INSPECTION PROCEDURE 60851

DESIGN CONTROL OF ISFSI COMPONENTS

PROGRAM APPLICABILITY: 2690 and 2515

SALP FUNCTIONAL AREA: ENGINEERING (ENG)

60851-01 INSPECTION OBJECTIVE

For the purposes of this procedure, three different entities will be referred to: "licensee" - a 10 CFR Part 72 site-specific license holder or a reactor licensee using a 10 CFR part 72 general license; "vendor" - an independent organization performing design oversight of spent fuel cask construction and holding the Certificate of Compliance (C of C) for a particular dry cask storage system (DCSS); and "fabricator" - an organization that is physically building the DCSS components and receives design oversight from either the "vendor" or "licensee." A vendor may also approve changes to a DCSS if authorized by the C of C.

01.01 To determine that the design control program described in the licensee's Quality Assurance (QA) program is appropriately implemented by the licensee, vendor, and fabricator.

01.02 To determine that any design changes or modifications implemented by the fabricator, vendor, or licensee have been properly evaluated by the licensee and/or vendor for impact on the functionality of DCSS components for their use in an Independent Spent Fuel Storage Installation (ISFSI).

01.03 To determine if these changes or modifications have been properly evaluated by the licensee and/or vendor and that these changes do not require a change to the conditions in the license or the C of C or constitute an unreviewed safety question, a significant increase in occupational exposure, or a significant unreviewed environmental impact.

01.04 To evaluate the effectiveness of the licensee's or vendor's management and QA oversight of the design control process.

60851-02 INSPECTION REQUIREMENTS

02.01 Before any on-site activity, review the Safety Analysis Report (SAR), NRC's corresponding Safety Evaluation Report (SER), C of C, and, if applicable, the site-specific license and technical specifications for the particular DCSS or ISFSI.

02.02 Verify that the licensee's and/or vendor's QA program and Part 21 procedures are in place and effective. Verify that fabrication activities are being conducted under an approved QA program and Part 21 procedures and that these programs are effective.

02.03 Determine, by review of selected drawings and documents, whether the procurement specifications for materials, components, and equipment agree with the design documents (SAR and SER). If the procurement specifications differ from the original design, verify that the licensee has reviewed all changes in accordance with 10 CFR 72.48. If the vendor is authorized to approve changes by the C of C, then verify it has also reviewed and approved all changes in accordance with the C of C. Inspection guidance on reviewing these changes is found in section 02.07.

02.04 Verify that a method has been established to ensure that design changes initiated by the vendor or fabricator are communicated to the licensee. Determine whether the licensee was notified in a timely manner. Verify the licensee has approved these design change and/or reviewed changes that were approved by the vendor.

02.05 Verify that nonconforming conditions, which were resolved by design changes, have been reviewed and approved by the licensee and the vendor, if authorized by the C of C. Determine if all nonconforming conditions identified before completion of fabrication were resolved before the DCSS was released to the licensee.

02.06 Verify, through review of records, inspection of equipment and components, and/or interviews with selected personnel, that the licensee, vendor, and fabricator personnel have established a method for tracking, evaluating, and dispositioning changes or modifications to the DCSS component design.

02.07 Verify, for selected design changes or modifications, that the following information has been documented and is available for review:

a. The reason for the change.
b. The impact on the design, regulatory, or licensing basis.
c. The nature of the change. This should include a technical evaluation of the effects of the change on the affected component, effects on the cask system as a whole, and any changes to the quality level or classification of the component.
d. The change's effect on the functionality of the specific component.
e. The change has been evaluated against 10 CFR 72.48 and does not involve a change to the conditions of the license or C of C, an unreviewed safety question, a significant increase in occupational exposure, or a significant unreviewed environmental impact. Verify that an amendment application for the license or C of C has been submitted for any issue that failed the these tests.

02.08 For selected changes and modifications, determine by independent review and calculation whether:

a. Calculations, assumptions, and conclusions used for the change or modification were technically correct, used sound engineering judgment, and did not adversely impact the functionality of the component.
b. The safety evaluations or screenings for the change have a sound technical basis.

