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

01 PURPOSE

The purpose of this inspection program is to describe the methodology that should be used 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 design and safety criteria as well as the development of the design details. The inspection should verify that:

a. Regulatory requirements and design bases as specified in the license application or license are correctly implemented in specifications, drawings, calculations, and procedures.

b. 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. Design engineers have sufficient experience and technical guidance to perform assigned engineering functions.

d. Design controls applied to the original design are also applied to design changes, including field changes.

The inspection should 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 (see 03.08) 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 inspection reports 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 and approval are required.

b. Unresolved Item. An unresolved item is a question that should receive a licensee response and NRC evaluation for resolution and approval.

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 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.

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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 and 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, chemical safety, 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 may be 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 should be determined using the guidelines provided in b, c, and d herein. The scope and depth of the inspection should be defined during the planning and preparation phase and appropriate revisions made as the inspection progresses.

The planning and preparation phase should include the 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 should be identified. For each of these entities, internal and external design information should be determined. From this network, critical design areas should be identified. Based on the results of this flow network evaluation, a specific sample system(s) should 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 generally represents 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 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 should cover topics such as

verification of the qualification and training of design personnel
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 should determine the frequency of IDIs. The scope of the inspection at a particular facility should provide

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a multidisciplinary evaluation of the overall design process and, within specific functional areas, should focus primarily on the potential areas of concern. Typical factors to be considered in the inspection plan development and implementation are delineated in this section (06).

06.02 Team Member Assignments. IDI inspector assignments should 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 should contact or meet with representatives of the licensee to identify and obtain background information needed for inspection preparation. The information should 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 to:

1. Identify those elements applicable to the specific facility being inspected

2. Formulate a detailed inspection plan for the identified elements (06.04a.1). (The inspection plan should be a guide for performing an inspection and should be revised based on the results of ongoing inspection activities.)

3. Make specific functional assignments to each team member

4. Define the inspection schedule

5. Familiarize the team members with the organizations performing design and engineering services for the selected facility

6. 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. 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

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the regional offices and NMSS. The entire IDI team should participate in selecting the system(s) to be inspected. 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. One of the team members should be assigned as lead for preparing an inspection plan for each functional area. The team members should 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

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(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) 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

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11. Construction status information

    (a) schedules

    (b) status reports

    (c) inspection and test reports

c. The team leader should 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
   Chemical and process safety
   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 should be 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 should conduct the inspection in accordance with the program guidance in 06. The team leader should 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 should be treated as proprietary. Team members should not make further copies or disclosure of documents received during the inspection. All such documentation should be returned to the licensee when the inspection is completed.

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

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 should be promptly informed, and the first priority will be to determine if prompt action is warranted. In addition, the IDI team leader should identify those findings appropriate for regional followup.

07.02 Entrance and Exit Interviews.

a. An entrance interview between applicant management and IDI team members should 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 should 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 should be used to summarize the findings and convey the significance thereof to senior applicant management. The results of the inspection should be openly and freely discussed, but written results or findings should not be given the applicant to ensure that preliminary information is not provided before the final report is issued.

07.03 Inspection Documentation. The team should 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 should 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) should 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. Should indicate the emphasis of the review.

2. Design Information. Should 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. Should 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. Chapter 10—Supporting Information. This chapter should 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 Management Directive 3.4, "Release of Information to the Public," all NRC employees and consultants must, as applicable, protect all draft and pre-decisional documents, including draft inspection and enforcement documents, from inadvertent release. Inspection notes, draft reports, draft evaluations, draft notices of violation or noncompliance, and other material containing preliminary inspection conclusions, findings and recommendations are not be to provided to the licensee, except as required by safety or security concerns.

In the event any draft document is inadvertently, or otherwise released contrary to the above, the unauthorized disclosure of agency information must be reported. This report may be transmitted through the supervisor to the office director or regional administrator, who shall refer the allegation of disclosure to the Office of the Inspector General (OIG), or it may be sent directly to the OIG.

07.05 Distribution of IDI Inspection Reports. The final version of the IDI report should 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 should be distributed as determined by the director, FCSS/NMSS.

07.06 Program Changes. Each team member should provide recommendations for IDI program changes(if any) to the team leader. The team leader should provide the recommendations 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 should typically request the licensee to respond to the report findings within 60 days. The licensee should be 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 should conduct reviews of responses in their respective functional areas. For each item that required a response the evaluation should address:

a. The acceptance of the response or identification of additional information or actions required. If additional information or licensee action is deemed necessary, the team member should provide background information and a draft of the request for the licensee to the team leader for coordination.

b. If followup inspection is needed. Followup inspection is recommended only for situations where an original team member is needed to achieve resolution. Routine followup inspection for general monitoring should be 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 should evaluate responses by team members and prepare a letter to the licensee for signature by the Director, FCSS/NMSS or the designated branch chief. 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 should 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 should be notified by the director, FCSS/NMSS, of potential enforcement findings (PEFs) for regional followup. This notification should include a preliminary determination of an appropriate enforcement classification for each PEF. The IDI team leader should be responsible for ensuring that regional tracking numbers are assigned to each PEF and to other items stemming from the IDI that require regional followup.

