INSPECTION PROCEDURE 37550

ENGINEERING

PROGRAM APPLICABILITY: 2515

FUNCTIONAL AREA: ENGINEERING (ENG)

37550-01 INSPECTION OBJECTIVE

Evaluate the licensee's engineering activities, particularly the effectiveness of the engineering organization to perform routine and reactive site activities, including the identification and resolution of technical issues and problems.

37550-02 INSPECTION REQUIREMENTS

02.01 Evaluate several safety-significant design changes and plant modifications to verify conformance with the applicable installation and testing requirements.

02.02 Evaluate several safety-significant temporary plant modifications to verify conformance with the applicable requirements.

02.03 Evaluate the extent and quality of engineering involvement in site activities.

a. Evaluate the extent and effectiveness of the site engineering com-munications with other departments such as maintenance, opera-tions, and corporate engineering.

b. Evaluate engineering involvement with the resolution of technical issues selected from recent plant events or routine work documents.

c. Evaluate the extent of backlogged engineering work.

02.04 Determine the degree to which the engineering organization maintains the plant's design bases current for selected significant safety systems, and verify that the regulatory requirements and licensee commitments are properly implemented in the performance of engineering activities.

02.05 If performance problems are identified, evaluate the relative capabilities of the site and corporate engineering organizations with regard to staffing levels, experience, clearly delineated responsibility, training, and procedures.

02.06 Evaluate the effectiveness of licensee's controls and self-assessment programs related to engineering activities.

a. Evaluate the appropriateness and timeliness of the licensee's controls in identifying, resolving, and preventing problems by reviewing such areas as corrective action systems, root cause analysis, safety committees, and self assessment in the area of engineering.

b. Evaluate the effectiveness of licensee controls by reviewing pertinent issues, events, or problems identified during the inspection in the area of engineering.

c. Determine whether there are strengths or weaknesses in the licensee's controls for the identification and resolution of the reviewed issues that could enhance or degrade plant operations or safety.

02.07 Evaluate the overall effectiveness of the independent safety engineering group (ISEG or equivalent) by reviewing various ISEG reports and the implementation of corrective actions. Review the following items:

a. Selected ISEG reports for the last year to identify areas for additional review and assess the licensee's root cause and corrective action processes.

b. Selected reports to evaluate whether thorough, in-depth reviews of known weak areas were performed and assess the adequacy of the reviews.

c. Corrective action recommendations made by ISEG and determine if the associated recommendations were implemented effectively and in a timely manner.

d. Discuss with ISEG members the day-to-day functions of their organization, the effectiveness of reports produced, and the quality of issues identified and make an assessment of the organization's effectiveness.

02.08 When design changes and modifications have been made to the systems installed as part of the NRC regulations 10 CFR 50.62, 10 CFR 50.63, and Supplement 1 to NUREG-0737 for RG 1.97 instruments and SPDS, evaluate these changes and modifications to ensure that the original design bases and margins for the applicable system/components have not been compromised, by performing the following:

a. Verify that the licensee has implemented appropriate software control and post-modification testing.

b. Determine if design requirements are translated correctly into vendor/design specifications and verified during post modification testing, Also, verify that the licensee's design, as endorsed through the SER, is being properly implemented and the design requirements as implemented are easily traceable.

c. Verify that the required qualified isolation devices are installed for systems such as RG 1.97 instruments, SPDS, SBO, and ATWS that interface with the safety systems. Also, confirm that the diversity requirements of 10 CRF 50.62 are still met with the change//modification in place.

d. Verify that the capacity of air, fluid and electrical systems support the modification of alternate ac source for station blackout.

e. Verify that the procurement specifications for station blackout coping equipment conform with the guidance provided in Regulatory Guide 1.155.

f. Determine how the licensee ensures the operability of equipment for systems such as ATWS, SBO, SPDS, and RG 1.97 instrumentation which are not covered by TS, but are installed in accordance with licensee commitments and are important to the safe operation of the plant.