60851-03 INSPECTION GUIDANCE

General Guidance

The design of each generic and site-specific DCSS has been reviewed and approved by NMSS. Certified generic cask designs are listed in 10 CFR 72.214. The licensee is permitted to make changes to the ISFSI and DCSS components within certain limitations as described in 10 CFR 72.48. Some vendors are also permitted to make changes to the ISFSI or DCSS components in

accordance with the C of C. A change that affects the C of C, should be treated similarly to a change affecting the conditions of the license, and requires prior NRC approval.

It is important to understand the functionality of a specific component. Functionality is the ability of a component to meet all its design requirements. Some components may have multiple design requirements and several functions. These requirements and functions are defined in the SAR, SER, C of C, and, if applicable, the site-specific license and technical specifications for the DCSS being used. For example, the cask support basket that separates the individual fuel bundles serves several functions: structural integrity, criticality control, heat transfer, and radiation shielding. Technical assistance for determining whether a specific DCSS component meets its intended functions may be obtained from the Spent Fuel Project Office (NMSS/SFPO).

For an Independent Spent Fuel Storage Installation (ISFSI) located at an existing reactor site Appendix A provides guidance for inspection of the ISFSI pad and area for compliance with 10 CFR Part 72.212.

Specific Guidance

03.01 SARs and SERs describing the dry cask storage system's components have been written for each type of approved DCSS. Information on operational commitments for a particular DCSS may also be found in the C of C and, if applicable, the site-specific license and technical specifications. DCSS designs vary, and care must be taken to review the documentation for the correct system. Copies of documentation may be obtained from the Division of Reactor Safety or from the Spent Fuel Project Office (NMSS/SFPO). While the SER can document or clarify commitments made by the licensee or vendor, it does not serve as an independent basis for enforcement actions.

03.02 The licensee's and/or vendor's QA program should have been previously reviewed and approved by the NRC. The purpose of this section is to verify that design control and related activities (e.g., document control, special processes, or resolution of nonconforming conditions) are conducted under an approved QA program. This can be done through a review of completed audits, interviews with selected personnel, and/or review of procedures. A similar approach should be taken for the 10 CFR Part 21 procedures. Inspectors should also review any related licensee QA audits or NMSS inspections regarding DCSS design modifications and determine whether corrective actions for the audit or inspection findings have been effectively implemented in a timely manner.

03.03 The procurement specifications should conform to the design requirements contained in the SAR, SER, etc. The inspector should concentrate on instances where components or raw materials do not meet the procurement specifications. The licensee's or vendor's design change evaluation process should appropriately resolve these issues. In the case where a material substitution is made, the inspector should determine whether the design change process was properly used to evaluate the adequacy of the substitution. Receipt inspection activities are part of the overall QA program. The inspector should concentrate on any receipt inspection problems that were resolved by design changes or modifications.

03.04 If the licensee or C of C holder has imposed requirements on the fabricator to notify it of any design changes initiated by the fabricator, then ensure that the fabricator is complying with these requirements. QA audits of the fabricator's activities in this area may also be reviewed. Oversight of fabricator activities should identify any programmatic or repetitive deficiencies in fabricator performance. Examples of design changes, are modifications to: procurement specifications, materials, drawings (dimensions and tolerances), fabrication techniques, quality classifications, or nondestructive examination processes.

03.05 See section 03.07 for guidance.

03.06 A process should be in place under the approved QA program to keep track of design changes and modifications. The inspector should concentrate on design interface activities, communications, and documentation of changes.

03.07 Inspectors should ascertain whether the licensee or C of C holder has performed design changes and modifications through the review of change documentation packages. The quality and timeliness of such documentation should be evaluated. Emphasis should be placed on the thoroughness of documentation and independence of reviews, particularly for those design changes and modifications that resolve nonconformances and field change requests. Evaluations should also include a discussion of the effect on component functionality. Information on component functionality may be found in the SAR, SER, C of C, or, if applicable, the site-specific license and technical specifications.

The timing of design change reviews is also important. Ideally the licensee and/or vendor should complete the reviews before the component is fabricated; however, licensee should not use the DCSS unless all design changes have been appropriately evaluated and approved or resolved.

