MANUAL CHAPTER 2530

INTEGRATED DESIGN INSPECTION PROGRAM

2530-01 PURPOSE

The purpose of this chapter is to describe the methodology for performing multidisciplinary integrated design inspections (IDIs) at nuclear power plants.

2530-02 OBJECTIVE

The objective of the IDI program is to gain additional assurance that the design process for a selected facility effectively implemented NRC regulations and the design commitments made in the Final Safety Analysis Report (FSAR). The inspections encompass the total design and architectural criteria through the development of the design details. The inspection should:

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

b. Verify that the correct design information has been provided to the responsible design organizations.

c. Verify that design engineers have sufficient technical guidance and experience to perform assigned engineering functions.

d. Verify that design controls, as applied to the original design, have also been applied to design changes, including field changes.

The inspection will include onsite verification of the design on a sampling basis.

2530-03 DEFINITIONS

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

a. <u>Deficiency</u>. A deficiency is an item which is an error, inconsistency, or procedural violation with regard to licensing commitments, specifications, procedures, codes, or regulations that is identified during the IDI. Followup action is required for licensee resolution of the deficiency and NRC evaluation of the resolution.

b. Unresolved Item. An unresolved item is a question that requires more information to reach a conclusion. Licensee response and NRC evaluation are required.

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.

03.02 Potential Enforcement Finding. An apparent noncompliance with specific regulatory requirements or deviation from specific commitments made by the applicant that to identified during the IDI.

03.03 Draft Inspection Report. All versions of the inspection report from its initial development, throughout the period of supervisory and management review, until final publication and distribution in accordance with IE Manual Chapter 0611. The preliminary draft inspection report provides the account and conclusions of an official NRC inspection.

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.

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 actual travel to the site.

03.06 Licensee: The holder of an NRC operating license or construction permit.

03.07 Construction Appraisal Team Inspection (CAT). Multi-discipline inspection performed to assess the quality of construction and hardware installation activities on a nuclear power plant project. A CAT may precede or follow an IDI inspection for a specific or replicate plant.

2530-04 RESPONSIBILITIES AND AUTHORITIES

04.01 Director, Office of Inspection and Enforcement. Selects facilities to be inspected, on the basis of information received from NRC offices at headquarters and in the regions, and issues the results of inspections.

04.02 Director, Division of Quality Assurance, Vendor and Technical Training Center Programs, IE. Administers the IDI program.

04.03 Chief, Quality Assurance Branch, IE. Implements the IDI program.

04.04 <u>Regional Offices</u>. Assist the Office of Inspection and Enforcement, as needed, in management of followup actions resulting from the IDIs, including enforcement action.

2530-05 INSPECTION CONCEPT

05.01 IDIs at nuclear facilities are comprehensive examinations of the development and implementation of the design for a selected system of the facility being inspected. Conclusions about the overall design process may then be drawn based on the results for the selected sample. The inspection is a multidisciplinary review including, as a minimum, areas such as mechanical systems and components, electric power, civil and structural design, and instrumentation and control. 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 errors are 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. Also the pervasiveness of a design error or weakness is evaluated including inspecting that aspect of design in other sectors of the plant design. An evaluation is performed to identify consistent weaknesses in the design process such as "lack of FSAR control", "lack of verification of design calculations" or "lack of documentation of engineering judgment made in the design process".

An IDI is normally implemented by the following process:

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

   The planning process includes development of a logic or flow network of the design process. Each fundamental 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 the above evaluation, a specific sample such as a portion of a system will be inspected.

b. A comprehensive inspection is performed for a specified sample system(s) which typically has some or all of the following characteristics:

   1. essential to plant safety

   2. designed by the architect-engineer (AE)

   3. a clearly defined design basis

   4. generally representative of safety-related features in other systems

    5. design involving internal interfaces between functional areas listed in 06.04c and external interfaces with the NSSS vendor, component vendors, and engineering service organizations

    6. major portions already installed in facility

    7. inspected by a preceding CAT thereby providing for an in-depth vertical sample examination of a particular system from design through construction

c. Some inspection will be conducted beyond the sample system(s), as needed, to test specific areas or functions.

