

# RADIOACTIVE WASTE TREATMENT/NUCLEAR MATERIAL PRODUCTION FACILITY INTEGRATED DESIGN INSPECTION PROGRAM

## 01 PURPOSE

The purpose of this chapter is to describe the methodology for performing multidisciplinary integrated design inspections (IDIs) at radioactive waste treatment and nuclear material processing plants.

## 02 OBJECTIVE

The objective of this IDI program is to gain additional assurance that the design process for a selected facility effectively implements Nuclear Regulatory Commission (NRC) regulations and the design commitments made in the license application or license. The inspections encompass development of the overall design and safety criteria as well as the development of the design details. The inspection should

- a. Verify that regulatory requirements and design bases as specified in the license application or license are correctly implemented in specifications, drawings, calculations, and procedures.
- b. Verify that the correct design information is provided to the responsible design organizations and that the information is the result of integration across the relevant technical functional areas.
- c. Verify that design engineers have sufficient technical guidance and experience to perform assigned engineering functions.
- d. Verify that design controls applied to the original design are also applied to design changes, including field changes.

The inspection will include onsite verification of the design on a sampling basis, whether the site is a design office or the site of the facility.

## 03 DEFINITIONS

03.01 Applicant. An applicant is a person who has submitted an application for a materials license containing information to meet the requirements of 10 CFR 70.22.

03.02 Draft Inspection Report. Draft inspection reports are all versions of the inspection report from its initial development, throughout the period of supervisory and management review, until final publication and distribution.

03.03 Finding. A finding is a deficiency, unresolved item, or observation identified during the IDI.

- a. Deficiency. A deficiency is an item that is an error, inconsistency, or procedural violation with regard to licensing commitments, specifications, procedures, codes, or regulations that is identified during the IDI. Licensee resolution of the deficiency and NRC evaluation of the resolution are required.
- b. Unresolved Item. An unresolved item is a question that requires licensee response and NRC evaluation for resolution.
- c. Observation. An observation is an item the inspection team considers appropriate to call to the attention of the licensee although it is neither a deficiency nor an unresolved item. It can include items recommended for licensee consideration that have no specific regulatory requirement. Licensee response is not required for an observation.

03.04 Inspection. An inspection is the examination, investigation, review, or evaluation of any record or activity of a licensee or licensee contractor to determine the safety significance of that record or activity, and/or to ensure compliance with any rule, order, regulation, or license condition pursuant to the Atomic Energy Act, or both.

03.05 Inspection Report. An inspection report is the final, published, written record of an inspection. It includes the inspection results obtained during the site inspection as well as the results of in-office inspection activities conducted before and after the travel to the site.

03.06 Licensee. A licensee is the holder of an NRC material license to receive title to own, acquire, deliver, receive, possess, use, or transfer special nuclear material issued under 10 CFR Part 70.

03.08 Person. Person means any individual, corporation, partnership, firm, association, trust, estate, public or private institution, group, government agency other than the NRC.

03.07 Potential Enforcement Finding. A potential enforcement finding is an apparent noncompliance with specific regulatory requirement or deviation from a specific commitment made by the applicant that is contained in the license identified during an IDI.

**04 RESPONSIBILITIES AND AUTHORITIES**

04.01 Director, Division of Fuel Cycle Safety and Safeguards (FCSS), Office of Nuclear Material Safety and Safeguards (NMSS). Selects facilities to be inspected based on information received from NRC branches in headquarters and in the regions. Issues results of the inspections.

04.02 FCSS/NMSS Staff. Administer and implement the IDI program.

04.03 Regional Offices. Assist FCSS/NMSS, as needed, in management of followup actions resulting from the IDIs, including enforcement action.

**05 INSPECTION CONCEPT**

05.01 IDIs are comprehensive examinations of the development and implementation of the design for selected systems of the facility being inspected. Conclusions about the overall design process may then be drawn based on the results from the selected sample. The inspection is a multidisciplinary review including, as a minimum, functional areas such as mechanical systems and components, electrical power, civil and structural design, nuclear materials, instrumentation and control, and fire safety. The primary focus is on assessment of the implemented design control process for the organization(s) and subcontractor(s). The process is evaluated by examining actual design details. If an error is found in the design details, the design process is evaluated to see if the error resulted from an isolated mistake or if it reflects a more fundamental weakness in the design process. The pervasiveness of a design error or weakness is also evaluated including inspecting that aspect of design in other plant systems. An evaluation is performed to identify consistent weaknesses in the design process such as inadequate safety program control, inadequate verification of design calculations, or inadequate documentation of engineering judgment made in the design process.