Additional guidance, along with a list of procedures that may be helpful is found in IP 37001. Although 37001 provides guidance for reviewing design changes, inspectors should be aware that ISFSI components are classified as important to safety as opposed to safety-related. Consequently, the inspector should apply judgement regarding the scope and rigor of the evaluations. Assistance on acceptable calculation methods or Code applicability may be obtained from NMSS/SFPO. The references for this procedure contain supplemental information on the quality classification of components.

03.08 Design basis accidents, such as a DCSS tip over or a drop from a maximum specified height, are addressed in the SAR; however, assistance is available from NMSS/SFPO in determining whether a change may result in an unreviewed safety question for a particular DCSS design.

60851-04 INSPECTION RESOURCES

To prepare for these inspections each inspector should spend approximately 16 hours for in-office review. Inspection activities will require approximately 40 hours, each, by three inspectors. Inspections may occur at the licensee's vendor's or fabricator's facilities. Documentation is estimated to require 16 hours per inspector. NMSS vendor inspection staff is expected to have the lead in inspecting vendors and fabricators, with assistance from regional inspection staff. Regional inspection staff is expected to have the lead in inspecting licensees, with assistance from NMSS and/or NRR. For inspections of Appendix A to this procedure, technical assistance will normally be needed from NRR's Civil Engineering and Geosciences Branch.

60851-05 REFERENCES

NUREG/CR-6407, "Quality Classification of Transportation Packaging and Dry Spent Fuel Storage System Components According to Importance to Safety," October 1995 (DRAFT).

END

Appendix:
A. Independent Spent Fuel Storage Installation Pad Inspection Guidance

APPENDIX A

INDEPENDENT SPENT FUEL STORAGE INSTALLATION PAD INSPECTION GUIDANCE

A. PURPOSE AND OBJECTIVE

The purpose of this Appendix is to provide guidance for inspection of: (1) an Independent Spent Fuel Storage Installation (ISFSI) pad located at an existing reactor site, and (2) aspects of for compliance with 10 CFR Part 72.212.

With this purpose in mind, the objectives of the inspection are the following: (1) to determine whether Independent Spent Fuel Storage Installation (ISFSI) pad is constructed in accordance with the design commitments and requirements specified in the vendor's Safety Analysis Report (SAR), NRC's Safety Evaluation Report (SER), the Certificate of Compliance (C of C), 10 CFR Part 72, 10 CFR Part 100, Appendix A, updated Final Safety Analysis Report (FSAR) and the NRC's SER for the nuclear power plant, and, if applicable, the site-specific license and technical specifications, and
(2) to determine whether the licensee has taken into account geological and seismological characteristics of the site when evaluating its suitability as an ISFSI.

B. INSPECTION REQUIREMENTS

Before conducting any on-site inspection, review the updated reactor FSAR and SER, the SAR, SER, C of C, and, if applicable, the site-specific license and technical specifications for the dry cask storage system (DCSS) being used.

Verify whether the licensee has met the requirements of Part 72.212 in accordance with the criteria contained in its current licensing basis. Verify whether or not seismic ground motion used in the ISFSI analysis and design is greater than or equal to SSE, the facility's design basis.

Since the facility's ground motion may not be appropriate for use at the ISFSI if the foundation conditions are different than those for the reactor, determine the following: (1) the plant structures are founded on rock or soil; (2) the SSE ground motion used in the design of the seismic Category I structures. Determine the location of the seismic ground motion input in the design of the plant Category I structures; if this was at the base of the reactor foundation or at the free field ground surface, verify if proper ground motion amplification analysis has been done for the ISFSI site to determine the proper seismic ground motion input for the cask design and for the liquefaction analysis of foundation soils, if necessary. Determine whether or not the seismic ground motion at the top of the ISFSI pad is enveloped by the seismic input used for the DCSS design so that the cask instability is precluded.

Determine that the ISFSI site investigation reports related to hydrology, geology/seismology and geotechnical engineering, address the following:
(1) hydrological data, if any, related to flooding (and erosion, if applicable) of the ISFSI site and adjacent areas; (2) geotechnical data such as soil boring logs paying special attention to soil description, ground water table, standard penetration test (SPT) data, long term consolidation of soil beneath the pad as well as the potential for swelling upon excavation and removal of overburden.