d. Results of PRA studies also should be considered when selecting the sample system(s) to be inspected.

e. An evaluation of any program weaknesses identified by a preceding CAT inspection of the same facility which could have root causes in the design or the design process should be made.

f. The inspection covers topics such as:

    1. validity of design inputs and assumptions

    2. validity of and conformance to design specifications

    3. validity of analyses

    4. system interface requirements

    5. inadvertent synergistic effects of changes

    6. proper component classification

    7. revision control

    8. documentation control

    9. verification of the design

    10. verification of the as-built condition

2530-06 PROGRAM GUIDANCE

06.01 Program Timetable and Scope. IE management will determine the frequency of IDIs. The scope of the inspection at a particular facility is to accomplish a multidisciplinary inspection of the total design process and, within a given discipline, 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.

The following is a typical schedule for an IDI:

IDI Activity	Time Allocation (Weeks)
Team Leader Planning - Licensee Notification - Schedule Preparation - Inspection Team Selection - Information Acquisition - Meetings with Regional Office, Licensee, AE and NSSS	4
Team Preparation - Team Indoctrination Meeting - Review of Background Material - Preparation of Draft Inspection Plans	1-2
Onsite and AE Entrance Meetings - Initial Plant Walkdown - Inspection of Licensee Engineering Organization - Initiation of Inspection of AE	1
Inspection Plan Refinements and Additional Review of Background Material	1
Inspection of the AE	3-4
Other Needed Inspections (e.g., onsite, NSSS, vendors, subcontractors, etc.)	1
Documentation of Inspection Results and Completion of IDI Report	4-6
Licensee Review and Response to IDI Report	8
Review of Licensee Report and Reinspection	4
Identification of Potential Enforcement Findings to Region for Followup	4

06.02 Team Member Assignments. Inspector assignments to the IDI shall be based on the expertise needed to implement the scope of the inspection planned for a particular facility. Consideration will be given to assignments of CAT team members to the IDI, particularly those who have or are expected to participate in a CAT inspection on the same or a replicate plant.

06.03 Information Acquisition. Before the initiation of the team planning phase for a facility inspection, the Team Leader or his representative will contact and/or meet with representatives of the licensee, as necessary, to identify and obtain the background information needed for inspection preparation. The needed information must be available to the team for the efficient development of a meaningful specific inspection plan.

06.04 Inspection Planning and Preparation

a. A key element for a successful team inspection is detailed planning and preparation. The objectives of planning and preparation are:

1. to identify those elements that are 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 inspections 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 inspection schedules

5. to familiarize the team members with the organization(s) 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 (such as the FSAR, design procedures, specifications, design criteria, and drawings.)

7. to indoctrinate team members to the team concept

Before the start of the inspection, the Team Leader should conduct an indoctrination for the team members of 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 the Office of Nuclear Reactor Regulation (NRR). The entire IDI team should participate in selecting the sample system 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, progress reports; details of deficiencies, or unresolved items and observation forms; personnel forms; area analysis forms; and other inspection report inputs.

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

1. Safety Analysis Report

2. Probabilistic Risk Assessment Report (where available)

3. NRR Safety Evaluation Report

4. Inspection history including:

   (a) previous CAT inspection obtaining information on any problems requiring further investigation during the IDI

   (b) special NRR audits and reviews in design and engineering

   (c) Vendor Program Branch and regional audits of AE, NSSS, and vendors involved in design and engineering

   (d) Systematic Assessment of Licensee Performance (SALP) reports

   (e) Institute of Nuclear Power Operations (INPO) evaluations of design or engineering

   (f) Independent Design Verification Program (IDVP) evaluations

   (g) inspection reports of site design activities including those of the resident inspector

5. 10 CFR 21 and 50.55(e) reports

6. organization charts - These charts provide the inspectors with an overview of the management interfaces, communication channels, and the identification of management personnel. Each inspector must develop an understanding of the organization and identify those managers and supervisors to be contacted. Of particular importance are the current project organization charts for licensee, NSSS, AE, and field engineering/design (including name of assignee) along with the changes in organization and personnel that have occurred over the course of the project.