An IDI is normally conducted taking into consideration the following factors.

- a. The scope and depth of the inspection for a particular facility is determined using the guidelines provided in b, c, and d. The scope and depth of the inspection are defined during the planning and preparation phase and appropriate revisions are made as the inspection progresses.

The planning and preparation phase includes development of a logic or flow network of the design process that focuses on safety hazards, accidents, and consequences. Each entity within the design organization will be identified. For each of these entities, internal and external design information will be determined. From this network, critical design areas will be identified. Based on the results of this flow network evaluation, a specific sample system(s) will be identified for inspection.

- b. The specified sample system(s) typically has some or all of the following characteristics:
  - 1. It is essential to plant safety.
  - 2. It was designed by the architect-engineer (AE) or other recognized design organization.
  - 3. It has a clearly defined design basis.
  - 4. It is generally representative of safety-related features in other systems.
  - 5. Its design includes internal interfaces among functional areas and external interfaces with the major subcontractors, component vendors, and engineering service organizations.
  - 6. It has major portions already installed in the facility.
- c. Some inspection may be conducted beyond the sample system(s) boundary to test relevant specific areas or functions.
- d. Results of Integrated Safety Analysis (ISA) studies should be considered when selecting the sample system(s) to be inspected.
- e. The inspection covers topics such as
  - validity of design inputs and assumptions
  - validity of and conformance to design specifications
  - validity of analyses
  - system interface requirements
  - analysis of inadvertent synergistic effects of changes
  - proper component classification
  - revision control
  - documentation control
  - verification of the design
  - verification of the as-built condition

**06 PROGRAM GUIDANCE**

06.01 Program Timetable and Scope. NMSS management will determine the frequency of IDIs. The scope of the inspection at a particular facility is to provide a multidisciplinary evaluation of the overall design process and, within specific functional areas, to focus primarily on the potential areas of concern. Typical factors to be considered in the inspection plan development and implementation are delineated in the following sections.

06.02 Team Member Assignments. IDI inspector assignments shall be based on the expertise needed to implement the scope of the inspection planned for a particular facility.

06.03 Information Acquisition. Before the initiation of the planning phase for a facility inspection, the team leader or representative will contact or meet with representatives of the licensee to identify and obtain background information needed for inspection preparation. The information must be available to the team for the efficient development of an inspection plan.

06.04 Inspection Planning and Preparation.

a. Key elements of a successful team inspection are detailed planning and preparation with the objectives:

1. To identify those elements applicable to the specific facility inspection
2. To formulate a detailed inspection plan appropriate for the particular facility (The inspection plan should be a guide for performing an inspection and should be revised based on the results of ongoing inspection activities.)
3. To make specific functional assignments to each team member
4. To define the inspection schedule
5. To familiarize the team members with the organizations performing design and engineering services for the selected facility
6. To familiarize the team members with the latest version of the documentation that defines the design (e.g., the license application, design procedures, specifications, design criteria, and drawings)
7. To indoctrinate team members on the team inspection concept.

During the inspection planning and preparation, the team leader should indoctrinate the team members on the IDI concept. The indoctrination should address plans for the inspection, background and guidance material, significant items pertinent to licensing, and design-related items identified by the regional offices and NMSS. The entire IDI team should participate in selecting the system(s) to be inspected, consistent with the inspection objectives. Announcement of the sample system(s) to be inspected should not be made until just before the initiation of the IDI to preclude inappropriate biasing of the activities to be inspected. In that regard, a design work inspection cutoff date should be established for the inspection. The cutoff

date should be the same date as the announcement of the sample system(s) to be inspected. The inspection work products should be discussed with the team, including information flow charts; report outlines, inspection plans, and progress reports; deficiencies or unresolved items and observation forms; personnel forms; area analysis forms; and other inspection reports.

b. The team members assigned to a functional area should develop an inspection plan for that area. The team members will use the following materials to plan the details and prepare for the inspection, especially those portions pertaining to the sample system(s) to be inspected.

