 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).

3. 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. Examples of such procedures for major equipment are as follows:
   a. Repair of PWR Steam Generator Tubes
   b. Replacement and Repair of Control Rod Drives
   c. Replacement of Important Strainers and Filters
   e. Repair or Replacement of Safety Valves
   f. Repair of Incore Flux Monitoring System
   g. Replacement of Neutron Detectors

4. Procedures should be developed for the following activities which could be categorized either as maintenance or operating procedures. Instructions for these activities may be included in systems procedures.
   a. Exercise of equipment which is normally idle, but which must operate when required
   b. Draining and Refilling Heat Exchangers
   c. Draining and Refilling Recirculation Loop
   d. Draining and Refilling the Reactor Vessel
   e. Draining and Refilling Steam Generators
   f. Removal of Reactor Head
   g. Disconnection and Reconnection of Wiring Penetrating Reactor Vessel Head
   h. Demineralizer Resin Regeneration or Replacement

5. 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:
   a. Method for obtaining permission and clearance for operations personnel to work and for logging of such work
   b. Factors to be taken into account in preparing the detailed work procedures, including the necessity for minimizing radiation exposure to workmen.

J. Chemical and Radiochemical Control Procedures

Chemical and radiochemical control procedures should be written to prescribe the nature and frequency of sampling and analyses, instructions maintaining water quality within prescribed limits, and 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.