7. organizational arrangements - The degree to which the licensee acts as its own AE, use of consultants and subcontractors to the AE are primary sources into the evaluation of interface effectiveness. The team should obtain a list of all contractors and subcontractors doing engineering and design work for the licensee or one of

its prime agents, including a scope of work for each contract.

8. licensee engineering organization(s) procedures:

   (a) AE engineering/design control procedures and QA procedures related to design including those related to any existing engineering assurance program

   (b) flow diagrams indicating the flow of 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 being done in the field

   (e) NSSS and AE documents indicating the scope of and procedure for design information exchange between the NSSS and AE.

   (f) licensee procedures indicating how it gets involved in the design process (e.g., by reviewing completed AE work)

   (g) quality assurance manual indexes for all organizations performing design work in the project

9. NRC-Licensee correspondence - questions and answers, principal meetings or special studies, and licensee or AE correspondence listing principal commitments and action items in response to NRC concerns.

10. Licensee engineering organization documentation:

   (a) AE general design criteria

   (b) AE and NSSS system descriptions describing design bases, system functions and operation, component data and instrumentation requirements

   (c) listing of engineering, design, and purchase specifications

   (d) system flow diagram showing flow paths and calculated flows, temperatures, and pressures for various conditions of operation

   (e) piping and instrumentation diagrams for the sample system and interfacing systems, including symbols and legend diagrams

   (f) list of calculations and analyses

(g) significant reports, meeting minutes, letters, etc., related to progress, status, or control of the engineering and design process

11. Construction Status Information - stage of completion will dictate the scope and types of inspections and evaluations appropriate for a particular discipline.

c. The planning and preparation stage should result in initial inspection plans to ensure that the objectives of this chapter are met. For each functional area, one team member will be assigned the lead for preparing an inspection plan for that functional area. It is the responsibility of the Team Leader to integrate the proposed plan/schedule/activities of that functional area into an overall team plan and to coordinate the inspection activities. The Team Leader should ensure that the overall team plan makes provision for analyses identifying findings having similar root causes including all deficiencies, unresolved items and observations. The analyses should identify significant design and design process weaknesses which appear to be pervasive across plant systems and functional areas.

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

1. mechanical systems

2. mechanical components

3. civil and structural

4. electric power

5. instrumentation and control

Additional guidelines to be considered in the inspection plan development and implementation both generally and for each specific functional area are delineated in Appendix A to this chapter.

The initial inspection plans may be revised as the inspection progresses, based on inspection results. The Team Leader is responsible for arranging/directing changes to the initial inspection plans.

2530-07 INSPECTION CONDUCT AND DOCUMENTATION

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

Documents pertinent to the IDI that are provided to team members, although not marked proprietary, may contain proprietary information. In similar manner, documents such as specifications that are 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 "Agreement" and "Information Concerning Potential Conflict of Interest" forms enclosed as Appendix B.

07.02 Entrance and Exit Interviews

a. An entrance interview between applicant management and all IDI team members shall be held before starting the onsite inspection. The regional office is encouraged to be represented at this meeting. 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, senior IE management, and the IDI team. The regional office is encouraged to be represented at this meeting. The exit interview will be used to summarize the findings and to convey the significance thereof to senior applicant management. The results of the inspection shall be openly and freely discussed, but the results or findings shall not be given the applicant in writing. This will ensure that preliminary information is not provided "via draft reports" before the final report is issued.

07.03 Inspection Documentation. The team will prepare an inspection report to be issued by the Director, IE, that documents all findings (i.e., deficiencies, unresolved items, and observations) identified during the inspection. The inspection report will conform to the requirements of IE Manual Chapter 0610, Inspection Reports. No disclosure of inspection notes (preliminary or draft inspection report materials developed by IDI team members) will be made, except to appropriate NRC staff (see 07.03 below).

a. Transmittal Letter. The transmittal letter should identify the deficiencies, unresolved items and significant design and design process weaknesses requiring licensee response. 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 IE MC 0610).

c. Chapter 1 - Introduction and Summary*. The Introduction should state the specific inspection objectives; define findings, deficiencies, unresolved items, and observations;

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 identified (if any) as well as a judgment as to the adequacy of control of the overall design. This summary should address any significant design and design process weaknesses identified in the inspection findings.

d. Chapters 2 through 6 - Detailed Inspection Results by Functional Areas*. Each of these chapters should cover one functional area.