02.09 Use of risk insights. Consider risk significance as one input in the selection of a sample of inspection items.

37550-03 INSPECTION GUIDANCE

General Guidance

This inspection procedure (IP) focuses on such routine and reactive engineering activities as: design changes and modifications, system engineering, engineering support to other plant departments, technical problem resolution, and operability reviews. This IP also involves reviewing the licensee's self-assessment efforts and the control of design information. The results of this engineering IP will provide input to the systematic assessment of licensee performance (SALP) in the engineering functional area.

Assess such licensee organizational elements as site engineering, corporate engineering, and systems engineering. During the course of evaluating engineering interfaces, other licensee organizations will be examined that have the following responsibilities: operations, maintenance, procurement, licensing, construction or modification installation, and testing. The inspectors performing this IP should be experienced in both plant engineering and operations.

The primary emphasis of this IP is to evaluate the effectiveness of the engineering organization in performing routine and reactive site activities. To the extent that some existing NRC team inspections also examine these engineering activities, it is highly

advantageous to implement portions of this IP in conjunction with any engineering-oriented team inspection. The advantage to this approach is that these other inspections include review of a broader scope and greater depth of engineering work products than is practical for this IP.

Specific Guidance

03.01 Select about five significant safety-related design changes and plant modifications from a list of modifications implemented during the last refueling outage or scheduled for the next refueling outage. Attributes to consider for examination:

a. Engineering involvement in determining procurement specifications for commercial grade items used in plant modifications.

b. Design changes and plant modifications were reviewed and approved by on-site and offsite review organizations as required by the Administrative Controls section of technical specifications or plant procedures.

c. Operating procedure and emergency operating procedure changes were identified, and implemented, as part of the modification package.

d. Operator training program revisions were identified and implemented as part of the modification package.

e. Controlled copies of as-built documents used by critical personnel were either revised and distributed or legibly marked up, on an interim basis, to show all changes relating to the plant modification(s). Critical personnel include maintenance technicians, tag hangers, and plant operators.

f. Appropriate FSAR revisions were planned or completed. Examine the associated 10 CFR 50.59 evaluations for technical adequacy.

g. Necessary documentation revisions for preventive maintenance, inservice inspection (ISI), and inservice test (IST) requirements were appropriately identified as part of the modification package.

h. For plant modifications that are partially completed, the effects of partial completion were fully considered and the partially completed status was adequately assessed in accordance with the requirements of 10 CFR 50.59.

i. Design change calculations, analysis, and design output documents ensure:

    1. Required technical, design verification, and independent design reviews were performed.

    2. Correct usage of design information between technical disciplines e.g., process values developed by mechanical

systems personnel are correctly used by instrumentation and control personnel in set point calculations.

3. Appropriate design inputs from codes and standards and from the relevant design criteria were properly identified.

4. Calculational and analytical methodology complied with regulatory requirements, licensee design guides, licensee commitments, and industry practices.

5. Calculational assumptions were technically reasonable.

6. Appropriate post-modification test acceptance criteria were deline-ated to verify all appropriate aspects of the implemented modification.

7. Open or verification-pending items in the calculations were satisfactorily resolved or properly identified and tracked for future resolution.

8. The licensee considered such design requirements as 10 CFR 50.59 evaluation, environmental qualification, electrical cable separation criteria, and seismic criteria.

j. Modified plant configuration was consistent with regulatory requirements and licensee commitments and deviations were communicated to the NRC, when required.

k. Post-modification test procedures focused on the installed changes, changes to the procedures were reviewed and approved in accordance with the licensee's program.

l. Licensee's evaluation of completed tests addressed test results that did not meet acceptance criteria and indicated that test deviations were resolved in consultation with the engineering organization and that required retesting was accomplished.

m. The testing criteria and results established that the levels of performance of new structures, systems, and components were as described in the license amendment application, if applicable, and in the detailed design documentation.

n. A review of selected field change requests indicated that appropriate and timely safety evaluations were performed by the design or engineering organization. Field changes to the initial design package provide an indication of the quality of the design work. Because a large number of field changes may indicate a problem, the reasons for the field changes need to be considered.

o. Installed hardware conformed to the post-modification as-built drawings.