1. Application documentation and license (if issued)
2. Integrated safety assessment
3. NMSS Safety Evaluation Report (if available)
4. Inspection history:
  - (a) Special NMSS audits and reviews for design and engineering
  - (b) Regional audits of the AE, subcontractors, and vendors involved in design and engineering
  - (c) Inspection reports of site design activities including those of the resident inspector, if a resident has been assigned other sources, as appropriate
5. 10 CFR Part 21 reports
6. Organization charts
7. Organizational interfaces
8. Licensee engineering organizations procedures:
  - (a) AE engineering/design control procedures and quality assurance (QA) procedures related to design
  - (b) Flow diagrams for design information in the AE organization
  - (c) Design and engineering procedures required for contractors and subcontractors
  - (d) Listing, definition of scope, and requirements for engineering and design work occurring in the field
  - (e) Major subcontractor and AE documents indicating the scope of and procedure for design information exchange between the subcontractor and AE

- (f) Procedures defining licensee responsibilities for the design process (e.g., by reviewing completed AE work)
  - (g) QA manual indexes for all organizations performing design work in the facility
9. NRC/licensee correspondence:
- (a) NRC to licensee, including questions and answers, principal meetings, or special studies
  - (b) Licensee or AE to the NRC, listing principal commitments and action items in response to NRC concerns
10. Licensee engineering organization and design documentation:
- (a) General design criteria for the sample system(s)
  - (b) Sample system(s) descriptions, including design bases, system functions and operation, component data, and instrumentation requirements
  - (c) Engineering, design, and purchase specifications
  - (d) System flow diagrams showing flow paths and calculated flows, temperatures, and pressures for various conditions of operation
  - (e) Piping and instrumentation diagrams for the sample system(s) and interfacing systems, including symbols and legends
  - (f) Calculations and analyses that support system design
  - (g) Significant reports, meeting minutes, letters, and such related to progress, status, or control of the engineering and design process
11. Construction status information
- (a) schedules
  - (b) status reports
  - (c) inspection and test reports

- c. The planning and preparation phase should result in initial inspection plans for each functional area. One team member will be assigned the lead for preparing an inspection plan for each functional area. The team leader shall integrate the proposed plan/schedule/activities of each functional area into an overall team plan and coordinate the inspection activities. The team leader should ensure that the overall team plan makes provision for analyses to identify findings having similar root causes. The analyses should be designed to identify significant design and design process weaknesses that appear pervasive across plant systems and functional areas.

Inspection plans should be formulated to address the following functional areas, as a minimum:

- Mechanical systems design
- Mechanical components
- Civil and structural designs
- Electric power systems design
- Instrumentation and control systems designs
- Nuclear safety system design
- Fire safety system design.

Additional guidelines to be considered in the inspection plan development and implementation are delineated in appendix A.

The initial inspection plans may be revised as the inspection progresses, based on inspection results. The team leader is responsible for changes to the initial inspection plans.

**07 INSPECTION CONDUCT AND DOCUMENTATION**

07.01 General. All team members should remain with the team for the duration of the inspection and have no other duties. Team members will conduct the inspection in accordance with the program guidance in 06. The team leader will conduct coordination meetings as needed to discuss status of activities and findings. As a result of such meetings, team members may be given additional assignments or efforts redirected.

Documents pertinent to the IDI provided to team members may contain proprietary information. Similarly, documents, such as specifications reviewed in the licensee's offices, may contain proprietary information. All such material handled during an IDI will be treated as potentially proprietary. Team members will not make further copies or disclosure of documents received during the inspection. All such documentation will be returned to the licensee when the inspection is completed.

All non-NRC team members will be required to sign the Proprietary Agreement and Conflict of Interest Forms in appendix B.

07.02 Entrance and Exit Interviews.

- a. An entrance interview between applicant management and all IDI team members shall be held before beginning the onsite inspection. The regional office is encouraged to be represented at this meeting. Inspection Procedure (IP) 30703, "Management Meeting—Entrance and Exit Interviews," should be used as guidance when conducting the entrance interview.
- b. An exit interview shall be held between senior applicant management and the IDI team. The regional office and FCSS/NMSS management are encouraged to be represented at this meeting. The exit interview will be used to summarize the findings and convey the significance thereof to senior applicant management. The results of the inspection shall be openly and freely discussed, but written results or findings shall not be given the applicant. This will ensure that preliminary information is not provided before the final report is issued.