Each of these chapters will have the following standardized format:

(1) Statement of the Objective indicating emphasis of the review.

(2) Design Information describing the principal elements of the design process, organization, and information flow. It should include brief discussions of design inputs (e.g., FSAR commitments and NSSS requirements), design outputs (e.g., specifications and calculations), information flow (e.g., inputs to safety analyses) and organization (e.g., utility/AE interface such as utility review of AE design).

(3) Functional Areas should include details as applicable to each respective major engineering discipline (e.g., Mechanical Components technical areas may include piping stress analysis, piping supports, mechanical equipment, subcontractors, and NSSS).

e. Chapter 7 - Design Control Aspects Related to More Than One Functional Area. This chapter should cover findings common to more than one functional area and should identify concerns that cross functional areas boundaries.

f. Chapter 8 - References. 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/EDO) and IE Manual Chapters 0610, "Inspection Reports," and 0611, "Review and Distribution of Inspection Reports," under no circumstances should draft inspection reports, either in their entirety or in part, be released to licensees or their agents or to any source outside the NRC without the express permission of the EDO.

In the event any draft inspection report is inadvertently or otherwise released contrary to this policy, the Director, IE shall be promptly advised in writing. The Director, IE 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 distributed in accordance with IE Manual Chapter 0611. The final version of the IDI report will be sent to NRR (DL) and to the appropriate Regional Administrator at the same time it is sent to the licensee for proprietary review. Any NRR or regional concurrence needed on portions of the report should be obtained during the review and approval stage before distribution. After proprietary review, the report will be sent to all utility executives on distribution list 1S and to other interested NRC organizations on distribution list IE01. NRR (DL) will make a decision on board notifications at the request of IE (DQAVT).

07.06 Input to Systematic Assessment of Licensee Performance (SALP). In accordance with the NRC SALP program (NRC Manual Chapter 0516), the Team Leader is responsible for submitting input to regional management. This should be provided, as needed, or within 60 days of completion of IE review of licensee response to the IDI report, to the appropriate region.

07.07 Inspection Program Credits. Direct inspection hours expended in the performance of an IDI are to be recorded under Dummy Module Number 099025B, "Integrated Design Inspections." The IDI team leader will provide a draft 766 Statistical Data Form to the responsible regional project section chief once the inspection is completed. The regional office will determine if inspection program credits are appropriate for the particular licensee.

07.08 Program Changes. Each team member shall provide recommendations (if any) to the team leader for IDI program changes. The team leader shall provide the recommendations (as appropriate) to the Chief, Quality Assurance Branch, IE.

2530-08 REVIEW OF LICENSEE'S RESPONSE AND RECOMMENDATION PROCEDURE

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

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

a. Whether the response describes an adequate resolution or the licensee or NRC needs to do 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.

b. Whether followup inspection is needed. Followup inspection should only be recommended for special situations where such inspection is needed to achieve resolution. Routine inspection for general monitoring is the responsibility of the appropriate regional office.

c. Any general comments regarding the response.

The team members should provide a brief summary of 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, Division of Quality Assurance, Vendor, and Technical Training Center Program (DQAVT). This letter should request the additional information needed to resolve IDI findings and discuss plans for a reinspection (if necessary).

08.02 Reinspection Procedure. The licensee will be given written notice stating the specific items to be reinspected when a reinspection is necessary. 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 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. This report will normally be signed by the Director, Division of Quality Assurance, Vendor, and Technical Training Center Programs (DQAVT).

2530-09 FOLLOWUP AND ENFORCEMENT

The focus of the IDI is evaluating the design process and the adequacy of the existing plant design, rather than enforcement. However, after IDI team evaluation of the licensee's response to the IDI report and completion of a reinspection, the appropriate Regional Director will be notified by the Director, DQAVT of the potential enforcement findings (PEFs) found during the IDI for regional followup. The notification of PEFs to the region 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 other items stemming from the IDI that require region followup. The Director of the Enforcement Staff will concur with the preliminary enforcement determinations.