10 APPENDIX

A—Additional Guidance for Inspection Plan Development and Implementation

B—Functional Area Inspection Plan Guidelines

APPENDIX A

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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, the inspector should 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. The inspector should verify and confirm that

   a. 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. The guidance provided by the project-specific procedures has been followed.

   c. Assumptions used in the design calculations are based on sound engineering principles and practices.

   d. The design calculations and analyses have been transmitted to the appropriate design organizations.

   e. The design information has been incorporated into project documents such as specifications, drawings, procedures, instructions, and contracts related to plant construction.

f. 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. 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. 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 design criteria as well as the functions to be included in the system description for the selected system. The inspection team should:

    a. Review the requirements imposed by the higher order mechanical 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. Calculations that confirm higher order system requirements can be met should be reviewed.

    b. Identify a function related to the selected mechanical system and 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 of 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 should be performed.

e. Verify that the portions of the system penetrating any 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. The spectrum of conditions considered in the design of the structures should be evaluated including the loading conditions that arise from events such as pipe ruptures, earthquakes, operational transients, 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. The proper safety and code classifications for the system components should be verified.

2. Mechanical Components Inspection Plan Guidelines.

The inspection team should:

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, the use of the correct as-built information should be verified.

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. Test qualification documents, if applicable, should be reviewed 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. The pipe support analysis for conformance with licensee commitments and procedures should be reviewed. 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, a review should be conducted to 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

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. The inspector should:

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

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

The safety categories defined in the license application/license and the classification of structures should be reviewed and comparison made of 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. The output provided from the civil structural engineering area to the other functional areas should also be reviewed. Any resulting safety related concerns should be assessed.

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. It should be ascertained 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. The design techniques committed to in the license application/license should be verified as having been met 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. The review should include:

   1. 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. Verification that the seismic model is representative of and consistent with the structural configuration should be completed.

   3. The techniques for assessing modal combinations, peak broadening, closely spaced modes, and such.

   4. The adequacy of computer programs used for seismic analysis.

   5. 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

The inspection team should:

a. Identify components of the mechanical system selected that require electric power to perform safety functions. Determination should be made whether the electric power system supplying power to these components will be capable of providing the required electric energy. An examination of the required voltage, current, and frequency (i.e., maximum, minimum, and nominal, including transient values) and a comparison of these with power source voltage, current, and frequency for conditions representative of maximum and minimum loads and expected perturbations of the power source should be completed. Determination should be made whether 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. The time allowed for disconnection from the power source and the corresponding time assured in the safety analysis should also be reviewed.

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. An evaluation of the design and installation of these circuits and assess the ability of the circuits to perform as required should be performed.

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). The consistency of the license application or license commitments with the acceptance criteria should be verified.

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

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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. Determination should be made whether 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. Several sample calculations in this area should be reviewed.

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. Determination of 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 should be made.

k. Review the design of electric motor-operated valves provided with torque switches used to cause motor shutdown when excess torque is detected. Determination should be made of the validity of the basis for torque switch settings and a review of the procedures for testing these switches should be completed.

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. A review should be conducted of 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

The inspection team should:

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. A verification that the design input parameters meet the requirements for the system design should be made. 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. A verification 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 should be made.

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)

8. Chemical and Process 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

PROPRIETARY AGREEMENT AND CONFLICT OF INTEREST FORMS

INFORMATION CONCERNING POTENTIAL CONFLICT OF INTEREST

____________________Radioactive Waste Treatment/Nuclear Material Processing Facility Integrated Design Inspection Team

________________________________ ________________________________

Proposed Team Member Organization

My participation in the integrated design inspection of the plant name does ( ) does not ( ) involve situations or relationships of the type set forth in 41 CFR 20-1.5403(b)(1). In particular, I have ( ) do not have ( ) direct previous involvement with activities at the plant that I will be reviewing and have ( ) do not have ( ) conflicting roles that might bias my judgment in relation to my work for the NRC. In addition

1. ( ) I have not been previously employed by the licensee to perform similar design work.

   ( ) I have been previously employed by the licensee. State the nature of the employment: ________________________________

2. ( ) I do not own or control significant amounts of licensee stock.

   ( ) I own or control significant amounts of licensee stock. State the nature of the ownership: ________________________________

3. ( ) Members of my present household are not employed by the licensee.

   ( ) Members of my present household are employed by the licensee. State the nature of the employment: ________________________________

4. ( ) My relatives are not employed by the licensee in a management capacity.

   ( ) My relatives are employed by the licensee in a management capacity. State the nature of the employment: ________________________________

In the above statement, licensee is construed to mean the licensee, the applicant, or the architect-engineer (____________________) for ___________________________.

________________________________ ____________________

Signature Date