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# APPENDIX 3.0-4 PLANNING AND DESIGN PROCEDURES

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## **100 PURPOSE**

This document establishes procedures to meet quality assurance standards for planning siting, design, construction, and decommissioning of radioactive waste facilities.

## **200 APPLICABILITY**

An appropriate quality assurance program, based on the nature and scope of the work to be performed and the relative importance of the items or services, shall be specified in contractual documents by selective applications of URS DOE West Nuclear Quality Assurance Procedures (NQAPs) for work-oriented activities. The procedures here apply to siting, design, construction, and decommissioning activities that affect the quality of structures, systems, and components for nuclear facilities. These procedures describe the work process to achieve quality to verify the correct performance of the work. The work activities include planning, siting investigation, designing, procuring, fabricating, handling, shipping, storing, cleaning, erecting, installing, inspecting, testing, maintaining, repairing, modifying, and decommissioning. These procedures shall be specified in written contracts, policies, specific procedures, or instructions where applicable.

## **300 RESPONSIBILITY**

The applicant is responsible for specifying which sections, or portions thereof, apply and appropriately implementing them to specific items and services. The applicant will implement the applicable provisions of these procedures to achieve a complete quality assurance program appropriate for the project specific items or services. The applicant is responsible for complying with the specified requirements.

## **400 PLANNING AND PROCEDURES**

### **401 Planning**

The applicant will develop a plan outlining the work and procedures required to accomplish the work scope. The plan may include the following items: fabrication, installation, modification, repair, maintenance, decommissioning, inspection, testing, and software verification and validation, a summary description of the system or component design and procurement specifications, materials lists, drawings, and preliminary schedules. The plan will include the feasibility of the work to be accomplished, and that time, resources, and training are sufficient to accomplish the work in accordance with the scope of work.

### **402 Procedures**

The applicant will prepare procedures and work instructions identified in the planning documents. Procedures will be in place before work begins. Procedures will be revised as necessary to assure that the work is performed in accordance with the latest information. Procedures will include the following:

- (a) Personnel safety and structure or facility protection considerations
- (b) Definitions, as needed

- (c) Work performance included in specifications and instructions
- (d) Sequence of activities to be followed and steps within each activity
- (e) Prerequisites, precautions, and limitations
- (f) Software verification, validation, and control
- (g) Special equipment required
- (h) Identification of inspection and test equipment and calibration requirements including recalibration dates
- (i) Sequence and frequency of verification
- (j) Acceptance criteria and methods for verification
- (k) Responsibility and required qualifications of personnel
- (l) Signature approvals for verification
- (m) Specific document references (standards, codes, rules, plans, programs, and records)
- (n) Data or test report forms
- (o) Information to be collected for records
- (p) Inspection and test data including objectives, analysis, evaluation, and final acceptance, and validation

## **500 DESIGN PROCEDURE**

This procedure establishes the methods and guidelines on design control as specified in NQA-1 2004. Factors that will be considered when performing design activities include the following:

- (a) Nature of the organization (e.g., facility owner, equipment designer, facility designer, etc.)
- (b) Importance of safety
- (c) Type of design (e.g., experimental, developmental, standard, etc.)
- (d) Stage of design (conceptual, preliminary, detailed, field engineering, or modifications)
- (e) Relationship/interface between design, operation, and construction activities
- (f) The effect of design change operations

### **501 Design Input**

Design inputs include characteristics and functions that vary depending on the application to or requirements of an item or system. The following inputs/requirements shall be considered as they apply to specific items or systems associated with radioactive waste facilities:

- (a) Basic functions of each structure, system, and component
- (b) Performance requirements (e.g., capacity, rating, output, etc.)