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, investigation of wrongdoing). If so, management in the OIE and the appropriate regional office will be promptly informed and the first priority will be pursuing the matter until the question of prompt action has been resolved. In addition, the IDI team leader will identify those findings which are appropriate for CAT, Vendor Program, regional programs, or NRR followup.

2530-10 LIST OF APPENDICES

A - Additional Guidance for Inspection Plan Development and Implementation
Agreement

B - Proprietary Agreement and Conflict of Interest Forms

END

APPENDIX A

ADDITIONAL GUIDANCE FOR INSPECTION PLAN DEVELOPMENT AND IMPLEMENTATION

PURPOSE

To provide additional guidance in developing and implementing an inspection plan for an Integrated Design Inspection (IDI).

GENERAL GUIDELINES

1. Project 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 to the engineers for performing design activities. The inspector should use the information from the review to highlight areas of limited or inadequate guidance to the engineers and for determining areas in which to focus the technical review.

2. Design Calculation Reviews. General guidance and information for the review of engineering calculations and design details are covered below. Specific details to be reviewed for each discipline follow in the guidelines for each functional area.

   a. Verify that design information is current and correct. This may require tracing back to the source of the input. Internal and external interfaces should ensure that all disciplines and design organizations for a project use a consistent and up-to-date set of design inputs and assumptions, e.g., 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 met.

   c. Verify that assumptions used in the design calculations are based on sound engineering principles and practices.

   d. Verify that the output information has been transmitted to the appropriate design organizations.

e. Verify that the design information has been translated 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.

g. Confirm that design verification (design review, alternate/independent calculations, or qualification testing) is being done. The extent of design verification is 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 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 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 mechanical fluid 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 reactor safety. To accomplish a review of the mechanical fluid system, it may be necessary to review how the licensee intends to meet the General Design Criteria as well as the system description for the selected fluid system.

   a. If the selected fluid system is directly connected to or related in function and behavior to the reactor coolant system, it will be necessary to review the requirements imposed by the reactor coolant system. The associated parameters could include such items as temperature, pressure, flow rates, chemical characteristics as well as information related to redundancy, accident analyses, physical location and protection from or control of the surrounding environment. This is a good opportunity to evaluate the interface between the NSSS (reactor system designer) and the AE (fluid system designer). Review calculations that confirm that NSSS requirements can be met.

b. Identify a function which is related to the selected mechanical fluid system. Determine whether the design ensures that this function will be met during all plant conditions. Various system parameters, such as temperature, pressure, flow rates, chemical composition, and action times, should be reviewed to verify proper design basis and to evaluate system interfaces. The system flow diagram and supporting calculations should be reviewed to evaluate whether the design ensures that system functions will be met under all anticipated conditions.

c. Review calculations which are important to the performance of the system to be inspected, e.g., net positive suction head calculations for fluid systems and flow calculations for systems such as auxiliary feedwater where required flow rates are safety-related items.

d. Review the design methods and assumptions used in evaluating the effects of pipe rupture on targets. Interfaces are involved in reviewing the designs of protective structures, pipe whip restraints, break exclusion runs, environmental effects of pipe rupture on essential electrical equipment and instrumentation, subcompartment pressurization, and inservice inspection of piping within protective structures or guard pipes.

e. Verify that the portions of the system penetrating the containment barrier are designed with isolation features that are acceptable for maintaining containment integrity for all operating and accident conditions. Check interfaces with the instrumentation and control functional area relative to isolation valve actuation and control.

f. Evaluate the classification of the structures related to the selected fluid system for conformance to the requirements for safety-related systems. Evaluate the spectrum of conditions that have been considered in the design of the structures. Evaluate the loading conditions that arise from events such as pipe rupture, LOCA, earthquakes, operational transients, reactor trip, loss of component cooling, etc.

g. Verify the compatibility of the materials and components of the selected fluid system with the service conditions, including normal and accident conditions as well as the design life. Ensure that the fluid system's components have proper safety and code classifications.