07.03 Inspection Documentation. The team will prepare an inspection report to be issued by the Director, FCSS/NMSS, or designated branch chief that documents all findings identified during the inspection. The inspection report will conform to the requirements of Manual Chapter (MC) 0610, Inspection Reports. No disclosure of inspection notes (e.g., preliminary or draft inspection report materials developed by IDI team members) will be made, except to appropriate NRC staff (see 07.04).

- a. Transmittal Letter. The transmittal letter should identify the findings. In addition, the letter should discuss all major items requiring licensee management attention.
- b. Cover Page. The cover page should provide basic identifying information about the licensee inspected and a brief summary of the scope and findings of the inspection (see exhibit 1 of MC 0610).
- c. Chapter 1—Introduction and Summary. The Introduction should state the specific inspection objectives, define the findings, and briefly describe the inspection activities, composition of the inspection team, areas of review, and level of effort. The summary should state the major conclusions, including the principal deficiencies (if any) and strengths (if any) as well as present a judgment on the adequacy of control of the overall design.
- d. Chapters 2 through 8—Detailed Inspection Results by Functional Areas. Each of these chapters should cover one functional area and have the following standardized format:

- 1. Statement of the Objective. Indicate the emphasis of the review.
- 2. Design Information. Describe the principal elements of the design process, organization, and information flow. This section should include brief discussions of design inputs (e.g., license application/licensee commitments and safety system supplier requirements), design outputs (e.g., specifications and calculations), information flow (e.g., inputs to safety analyses/safety assessments), and organization (e.g., facility/AE interface such as applicant review of AE design).
- 3. Inspection Details. Provide a list applicable to each respective major engineering discipline (e.g., the mechanical components technical area may include piping stress analysis, piping supports, mechanical equipment, and subcontractors).
- e. Chapter 9—Design Control Aspects Related to More Than One Functional Area. This chapter should address findings common to more than one functional area and identify concerns that cross functional area boundaries.
- f. Supporting Information. This chapter will contain a chronology of events, meeting attendance, personnel interviewed, and other miscellaneous items, as needed.

07.04 Release of Draft Inspection Reports. In accordance with the memorandum of October 7, 1983, "Policy on the Distribution of Draft Inspection and Investigation Reports," from W. Dircks [NRC/Executive Director of Operations (EDO)] and MCs 0610, "Inspection Reports," and 0611, "Review and Distribution of Inspection Reports," under no circumstances should draft inspection reports, either in entirety or in part, be released to licensees or their agents or to any source outside the NRC without the express written permission of the EDO.

In the event any draft inspection report is inadvertently or otherwise released contrary to this policy, the director, FCSS/NMSS, shall be promptly advised in writing. The Director, FCSS/NMSS, will take or recommend action, as appropriate, including prompt notification to the EDO.

07.05 Distribution of IDI Inspection Reports. The final version of the IDI report will be sent to the appropriate regional administrator at the same time it is sent to the licensee for review to identify any proprietary information. Any regional concurrence needed on portions of the report should be obtained during the proprietary review and approval stage before distribution. After proprietary review, the report will be distributed as determined by the director, FCSS/NMSS.

07.07 Program Changes. Each team member shall provide recommendations for IDI program changes(if any) to the team leader. The team leader shall provide the recommendations (as appropriate) to the appropriate branch chief and director, FCSS/NMSS.

**08 REVIEW OF LICENSEE RESPONSE AND RECOMMENDATION PROCEDURE**

08.01 Review of Licensee Response. The transmittal letter for the IDI report will request the licensee to respond to the report findings within 60 days. The licensee is requested to specify the resolution or corrective actions it has taken or plans to take with respect to the deficiencies and unresolved items in the IDI report.

After the licensee response is received, individual team members are to conduct reviews of responses in their respective functional areas. For each item that required a response (deficiencies and unresolved items), the evaluation should address:

- a. If the response describes an adequate resolution or the licensee or NRC staff needs something further to achieve resolution. If additional information or licensee action is deemed necessary, the team member should provide background information and a draft of the request to the licensee to the team leader for coordination.
- b. If followup inspection is needed. Following inspection is recommended only for situations where such inspection is needed to achieve resolution. Routine inspection for general monitoring is the responsibility of the appropriate regional office.