03.02 Select about five safety-significant temporary modifications (including a mix of mechanical, electrical, and instrumentation and controls) and consider the critical elements listed below to determine consistency with the licensee's quality assurance (QA) program.

a. The review and approval process of the temporary modification.

b. The procedures for installing the temporary modification.

c. The formal record for tracking the status of temporary modifications, lifted leads and jumpers, temporary strainers, and temporary trip set points of control equipment.

d. The independent verification, where appropriate, of installation and removal of temporary modifications.

e. Functional testing of equipment following installation or removal of the temporary modification.

f. Correct installation of the temporary modifications.

g. For temporary modifications that have been in place for a long period of time (9-12 months), the cause of any delay and the overall effect of the temporary modification.

h. The affected control room drawings and documents indicate outstanding temporary modifications.

i. The method of identifying the temporary modification on the modified equipment.

j. Pertinent design change and plant modification attributes listed in Section 03.01 have been considered by the licensee.

03.03 This requirement evaluates management and staff communications between site engineering and other such organizations as maintenance, operations, quality and regulatory assurance, and corporate engineering. Include responsiveness to requests for engineering assistance, timeliness of engineering resolutions (i.e., to address the technical issues evaluated in 2.03.b and c) and engineering performance in an advisory role in the evaluation.

Identify recent plant nonconformances or deficiencies from the licensee, e.g., condition reports, deviation reports, material nonconformance reports, or other similar licensee documents that identified problems within the last year. The sample may include installed temporary plant design changes, recent set point changes, licensee event reports, and 10 CFR Part 21 notices and Part 50.72 notifications. Also consider previous inspection reports and SALP reports, and the licensee's response to NRC bulletins, generic letters, and information notices.

On the basis of the above information, select a sample of safety-significant issues that required engineering involvement and

request additional information on the issues selected, to provide a complete picture of how the issue was resolved. Further assess engineering by conducting onsite interviews with individuals cognizant of the issues and reviewing documentation not previously available. During these interviews and reviews, consider the following:

a. The engineering organization normally will be involved in identifying and resolving technical issues affecting the plant. It should arrive at a sound technical resolution based on an appropriate technical basis supported by appropriate documentation. Beyond the specific issue, a determination should have been made of the extent of the problem, its root cause, and actions necessary to prevent recurrence. This should include an assessment of the engineering disposition of deficiencies identified from the ISI programs and responses to such operational matters as licensee event reports (LERs), set point changes, or unanticipated system responses either during normal operation or an event.

b. The engineering organization normally will provide support to the maintenance department in the analysis of equipment performance trending data and recommend changes to preventive maintenance schedules. The ultimate measure of acceptability is whether the plant equipment runs reliably with few maintenance-related failures. The engineering organization also should identify post-maintenance testing requirements and acceptance criteria; recommend troubleshooting of complex problems; develop specifications for the procurement of commercial grade parts; and ensure that unauthorized modifications are not performed as maintenance activities without proper review (i.e., 10 CFR 50.59) and approval and maintenance work requests. Additional inspection guidance on commercial grade dedication is available in IP 38703, "Commercial Grade Dedication."

c. The engineering organization will evaluate such external information as vendor bulletins and NRC generic communications. The engineering groups should maintain records of such evaluations and should perform the evaluations in a timely manner.

d. The degree of engineering involvement with plant procedure revisions, 10 CFR 50.59 and Part 21 evaluations, and technical specification or FSAR amendments.

e. The work prioritization process, safety significance of specific work activities, and the system for tracking backlogged items. The size and shape of the engineering backlog is not as important as management of the backlog.

03.04 Inspectors have a regulatory basis for actions during inspection that result in the licensee providing records, including newly generated calculations, that substantiate the licensee's ability to fulfill its design-basis commitments. A request by an inspector for a broad range of specific design documents without

any identified concerns may be perceived as a backfit by the licensee. However, the intent of this guidance is to have any licensee effort to confirm system functionality result from legitimate concerns identified by the inspector. To the extent that such licensee effort is perceived by the licensee as a backfit, this should be addressed through the normal channels for backfit review.