Verify that soil borings have been drilled to bedrock level, or well into very dense material as evidenced by high SPT blow counts. Verify that the reports document the thicknesses of soil layers below the ISFSI pad including other significant properties of soil layers (such as unit weight, Poisson's ratio, low
strain shear modulus, moisture content, fines content, relative density, and shear wave velocity). Also, verify the following: (1) calculations of total and differential settlements of the ISFSI pad due to both static and seismic loadings exist; (2) calculations of the ultimate and allowable soil bearing

capacities used in the pad design are below the allowable bearing capacity within acceptable factors of safety, the sequential, partial and total loads on the pad are incorporated in the design; (3) stability analysis of slopes in the vicinity of the pad have been evaluated to ensure that failure of such slopes do not affect the safety of either the ISFSI casks or that of the adjacent structures, if any. Additional requirements on geotechnical/foundation activities may be found in the references.

Determine, through direct observation, whether the construction activities and procedures duly account for safety related buried piping, tunnels, etc. to avoid potential adverse impact.

If the pad has already been constructed, then verify, through the review of records, that the foundation bed has been prepared and the subsoil has been compacted or otherwise treated to meet the specifications defined in the SAR, SER, C of C, and, if applicable, the site-specific license and technical specifications. Verify, through review of records, that the licensee has designed and constructed the pad to be functional with respect to the total and differential settlements, swell, bearing capacity and liquefaction potential of the soil under static and dynamic loading conditions.

If pad construction activities are observed, then verify through direct observation whether the foundation bed is being prepared in accordance with applicable standards prior to placement of the backfill materials, the backfill material is placed and compacted in specified layers and records of such placement are maintained to show compliance with the specifications defined in the SAR, SER, C of C, and, if applicable, the site-specific license and technical specifications. Additional requirements on geotechnical/foundation activities may be found in the references.

Determine whether the construction activities and procedures duly account for safety related buried piping, tunnels, etc. to avoid potential adverse impact.

Verify whether the licensee has analyzed the adequacy of roadways along the transporter route by using the results of any field explorations and laboratory testing of soil samples to determine the bearing strength of soil layers beneath the roadways.

C. INSPECTION GUIDANCE

The adequacy of the methods to calculate the total and differential settlements of the pad, and the stresses/strains of the concrete pad subject to the static and dynamic loads required in 10 CFR 72.212(b)(2)(ii) and 72.212(b)(3) should be determined from the design reports. The methods should be able to model realistic static and dynamic soil-structure interaction (SSI) phenomena, and all SSI analyses must recognize the uncertainties prevalent throughout the phenomena, including: (a) nature of the soil and rock configuration and material characteristics including lack of symmetry in the soil deposits, (b) uncertainty in soil constitutive modeling and soil properties, (c) effect of variable water table with time, (d) effect of soil swelling and corresponding reversed tensile and compressive stresses in the concrete pad, (d) effect of partial separation or loss of contact between the structure and the soil during the sequential static loading or during the earthquake. If a finite element analysis of the pad is made, the criteria for determining the location of the bottom boundary and side boundary of the analysis model should be assessed. Additional guidance on soil-structure interaction analysis may be found in the references.

IP 60853 may be used for supplemental guidance.

D. INSPECTION RESOURCES

To prepare for these inspections an inspector should spend approximately 16 hours for in-office review. Inspection activities will require approximately 16 hours by the inspector. Inspections may occur at the licensee's vendor's or fabricator's facilities. Documentation is estimated to require 8 hours. Regional inspection staff is expected to have the lead in inspecting licensees, but for this inspection in Appendix A, technical assistance will normally be needed from NRR's Civil Engineering and Geosciences Branch.

E. REFERENCES

NRC Inspection Manual IP 45053 Geotechnical/Foundation Activities Work Observation

NRC Standard Review Plan, Sections 2.5 and 3.7, Rev.2.

NRC Regulatory Guide 1.132, "Site Investigations for Foundations of Nuclear Power Plants," March, 1979

NRC Regulatory Guide 1.138, "Laboratory Investigations of Soils for Engineering Analysis and Design of Nuclear Power Plants", April 1978

NRC Information Notice 95-28, "Emplacement of Support Pads for Spent Fuel Dry Storage Installations at Reactor Sites", June 5, 1995

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