The team members should provide a brief summary and any general comments regarding the response to their evaluations for those items not needing additional information or reinspection.

The IDI team leader will evaluate responses by team members and prepare a letter to the licensee for signature by the Director, FCSS/NMSS. This letter should request the additional information needed to resolve IDI findings and discuss plans for a reinspection if necessary.

08.02 Reinspection Procedure. When a reinspection is necessary, the licensee will be given written notice stating the specific items to be reinspected. A relatively short team inspection (typically 3 days) should be sufficient to resolve uncertainties regarding the responses. Generally there would be at most one team member per technical discipline participating in the reinspection. The applicable region should be contacted by the team leader before the reinspection to provide an opportunity for regional participation. This may be particularly helpful for identification of potential enforcement findings. A reinspection should be documented by an inspection report, which normally will be signed by the director, FCSS/NMSS.

## **09 FOLLOWUP AND ENFORCEMENT**

The purpose of the IDI is evaluation of the design process and adequacy of the existing plant design, rather than enforcement. After IDI team evaluation of the licensee response to the IDI report and completion of a reinspection, the appropriate regional administrator will be notified by the director, FCSS/NMSS, of potential enforcement findings (PEFs) for regional followup. This notification will include a preliminary determination of an appropriate enforcement classification for each PEF. The IDI team leader is responsible for ensuring that regional tracking numbers are assigned to each PEF and to other items stemming from the IDI that require regional followup.

During an inspection, situations may be encountered where the significance of a matter warrants consideration of prompt action (e.g., licensee stop work, NRC order, or investigation of wrongdoing). If so, FCSS/NMSS management and the appropriate regional office will be promptly informed, and the first priority will be to determine if prompt action is warranted. In addition, the IDI team leader will identify those findings appropriate for regional followup.

## **10 APPENDIX**

A—Additional Guidance for Inspection Plan Development and Implementation

B—Functional Area Inspection Plan Guidelines

**APPENDIX A**

## APPENDIX A

### ADDITIONAL GUIDANCE FOR INSPECTION PLAN DEVELOPMENT AND IMPLEMENTATION

#### PURPOSE

To provide additional guidance in developing and implementing an inspection plan for a radioactive waste treatment or nuclear material processing facility integrated design inspection (IDI).

#### GENERAL GUIDELINES

1. Design Procedures Review. Within each design discipline, review the project-specific specifications, instructions, and procedures that provide design criteria or guidance to design engineers.

The purpose of this review is to determine the extent of the formal guidance given the engineers for performing design activities. The inspector should use information from the review to identify areas of limited or inadequate guidance to the engineers and to determine areas in which to focus the inspection.

2. Design Calculation Reviews. General guidance for the review of engineering calculations and design details is covered in succeeding paragraphs. Specific details to be reviewed for each functional area are provided in the guidelines contained in appendix B.
  - a. Verify that design information is current and correct. This may require tracing to the source of the input. Internal and external interfaces should be examined to ensure that all functional areas and design organizations for a project use a consistent and up-to-date set of design inputs and assumptions, particularly where the output of one analysis becomes the input of a second analysis.
  - b. Verify that the guidance provided by the project-specific procedures has been followed.
  - c. Verify that assumptions used in the design calculations are based on sound engineering principles and practices.
  - d. Verify that the design calculations and analyses have been transmitted to the appropriate design organizations.

- e. Verify that the design information has been incorporated into project documents such as specifications, drawings, procedures, instructions, and contracts related to plant construction.
- f. Verify that design changes (including field changes) result in all affected elements of the design being evaluated (e.g., reanalysis may need to be performed commensurate with the original design analysis).
- g. Confirm that design verification, including design review, alternate/independent calculations, and qualification testing is being performed. The extent of design verification should be commensurate with the importance to safety, complexity, degree of standardization, state-of-the-art, and similarity with proven designs.
- h. Confirm that calculational methods, using both hand calculations and computer programs, are being properly controlled. This control includes computer program verification and qualification (assuring that the computer program functions correctly in all modes and options and is used correctly in representing a physical process) and the proper use and accuracy of inputs. Particular attention should be given to the basis and validity of assumptions, identifying/assessing undocumented calculations/decisions and confirming that as-built conditions are reflected in design analyses.