Licensee configuration management should ensure that design-basis documentation is consistent with regulatory requirements, licensee commitments, and the as-built facility.

For plant modifications reviewed as part of 02.01 and 02.02, there must be assurance that systems, structures, or components will perform their intended safety functions. The inspector should consider the following whether:

a. Design-bases documentation (e.g., design criteria, licensing commitments, and calculations of record) was available and utilized in conjunction with the generation of the engineering analysis to support the plant design change and modification.

b. Documents containing design-bases information are controlled and updated to ensure they remain current.

c. System design requirements (e.g., system descriptions, calculations and analysis, component specifications, and drawings) reflect the as-built condition of the plant and are consistent with regulatory requirements and licensee commitments.

03.05 If significant weaknesses are identified in the engineering organization, consider pertinent engineering elements listed below:

a. The engineering organization should have clearly defined responsibilities that are understood by both management and staff. The engineering staff should understand and implement engineering procedures and programs. Some organizations may have a number of different engineering organizations, each serving a different function. Examine all of these groups to determine the amount of overlap and interface between them. Consider the extent and effectiveness of communications between licensee organizations (e.g. engineering, operations, maintenance) associated with a specific modification package.

b. Review the distribution of engineering responsibilities between site and corporate groups. Determine if the location of the engineering support staff away from the site adversely affects the staff's familiarity with the plant and level of involvement in resolution of problems.

c. Review the extent and reliance upon contracted engineering organizations. Consider the adequacy and timeliness of the engineering followup on concerns identified by the licensee's contractors. Determine the degree to which the licensee

engineering organization monitors the technical adequacy and assumes ownership of contractor work products.

d. If the licensee uses system engineers, review the role of the system engineers and their knowledge of system requirements and plant design bases. As appropriate to the licensee's programs, review the system engineers' involvement in activities on their systems, including planned maintenance, modifications, surveillance testing affected by temporary modifications, operability determinations, and disposition of condition reports and nonconformances. The length of time that engineers have had system responsibility may affect their extent of knowledge; if this appears to be a problem, evaluate their training.

e. Review the adequacy and utilization of staffing within the engineering organization to accommodate assigned workload through such indicators as ability to respond to plant needs within required time frame, amount of overtime required, backlog and prioritization of work, and number of staffing vacancies. Consider the qualifications of engineering personnel.

f. Review the adequacy of formal and informal training programs for the engineering staff. In particular, review the adequacy of training provided for personnel authorized to perform 10 CFR 50.59 evaluations. Also review the training provided to personnel who perform operability determinations and root-cause analyses.

g. Review the adequacy of design control procedures, design guides, design specifications, engineering administrative control procedures, and organizational interface control procedures.

03.06 Evaluate the effectiveness of licensee's engineering staff to support plant operations based on the above. In addition, review recent evaluations by internally and externally conducted technical audits, such as self-initiated safety system functional inspections (SSFIs), focusing on engineering. These reviews should assess the depth of technical reviews performed and issues identified by the licensee (as opposed to those identified by the NRC) and the adequacy of licensee resolution of issues identified by audits.

When safety issues, events, or problems are reviewed, the adequacy of the results of licensee controls may be assessed by determining how effective the licensee was in performing the following:

1. Initial identification of the problem.

2. Elevation of problems to the proper level of management for resolution (internal communications and procedures).

3. Root cause analysis.

4. Disposition of any operability issues.

5. Implementation of corrective actions.

6. Expansion of the scope of corrective actions to include applicable related systems, equipment, procedures, and personnel actions.

When evaluating engineering activities, consider the timeliness of resolving engineering findings and the number of repeat findings. Another potential indicator of engineering performance is the number of modifications initiated to correct problems with earlier modifications. Consider the engineering use and reliance upon QA activities and use of feedback to improve engineering processes.

Interview licensee management to determine how they perceive engineering performance, capability, and effectiveness. During these discussions, determine licensee initiatives and recent improvements in the engineering function.

The determination of whether there are strengths or weaknesses in the licensee's controls will be limited to those issues, events, or problems reviewed in detail. The evaluation will not draw sweeping conclusions about the licensee's overall control programs but will be very specific in identifying any licensee strengths or weaknesses encountered with the individual issues reviewed.