- (c) Codes, standards, regulatory requirements, or responses to federal, state, and local regulations, including, but not be limited to the following:
  - (1) Safety and safety evaluation reports
  - (2) Environmental reports and statements
  - (3) Technical specifications
  - (4) Regulatory guides, bulletins, circulars, notices, or letters
  - (5) Federal regulations
  - (6) Commitments in correspondence with regulatory agencies
- (d) Design conditions (e.g., pressure, temperature, volumetric flow, chemistry, voltage, etc.)
- (e) Loads (e.g., seismic, wind, thermal, dynamic, etc.), and the effects due to design changes
- (f) Environmental conditions (e.g., pressure, temperature, humidity, corrosivity, elevation, wind, flooding, radiation, exposure, toxicity, etc.)
- (g) Interface requirements (i.e., functional and physical) and associated effects
  - (1) The effect on equipment capability (e.g., DC loads, AC capacity, water inventory, air capacity, water systems, HVAC, etc.)
  - (2) The effect of cumulative tolerances in the design
  - (3) The effect on design and safety
  - (4) Compatibility with unimplemented design changes
  - (5) Compatibility with technical specifications
- (h) Material requirements (i.e., compatibility, insulation properties, and corrosion resistance)
- (i) Mechanical requirements (i.e., vibration, stress, shock, and reaction forces)
- (j) Structural requirements (i.e., foundations and supports)
- (k) Hydraulic requirements (i.e., net positive suction head (NPSH), pressure drop, and fluid velocity)
- (l) Chemistry requirements (i.e., system flushing, batch sampling, in-line sampling, and water treatment)
- (m) Electrical requirements (i.e., power source, voltage load profile, insulation, and physical and electrical separation of circuits and equipment)
- (n) Layout and arrangement requirements
- (o) Operational requirements under various conditions, (e.g., startup, normal operation, shutdown, maintenance, emergencies, special design changes, etc.)
- (p) Instrumentation and control requirements (i.e., indicating instruments, controls, and alarms; and type of instrument, installed spares, range of measurement, and location of indication)

- (q) Security requirements, including access and administrative control, system design (i.e., redundancy, power supplies, support systems, emergency modes), and personnel accountability
- (r) Redundancy, diversity, and separation requirements
- (s) Failure requirements (i.e., definition of events/accidents that structure, system, or component must be designed to withstand)
- (t) Testing requirements (e.g., preoperational and periodic) with performance conditions
- (u) Facility accessibility, maintenance, repair, and pre-service/in-service inspection requirements with performance conditions
- (v) Personnel requirements and limitations, including qualifications and number of personnel for on-site activities, and radiation exposures to the public and facility personnel
- (w) Transportability requirements (e.g., size, weight, limitations, I.C.C. regulations, etc.)
- (x) Fire protection or resistance requirements:
  - (1) Safe shutdown analyses and introduction of safe shutdown equipment into fire areas
  - (2) Routing of piping and electrical cables for fireproofing or fire stops
  - (3) Fire detection and fire suppression capabilities
  - (4) Fire barrier capabilities, including fire door installation
  - (5) Fire dampers
  - (6) Access to fire fighting and emergency equipment
  - (7) Use of noncombustible materials
  - (8) Allowances of combustible materials in safe shutdown areas
  - (9) Smoke and toxic gas generation
- (y) Handling, storage, cleaning, and shipping requirements
- (z) Health and safety requirements to prevent undue risk to the public
- (aa) Materials, processes, parts, and equipment suitable for application
- (bb) Personnel safety requirements (e.g., radiation safety, criticality safety, dangerous materials restrictions, escape provisions, electrical safety, etc.)
- (cc) Quality assurance and quality control requirements
- (dd) Reliability requirements, including interactions that may impair functions important to safety
- (ee) Interface requirements (i.e., equipment and operation and maintenance (O&M) personnel)
- (ff) Criticality control and nuclear materials accountability requirements
- (gg) Load path requirements for installation, removal, and repair of equipment or components

## **502 Design Process**

Design activities will be prescribed in job specifications, work instructions, work plans, procedure manuals, test procedures, or other documents that provide adequate design control and permit reviewing, checking, or verifying the outcome of the design activity.

- (a) Procedures for the preparation and control of drawings will typically address the following:
  - (1) Drafting standards
  - (2) Standardized symbols
  - (3) Identification system
  - (4) Indication of completion status (e.g., draft, draft final, 30%, 60%, 90%, etc.)
  - (5) Checking methods
  - (6) Review and approval requirements
  - (7) Issuance and distribution control
  - (8) Storage and control of originals or master copies
  - (9) Revisions
  - (10) As-built drawings
- (b) Procedures for the preparation and control of specifications and other design documents will typically include the following:
  - (1) Format requirements
  - (2) Identification system
  - (3) Review and approval requirements
  - (4) Issuance and distribution protocol
  - (5) Revisions
  - (6) Indication of completion status (e.g., draft, draft final, 30%, 60%, 90%, etc.)
  - (7) Storage and control of originals or master copies
- (c) Design documents needed to support facility operations will typically include the following information:
  - (1) Document control
  - (2) Maintenance schedules and requirements
  - (3) Listings of spare and replacement parts
  - (4) Environmental qualifications of equipment
  - (5) Operations planning and scheduling
  - (6) Safety evaluations
  - (7) Facility modifications

- (8) Personnel training and qualifications
- (9) Indication of completion status (e.g., draft, draft final, 30%, 60%, 90%, etc.)

