INSPECTION PROCEDURE 45051.A

GEOTECHNICAL/FOUNDATION ACTIVITIES PROCEDURE REVIEW

PROGRAM APPLICABILITY: 2512

45051.A-01 INSPECTION OBJECTIVES

01.01 To determine whether the technical requirements detailed or referenced in Chapters 2 and 3 of the facility SAR associated with geotechnical/foundation construction and quality control involving safety-related structures have been adequately addressed in the construction specifications, drawings, and work procedures and whether the established system of management control is adequate.

01.02 To determine whether quality assurance plans, instructions and procedures for geotechnical/foundation activities have been established in the facility QA manual, and whether these documents conform to the QA program as described in Chapter 17 of the facility SAR.

01.03 To determine whether specification or procedural inadequacies associated with geotechnical/foundation activities indicate any potential generic problems or weaknesses within the preparing technical organization.

Inspection Schedule

May Be Started	Must Be Started	Must Be Completed
Six months before site exploration or preparation is started	One month before site exploration or preparation is started	Before significant use of the specifications or procedures

45051.A-02 INSPECTION REQUIREMENTS

02.01 For each onsite organization with QA/QC responsibilities relative to geotechnical/foundation activities, complete the inspection requirements of Inspection Procedure (IP) 35100 relative to this area. Usually IP 35100 will be completed before conducting the inspection requirements of this section. If there are multiple contractors with QA/QC responsibilities in this area, the region may inspect a sample, using engineering judgment concerning the safety significance and the complexity of the work activity.

02.02 Review the construction specifications related to geotechnical activities and ascertain whether the specified technical requirements conform to the commitments contained in Chapters 2 and 3 of the SAR.

02.03 Determine whether appropriate and adequate procedures in nine of the following areas are compatible with the QA program and prescribe adequate methods to meet the construction specifications, where applicable.

a. Excavation.
b. Foundation verification.
c. Embankments.
d. Backfilling.
e. Settlement monitoring.
f. Retaining walls.
g. Piers.
h. Piling.
i. Grouting.
j. Blasting.
k. Dewatering.
l. Pond liners.
m. Instrumentation.
n. Testing (including subsurface exploration).
o. Inspection.
p. Structural concrete.
q. Surveying.
r. Engineering direction.

02.04 Determine whether the licensee has an established audit program (including plans, procedures, and schedule) covering the safety-related work and control functions in the area of geotechnical/foundation activities.

02.05 Determine whether the licensee has an established audit program for ensuring that examination and inspection personnel associated with geotechnical/foundation activities are qualified to perform their assigned work. Determine whether a program has been established to train craft personnel in their assigned tasks.

02.06 If applicable to the project, perform a review of the results of the test fill program and pile load tests before reviewing the implementing construction procedures to verify that the fill and piling procedures have been qualified. The implementing procedures should reflect the methods, equipment, materials, and conditions of the test fill program and pile load tests.

02.07 Additional inspections, as determined by Regional management, may be conducted in the inspection areas covered above when licensee performance is classified as Category 3 by the SALP program, or if Regional management concludes that recent findings will likely result in a SALP Category 3 rating. In these cases, particular consideration should be given to an expanded sample of items to be inspected under Section 02.01, 02.03, 02.04 above, and completion of the following additional inspection requirement, where applicable. Review the settlement calculations to assure that they are based on actual soil and foundation parameters.

45051.A-03 INSPECTION GUIDANCE

General Guidance. Applicable portions of the SAR (2.4, 2.5, 3.8.5, and 17.1), the SER, and NRR/licensee questions and answers should be reviewed to determine licensee commitments relative to construction and inspection requirements before performing this inspection. The inspector should then utilize these documents during the review of the construction specifications, drawings, work procedures, and QA implementing procedures.

Most of this review can be completed during inspection preparation after these procedures have been obtained from the site.

Findings from this inspection activity should address each element as being satisfactory, being unresolved and requiring resolution, or being in violation and requiring correction. Geotechnical/foundation activities should also be reviewed in the light of being consistent with standard industry practice for the successful completion of that activity. When significant inadequacies are identified in the specifications or procedures indicating weakness within the preparing organization, the inspector should inform cognizant regional management. The issue should be addressed at the appropriate level of licensee management.

Because earth structures involve unique construction processes for each project, the number of geotechnical/foundation activities listed in 02.03, above, which should be reviewed depends on the significance and applicability of that activity with respect to site conditions and the need for establishing a close relationship between the geotechnical design and the construction techniques and related monitoring. It is for this reason that this inspection module should be performed by someone who is able to discriminate between and weigh those activities which will require the most attention and which will have the most impact on safety.

Review of the structural concrete activities in the construction of the ultimate heat sink (lake, dam, or canal) should be accomplished in conjunction with this procedure using the inspection elements of IP 46051. The intent is to review safety-related structural concrete activities in the initial phases of construction (either during site preparation or during power block construction). The basemat of a concrete containment structure is not covered in this procedure because it is considered part of the containment structure and is included in IP 46051. If other structural concrete foundations are the first use of safety-related structural concrete at the site, the inspection requirements of IP 46051 are to be accomplished in conjunction with this procedure (IP 45051.A).