**FUNCTIONAL AREA INSPECTION PLAN GUIDELINES**

The following guidelines are illustrative of the extent of the inspection to be conducted in each functional area. These guidelines are not intended as a checklist to be used by team members. Individual inspection plans will be developed for each plant inspected.

- 1. Mechanical Systems Inspection Plan Guidelines. The overall design basis of the selected mechanical system should be known by the inspection team. Particular attention should be given to the functional and performance requirements imposed on the system for the purpose of assuring safety. To accomplish a review of the mechanical system, it may be necessary to review how the licensee intends to meet the facility general design criteria as well as the functions to be included in the system description for the selected system.
  - a. Review the requirements imposed by the higher order system if the selected mechanical system is directly connected to or related in function and behavior to a higher order system. The associated parameters could include such items as static and dynamic loads, temperature, pressure, flow rate, or chemical characteristics as well as information related to redundancy, accident analyses, physical location, and protection from or control of the surrounding environment. Review calculations that confirm higher order system requirements can be met.

- b. Identify a function related to the selected mechanical system. Determine if the design ensures that this function will be met during all plant conditions. Various system parameters such as static and dynamic loads, temperature, pressure, flow rate, chemical composition, and action times should be reviewed to verify proper design basis and evaluate system interfaces. The system flow diagram and supporting calculations should also be reviewed to evaluate if the design ensures that system functions will be met under all anticipated conditions.
- c. Review calculations important to performance of the system to be inspected (e.g., net positive suction head calculations for fluid systems and flow calculations).
- d. Review the design methods and assumptions used in evaluating the effects of pipe rupture. Review the designs and interfaces of protective structures, pipe whip restraints, break exclusion runs, environmental effects of pipe rupture on essential electrical equipment and instrumentation, subcompartment pressurization, and in-service inspection of piping within protective structures or guard pipes.
- e. Verify that the portions of the system penetrating containment barriers are designed with isolation features acceptable for maintaining barrier integrity for all operating and accident conditions.
- f. Evaluate the classification of the structures related to the selected system for conformance to the requirements for safety-related systems. Evaluate the spectrum of conditions considered in the design of the structures. Evaluate the loading conditions that arise from events such as pipe ruptures, earthquakes, operational transients, loss of component cooling, and such.
- g. Verify the compatibility of the materials and components of the selected system with the service conditions, including normal and accident conditions and the design life. Ensure the systems components have proper safety and code classifications.

2. Mechanical Components Inspection Plan Guidelines.

- a. Select a sample of calculations to be reviewed, including the following items:
  - 1. piping analysis calculations
  - 2. major components attached to the piping such as a pump or tank
  - 3. valves in the pipe run
  - 4. pipe supports (i.e., rigid, snubber, and spring).

- b. Review the input used in the piping analysis. This requires coordination with other team members to determine that the correct inputs were used. Also, to the extent possible, verify that the correct as-built information was obtained.
- c. Review the model used in the piping analysis. This should include review of the analyses performed (e.g., thermal, deadweight, or seismic) and the computer programs and the analytical model used for conformance with licensee commitments and procedures. Particular attention should be given to the model used for seismic analysis to verify appropriateness of the boundary conditions assumed at anchors and supports.
- d. Review stress and support load summary sheets for correct load combinations as specified in the commitments of the license or license application.
- e. Review component design reports to verify that the design requirements are correct and that results are in conformance with licensee commitments. Review test qualification documents, if applicable, including appropriateness of the test parameters for conformance with the commitments of the license or license application. This review should verify that the loads from the piping analysis are included in the component evaluations.
- f. Review valve design reports for conformance with licensee commitments. Particular attention should be given to the operability evaluation for seismic events. Valve actuator qualification documentation also should be reviewed for conformance with licensee commitments.
- g. Review the loads used in the evaluation of pipe supports and verify that these are the correct loads from the piping analysis. Review the pipe support analysis for conformance with licensee commitments and procedures. The load combinations should be checked for the correct specification of primary and secondary loadings.
- h. Verify that integral attachments were evaluated for effects on the piping and that buckling of compression members was considered. For spring hangers and snubbers, verify that thermally induced movements were appropriately considered.
- i. Review the piping attachment to the structure and verify that the loads were considered in analyses by the structural group.