### **503 Design Analyses**

Design analyses shall be performed using a planned, controlled, and documented approach. Design analyses will identify the purpose/scope, methodology, assumptions, inputs, requirements, references, and other data used to produce the resultant/conclusion. Supporting calculations shall be identifiable by subject, originator, reviewer, date, or by other indicator such that calculations are retrievable. Calculations shall be checked and approved in accordance with the approved quality assurance program.

### **504 Design Verification**

Design verification will provide a confirmatory check of design adequacy and competence. A person(s) with sufficient ability and knowledge to have created the design shall perform the verification, but this person(s) shall also be sufficiently independent of the design such that they would not be verifying their own work. The design verifiers shall be a supervisor, or other individual that would have access to the necessary design information.

Certain design verifications can be achieved by suitable qualification testing. The operating modes and environmental conditions in which the structure, system, or component will perform satisfactorily shall be considered in determining the testing conditions. Qualification testing can be used in combination with other verification methods. For example, it would be most effective to verify that the structural integrity of an instrument is designed adequately by subjecting it to physical impact tests. However, these physical tests would not verify that the circuitry or components within the instrument are designed correctly or will perform their intended function. Other tests or verification processes would be required to confirm that the additional design components adequately perform their intended function under the conditions to which they will be subjected. If qualification testing indicates that design modifications are necessary to obtain acceptable performance, the modification will be documented and the system or component will be modified and subsequently verified to ensure satisfactory performance.

### **505 Design Change Control (Configuration Management)**

The same person(s) that reviewed and approved the original design documents will approve design changes, except when that person(s) is no longer responsible. Under these circumstances, the owner of the design or shall designate a new responsible person who will be responsible for review and approval.

Design documents shall be maintained to ensure that they are current and available to support component, system, or facility design, construction, and operation. Design changes can be approved without prior revision to the affected document(s). When this occurs, procedures shall be established in support of the design document changes to ensure that final design and as-built conditions will be completed consistent with the applicant's requirements. Other actions that will be taken (within the procedures or as standalone requirements) include, but are not limited to, imposing a deadline for updating the affected document(s), limiting the number of allowable

design changes before revisions must be made to the design document(s), or providing a process that continually updates the affected design document(s).

System modifications, temporary mechanical/electrical alterations, and instrument setpoint changes will be thoroughly addressed during operations to ensure that design changes are processed in accordance with control requirements. Proposed modifications, alterations, and changes can occur arbitrarily, thus creating the risk of being installed contrary to design specifications. Therefore, the responsible person in charge shall control approved design changes and specify the sequence of modifications, alterations, or changes to mitigate any change inconsistencies. The responsible person in charge shall approve and control partial design changes to ensure that the required operational design documents reflect the as-built conditions of the component, system, or facility. The responsible person in charge shall also review temporary and permanent repair work and parts replacement to determine if these activities constitute design changes.

### **506 Design Interface Control**

The definition and control of the interfaces and responsibilities between organizations participating in the overall design or design changes/modifications shall be clearly delineated. Responsibilities for the design of the system, component, or facility shall be appropriately divided to correspond to the capabilities of the participating organizations and the status of construction or operations.

The assignment of design responsibilities will be documented in procedures, internal or external correspondence, contracts, or other suitable documents. Integration and design consistency is the sole duty of the person in responsible charge.

### **507 Documentation and Records**

The documentation and records for component, system, and facility design (including as-built documentation) associated with a radioactive waste facility shall address the following provisions:

- (a) List of required documents (as applicable)
  - (1) Design criteria
  - (2) Engineering calculations
  - (3) Drawings
  - (4) Specifications
  - (5) Supporting Plans: Construction Quality Assurance and Quality Control Plan, Health and Safety Plan, Plan of Operations, etc.
  - (6) Cost estimates
  - (7) Schedule
  - (8) Bid forms

- (9) Measurement and payment
- (10) Terms and conditions
- (b) Degree of detail for the as-built documentation
- (c) A process or methodology for updating
- (d) Identification system for lifetime or nonpermanent records

The completion status of approved designs shall be readily available to all participating design organizations. Construction record documents and the completion status of design modifications shall be readily available to the operating organization. Construction record documents will include, but not be limited to the following:

- (a) Record (“as-built”) drawings
- (b) Modification packages
- (c) Manufacturer O&M instructions
- (d) Manufacturer vendor manuals
- (e) Manufacturer technical bulletins
- (f) Equipment and instrumentation listings
- (g) Environmental qualification listings
- (h) Spare and replacement parts listing