2. Mechanical Components Inspection Plan Guidelines

a. Select a sample of calculations to be reviewed; it should include the following items:

   (1) piping analysis problems

   (2) major components attached to the piping problem such as a pump or tank

   (3) valves in the pipe run

   (4) pipe supports: rigid, snubber, and spring

b. Review all input information used in the piping analysis. This will require coordination with other team members to determine that the correct inputs are used. Also, to the extent possible, verify that the correct as-built information has been obtained from the field (see Inspection Procedure 37051).

c. Review the model used in the piping analysis. This includes review of the analyses performed (thermal, deadweight, seismic, etc.), review of the computer programs and the analytical model for conformance with licensee commitments and procedures. Particular attention should be given to the model used for seismic analysis for the 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 licensing commitments. Also verify that these documents have been transmitted to the appropriate group for support evaluations.

e. Review component design reports to verify that the basic premises are correct and that data are in conformance with licensee commitments. Review test qualification documents, if applicable, including correctness of the test parameters for conformance with the licensee commitments. This review should verify that the loads from the piping analysis are included in the component evaluation.

f. Review valve design reports for conformance with licensee commitments. Particular attention should be given to the operability evaluation for seismic events. Also, valve actuator qualification documentation 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 support analysis for conformance with licensee commitments and procedures. The load combinations should be checked for the correct specification of primary and secondary loadings.

Verify that integral attachments have been evaluated for their effects on the piping and that buckling of compression members has been considered. For spring hangers and snubbers, verify that thermal movements were considered. Review the attachment to the structure and verify that the loads have been considered by the structural group.

3. <u>Civil and Structural Inspection Plan Guidelines</u>

a. Identify the location of the fluids system selected. Include 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. However, the load path of the structure or structural elements should be reviewed to ensure that the applied loads are properly carried through the structure or structural elements to the supporting points.

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

Review the safety categories defined in FSAR Section 3 and the classification of structures. Compare the safety categories of the mechanical fluid 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 area to the other disciplines. Assess the safety impact of these reviews.

d. Verify that all pertinent loads and load combinations are considered in the analysis of structural elements, in addition to the piping system. Examine the sensitivity of the structural analysis and design to changes in piping system loads, supports, and configurations as well as the influence on resulting structural deformations.

Emphasis should be placed on the identification of the discipline 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 SAR have been or are being met. Also review specific areas of the design calculations.

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 product, components, or elements that will be integrated into the final structure. This review would include such items as fabrication and shop drawings, produced by a subcontractor, or installation procedures, defined by a supplier.

h. Review and evaluate the process by which design documents are checked and verified and the process by which the final documents are issued for use and construction.

i. Review and evaluate several types of design changes, such as those initiated by:

(1) design office

(2) field engineering

(3) the licensee

(4) errors or interference in construction

(5) errors in engineering

j. Review and evaluate the acceptance process used in the civil-structural area for final acceptance of the structures or elements thereof. As-built information, information per Inspection Procedure 37051, should be used in this portion of the effort.

k. Review the seismic analysis of one seismic Category I structure that is associated with the sample system being inspected.

(1) Review seismic inputs, such as the developing of ground response spectra, artificial time-history generation.

(2) Review procedure of seismic modeling, including stiffness, masses, damping values. Verify that the

seismic model is representative of and consistent with the actual structural configuration.

(3) Review the techniques dealing with modal combinations, peak broadening, closely spaced modes, etc.

(4) Review the adequacy of computer programs used for seismic analysis.

(5) Review the procedure for soil-structure interaction (SSI), if applicable, to ensure that the adequacy of the procedure and the methodology prescribed is consistent with FSAR commitments.