For additional inspection guidance on licensee controls, refer to IP 40500, "Effectiveness of Licensee Controls in Identifying, Resolving, and Preventing Problems."

03.07 The overall mission of the ISEG (or equivalent) is to prevent accidents that might affect the public health and safety. The exact organizational arrangement for safety review at each utility will differ. However, whatever the organizational arrangement, the safety review personnel must have the required abilities, experience, and authority to perform quality technical reviews. The inspectors should assess whether the committees have been aggressive in seeking out areas needing improvement, rather than just responding to events and inputs from outside sources.

03.08 While some licensee's have implemented administrative TS with limiting conditions of operations to maintain availability and operability of these systems, the NRC did not require licensees to address the operability of these systems in plant TS, except for Category 1 and Type A variable RG 1.97 instrumentation. It is important that the inspectors verify that the licensees maintain such equipment and systems that are not covered by TS to ensure system reliability and operability. Any unacceptable conditions must be brought to the attention of NRC regional management for proper resolution.

Additional information for ATWS is available in Generic Letter 85-06: "Quality Assurance Guidance for ATWS Equipment That is Not Safety-Related," Information Notice: 92-06 and its supplement "Reliability of ATWS Mitigation System and Other NRC Required Equipment Not Controlled by Plant Technical Specifications." Also, NUREG/CR-4640, "Handbook, of Software Quality Assurance Techniques Applicable to the Nuclear Industry" has information on how to control the development and use of software design in nuclear power

plants. Industry standards such as NQA-2, IEEE Standard 7.4.3.2-1993 and IEEE Standard 730-1984 provide additional guidance to facilitate verification of appropriate design modification quality, testing and software configuration control.

Additional information for station blackout is available in Regulatory Guide 1.155, "Station Blackout," and NUMARC 87-00, "Guidelines and Technical Bases for NUMARC Initiatives Addressing Station Blackout at Light Water Reactors," Revision 1.

03.09 Use of risk insights. The inspector should refer to IMC 2515 Appendix C for guidance on the use of PRA insights to help in the selection and prioritization of items to inspect. If necessary, contact NRC PRA specialists (e.g., Senior Reactor Analysts or the NRR Probabilistic Safety Assessment Branch) for assistance.

37550-04 RESOURCE ESTIMATE

This inspection procedure is expected to take approximately 180 direct inspection hours for a single-unit site. Multi-unit sites are expected to require an additional 72 hours of direct inspection for each additional unit. The scope of planned examinations should be adjusted accordingly. The inspection should involve 1 week of onsite inspection by two inspectors, as a minimum.

Licensee performance (e.g., SALP 3) and design issues may indicate the need for additional inspectors, including contractor design specialists. The duration of the inspection also may be expanded, if required.

37550-05 REFERENCES

ANSI N45.2.11-1974, "Quality Assurance Requirements for the Design of Nuclear Power Plants"

ANSI N45.2.13-1976, "Quality Assurance Requirements for Control of Procurement of Items and Services for Nuclear Power Plants"

ANSI N18.7-1976, "Administrative Controls and Quality Assurance for the Operations Phase of Nuclear Power Plants"

ANSI N45.2.9, "Requirements for Collection, Storage, and Maintenance of Quality Assurance Records for Nuclear Power Plants"

Regulatory Guide 1.28, Quality Assurance Program Requirements (Design and Construction)"

NRC Policy Statement, "Availability and Adequacy of Design Bases Information at Nuclear Power Plants," August 10, 1992

NUREG-1397, "An Assessment of Design Control Practices and Design Reconstitution Programs in the Nuclear Power Industry"

SECY-91-364, "Design Document Reconstitution"

SECY-92-193, "Design Bases Reconstitution"

10 CFR Part 50, Appendix A, Criterion I, "Quality Standards and Records"

---, Appendix B, Criterion III, "Design Control"

---, Appendix B, Criterion XVII, "Quality Assurance Records"

10 CFR 50.59, "Changes, Tests, and Experiments"

10 CFR 50.2, "Design Bases"

END