3. Civil and Structural Design Inspection Plan Guidelines

- a. Identify the location of the system selected and associated equipment, such as
  - 1. pumps
  - 2. tanks
  - 3. power supplies
  - 4. control systems
  - 5. piping supports

There is no attempt in this inspection procedure to evaluate the global behavior of the individual buildings or the foundations. The load path of the structure or structural elements, however, should be evaluated to ensure the applied loads are properly carried throughout the structure to the supporting points.

- b. Verify that structural safety categories are consistent and correct. Consider the location and possible effect of nonsafety-related items on the system.

Review the safety categories defined in the license application/license and the classification of structures. Compare the safety categories of the mechanical system selected against these criteria for compatibility.

- c. Review the model and boundary conditions used in the structural analysis of the design configuration utilizing the output and information from other functional areas such as mechanical, electrical power, instrumentation and control, and systems design to verify the correctness. Also review the output provided from the civil structural engineering area to the other functional areas. Assess any resulting safety related concerns.
- d. Verify that all pertinent loads and load combinations are considered in the analysis of structural elements, in addition to the piping system. Emphasis should be placed on the identification of the functional area boundaries and necessary interfaces in the design process. Ascertain that the correct loads and load combinations have been used and that techniques for combining loads or load elements are correct.
- e. Review samples of the design calculations based on the internal forces resulting from the analyses. Ascertain that the design techniques committed to in the license application/license have been or are being met.
- f. Review examples of the design documents produced as a result of the design calculations such as detailed specifications, drawings, and procedures.

- g. Review examples where the basic design documents are used to produce products, components, or elements that will be integrated into the final structure. This review should include such items as fabrication and shop drawings produced by a subcontractor or installation procedures defined by a supplier.
- h. Review and evaluate the processes by which design documents are checked and verified and are issued for use and construction.
- i. Review and evaluate several types of design changes, such as those initiated by the design office, field engineering, the licensee, errors or interference in construction, and errors in engineering.
- j. Review and evaluate the acceptance process used in the civil-structural engineering area for acceptance of its structures or elements. As-built information should be used in this portion of the effort.
- k. Review the seismic analysis of at least one seismic Category I structure associated with the sample system being inspected.
  - 1. Review seismic inputs such as the development of ground response spectra and artificial time-history generation.
  - 2. Review the seismic modeling procedure, including stiffness, masses, and damping values. Verify that the seismic model is representative of and consistent with the structural configuration.
  - 3. Review the techniques for assessing modal combinations, peak broadening, closely spaced modes, and such.
  - 4. Review the adequacy of computer programs used for seismic analysis.
  - 5. Review the procedure for incorporating soil-structure interaction (SSI), to ensure its adequacy and that the methodology prescribed is consistent with license application/license commitments.

#### 4. Electric Power Systems Inspection Plan Guidelines

- a. Identify components of the mechanical system selected that require electric power to perform safety functions. Determine if the electric power system supplying power to these components will be capable of providing the required electric energy. Examine required voltage, current, and frequency (i.e., maximum, minimum, and nominal, including transient values) and compare these with power source voltage, current, and frequency for

conditions representative of maximum and minimum loads and expected perturbations of the power source. Determine if the required power quality can be provided. Diesel generator load sequencing, for the mechanical system components that require power to perform safety functions, should be reviewed.

- b. Review the control circuits of two mechanical system components that require they be disconnected from electric power to perform their safety function and determine if they meet their design requirements. Focus on the time allowed for disconnection from the power source and the corresponding time assured in the safety analysis.
- c. Examine the control relay procedure for at least two mechanical system components that require power to perform their safety function and at least two that require power to be disconnected to perform their safety function. Evaluate the design and installation of these circuits and assess the ability of the circuits to perform as required.
- d. Determine if the designs meet the acceptance criteria for performing the required safety function in the presence of the most severe environment specified in the component design bases for several samples of each kind of electric component (i.e., motors, valve operators, relays, connections, cables). Verify that acceptance criteria are consistent with the license application or license commitments.
- e. Examine the physical arrangement of redundant electric power source components including separation, barriers, and environmental controls, to ensure that single failures affecting such components will not cause the mechanical system to fail to perform its safety function.
- f. Examine the qualification documentation for at least two motors, valve operators, relays, connections/connectors, and cables to determine if
  - 1. the test conditions specified were consistent with predicted accident conditions at the equipment location
  - 2. equipment performance was properly specified for the worst accident for which the equipment is required to operate
  - 3. test results showed the equipment able to meet specified performance under the design basis conditions specified.
- g. Compare procurement specifications for the equipment examined under item f. to determine whether they are consistent with qualification specifications for performance and environment.