4. <u>Electric Power Inspection Plan Guidelines</u>

a. Identify all components of the mechanical fluid system selected that require electric power to perform their safety function(s). Determine whether the electric power system supplying power to each of these components will be capable of providing the required electric energy as needed by each component. Examine required voltage, current, and frequency (maximums, minimums, and nominal including transient values) and compare with power source voltage, current and frequency for several sample sets of conditions representative of maximum and minimum loads and expected perturbations on the power source. Determine if required power quality can be provided for the needed time of interest. A review of diesel-generator load sequencing of the selected mechanical fluid system components (requiring power to perform their safety function) should be performed.

b. Identify all components of the mechanical fluid system that require disconnection from their electric power source in order to perform their safety function. Review the control circuit for at least two such components to determine if it meets its design requirements. Focus on time allowed for disconnection from power source in the electric power system design and the corresponding time assumed in safety analysis.

c. Examine the control relaying for at least two components of the mechanical fluid system that require power to perform their safety function and two that require power disconnection to perform their safety function. Evaluate the documentation and actual installation of these circuits and assess the ability of the circuits to perform as required.

d. For several samples of each kind of electric component (i.e., motors, valve operators, relays, connections, cables), determine if the design meets acceptance criteria for performing the required safety function in the presence of the most severe environment specified in the component's design bases. Verify that acceptance criteria are consistent with licensee 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 fluid system to fail to be able to perform its safety function(s).

f. Examine the qualification documentation of 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) required equipment performance was properly specified for the worst accident for which the equipment was 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 equipment examined in item (f) above to determine if they are consistent with qualification specification 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 the power distribution system to safety-related electric loads has been adequately designed with regard to breaker, motor starter, and cable sizing, as well as breaker coordination. Review several sample calculations in this area.

j. For at least 2 electric loads, determine the basis 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 whether the system was designed to ensure the performance of the safety function or to protect the equipment in cases of overloads. Review design of electric motor-operated valves provided with torque switches used to cause motor shutdown when excess torque is detected. Determine the validity of basis for torque switch settings. Review procedures for testing such switches.

k. Examine specifications for several items of electric equipment and compare to the expected environment in their designated location to determine if special environmental controls should have been provided or if a different location should have been selected.

l. Determine how the need for special environmental controls (e.g., battery room ventilation) on electric equipment was determined. Review design documentation (descriptions, drawings, etc.) to determine how the environment is to be maintained and how operating personnel are made aware of the needs for these special environmental controls.

5. <u>Instrumentation and Control Inspection Plan Guidelines</u>

a. Select two different process measurements, such as flow, level, pressure, temperature, etc., associated with the mechanical fluid system selected and select two associated control (or non-safety measurement) systems. The selected measurements (at least one) should be selected from those that perform a safety function, such as reactor trip or actuation of one or more engineered safety features.

b. Review all input information used for the design; it will be necessary to interface with the electrical power system design and the mechanical system design. Verify that the design input parameters meet the design requirements for the fluid system design. This 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's 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 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; the documentation to assure that the field change had been evaluated for general implications.

e. Review qualification documentation associated with safety-related instruments to determine compliance with regulations, regulatory guides and national standards applicable to qualification.

f. Identify alarms or annunciators provided from the instrumentation for the mechanical fluid system and review the basis for providing these alarms or annunciators, their set-points, and their locations.

g. Review the system description for any unusual operating requirements. Examples of these requirements could be: special operation required of the systems during and after an accident, capability of the systems to shut down the reactor from a remote location, or any special automatic/manual control features.

h. Verify that the instrumentation and control system detects and maintains essential parameters during all anticipated plant conditions. Check if 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 bypassed and inoperable status is indicated as necessary.

k. Review procedures and basis for developing set points and for ensuring that as-built deviations are considered.

END

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's 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 upon completion of the inspection project 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

INFORMATION CONCERNING POTENTIAL CONFLICT OF INTEREST

___________________ Integrated Design Inspection Team

_________________________________ ______________________________

Proposed Team Member Organization

My participation in the Integrated Design Inspection of _____________________ 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 which might bias my judgment in relation to my work for the NRC. In addition:

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

   ( ) I have been previously employed by the Applicant. (State the nature of the employment.)

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

   ( ) I own or control significant amounts of Applicant stock. (State the nature of the ownership.)

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

   ( ) Members of my present household are employed by the Applicant. (State the nature of the employment.)

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

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

In the above statement, the "Applicant" is construed to mean the applicant (___________________________), the architect-engineer (_______________________________________), or the NSSS vendor (_______________________) for _____________________________.

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Signature Date