- h. Examine methods and procedures for providing electric power to operable electric equipment when the normal offsite source and the normal onsite emergency source are unavailable. Determine if these methods or procedures could compromise redundant power source independence or prevent supply of electric power to one or more redundant loads.
- i. Confirm that the power distribution system to safety-related electric loads has been adequately designed with regard to breaker, motor starter, cable sizing, and breaker coordination. Review several sample calculations in this area.
- j. Determine the basis for at least two electric loads for interruption of electric power in the case of an electric power demand in excess of the normal rating for the loads. Determine what basis was used to decide if the system was designed to ensure the performance of the safety function or to protect the equipment in cases of overloads.
- k. Review the design of electric motor-operated valves provided with torque switches used to cause motor shutdown when excess torque is detected. Determine the validity of the basis for torque switch settings. Review the procedures for testing these switches.
- l. Examine specifications for several items of electric equipment and compare to the expected environment in the designated locations to determine if special environmental controls should have been provided or if a different location should have been selected.
- m. Ascertain how the need for special environmental controls on electric equipment was determined. Review design documentation (descriptions, drawings, and such) to determine how the environment is to be maintained and how operating personnel will be made aware of the needs for these special environmental controls.

5. Instrumentation and Control Systems Inspection Plan Guidelines

- a. Select two different process measurements (e.g., flow, level, pressure, or temperature) associated with the mechanical system selected and select two associated control (or nonsafety measurement) systems. At least one of the selected measurements should perform a safety function, such as actuation of one or more engineered safety features.
- b. Review input used for the design interfaces with the electrical power system design and the mechanical system design. Verify that the design input parameters meet the requirements for the system design. This verification should include the ranges of system process parameters required for normal and accident conditions.

- c. Review the appropriate functional, wiring, and installation drawings to assure conformance to licensee commitments.
  - d. Select several field design change requests and verify that the vendor design verification program is being effectively and accurately implemented. The inspector should review the verification method; the procedure for implementation; the authority for the design change; the associated equipment documentation such as equipment specification on purchase orders, IEEE standards, regulatory guides, "approved for construction" drawings, and the as-built installation drawings that complete the design change cycle; the results of the functional tests after the components/systems have been installed; and the documentation that the field change has been evaluated for effects on related systems.
  - e. Review qualification documentation associated with safety-related instruments to determine compliance with applicable regulations, regulatory guides, and national standards.
  - f. Identify alarms or annunciators provided from the instrumentation for the mechanical system and review the basis for providing these alarms or annunciators, their set points, and locations.
  - g. Review the system description for unusual operating requirements such as special operation requirements during and after an accident, capability to shut down processing from a remote location, or special features for automatic/manual control.
  - h. Verify that the instrumentation and control system detects and maintains essential parameters during all anticipated plant conditions. Verify that the capability to provide the required detection and control during loss of offsite power or other anticipated operational occurrences and accident conditions meets design requirements.
  - i. Assure that all logic functions (i.e., interlocks, automatic actuation, and permissives) are properly implemented.
  - j. Assure that the status of bypassed and inoperable components is indicated as necessary.
  - k. Review the procedures and bases for developing set points and for ensuring that as-built deviations are considered.
6. Nuclear Safety Inspection Plan Guidelines. (to be developed)
7. Fire Safety Inspection Plan Guidelines. (to be developed)

**APPENDIX B**

**PROPRIETARY AGREEMENT AND CONFLICT OF INTEREST FORMS**

AGREEMENT

For proprietary and potentially proprietary information that is disclosed to me in connection with my work on the NRC Radioactive Waste Treatment/Nuclear Material Processing Facility Integrated Design Inspection of the (plant name), I agree

- 1. Not to make further disclosures
- 2. Not to make further copies
- 3. To return my copies to the NRC team leader on completion of the inspection unless copies were previously returned to the applicant or applicable design organizations.
- 4. Not to make further disclosures or copies of inspection notes that contain potentially proprietary information.

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Date