If the same construction and inspection organizations, essentially the same construction and inspection (QC) procedures, and adequately staffed and qualified personnel are utilized for other safety-related structural concrete at the site, the inspection requirements of IP 46051-02.01 need not be repeated for this procedure. However, it should be verified that the above conditions are met if these procedure review requirements are not repeated.

The licensee is responsible to implement or have implemented the QA program described in the SAR. The inspector must determine if this program is implemented in an adequate and timely manner for the safety-related work in progress. The aggregate of plans, lists, checklists, and procedures form the QA manual and QA implementing procedures/work procedures.

QA/QC procedures must provide for effective inspections which will ensure that work is performed in accordance with specification requirements. QA audits should identify procedural inadequacies and the root cause of repetitive nonconforming conditions. Inspections should require verification of specified controls and should not be accomplished merely by surveillance. Laboratory and field testing procedures must provide for verification of correct material usage, correct selection of reference standards, and should prohibit discretionary selection of inspection and testing parameters on the part of inspectors. Results of testing should be reviewed by qualified personnel and a determination of acceptability of the results made. Construction procedures must reference the required inspection hold points and must also address the quality assurance department authority to stop work.

03.01 Specific Guidance

Note: The numbering of the guidance below refers to specific subsections of 02, above.

02.01 The inspector should also review ANSI N45.2.5, Supplementary Quality Assurance Requirements for Installation, Inspection, and Testing of Structural Concrete, Structural Steel, Soils and Foundations During the Construction Phase of Nuclear Power Plants, if cited by the licensee. Specific attention should also be given to the quality assurance program needs that may result from the distribution of design and construction responsibilities. Examples of these needs may be: provisions for adequate onsite engineering direction, appropriate and adequate procedures related to procurement and use of materials, and adequate control of hold points.

02.02 The construction specifications must translate design requirements with sufficient detail to define the acceptance testing requirements and should specify the personnel and interface responsibilities required to define, control and resolve field or design geotechnical/foundation problems that are evidenced during construction. The specifications must also provide for qualifications of the equipment and techniques to be used to meet the specification requirements for compaction of soils. The specifications should provide for control of design changes and the issuance of design change notices.

02.03a Generally, procedures for the removal of material (excavation) are not required, but the condition of the underlying bedrock or soil must be prepared/retained as specified. However, if material is removed by blasting, for example, the effect on adjacent rock and existing structures needs to be considered, and inspection and monitoring procedures should be required.

02.03d Selection and compaction of fill material is not always considered an important activity by some construction contractors. Attention should be given to the adequacy of compaction procedures and inspection (QC) procedures to ascertain whether fill placement meets applicable requirements.

02.03e Procedures for settlement monitoring should provide for: establishment of bench marks for vertical control such that they are unaffected by river and groundwater levels; first-order settlement surveys including ground water level and river, bay, or ocean level at time of survey; installation of settlement monitoring instrumentation, vertical and horizontal (i.e., brass plugs in concrete, extensometers, piezometers, soil pressure, or pressure cell instruments).

02.03q Site surveying activities are one of the fundamental jobs done during construction but do not receive much attention. Since surveying activities can affect the quality of structures, systems, or components, the requirements of Appendix B to 10 CFR 50 do apply. Surveying activities include layout, settlement monitoring, and dimensional verification of structures, components, or equipment.

03.02 Prevalent Errors and Concerns. Prevalent errors and recent concerns are areas in which the inspector should be alert to potential generic issues. These areas include:

a. Insufficient compaction of foundation and backfill materials was identified at several sites and the cases are described in IE Circular 81-08.

b. QA audits should identify procedural inadequacies or the cause of repetitive nonconforming conditions.

c. Placement of fill for control of compaction should identify minimum depth to ground water level, especially for tidal areas, because the potential exists for causing bulging and rolls during compaction.

45051.A-04 REFERENCES

SAR, Chapters 1, 2, 3, and 17, including pertinent codes and standards referenced in these chapters.

IE Circular No. 81-08, Foundation Materials, May 29, 1981.

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

Regulatory Guide 1.58, Qualification of Nuclear Power Plant Inspection, Examination, and Testing Personnel.

Regulatory Guide 1.88, Collection, Storage, and Maintenance of Nuclear Power Plant Quality Assurance Records.

Regulatory Guide 1.94, Quality Assurance Requirements for Installation, Inspection, and Testing of Structural Concrete, Structural Steel, Soils and Foundations During the Construction Phase of Nuclear Power Plants.

Regulatory Guide 1.132, Site Investigation for Foundations of Nuclear Power Plants.

Regulatory Guide 1.138, Laboratory Investigation of Soils for Engineering Analysis and Design of Nuclear Power Plants.

ANSI/ASME N45.2.5, Supplementary Quality Assurance Requirements for Installation, Inspection and Testing of Structural Concrete, Structural Steel, Soils and Foundations During the Construction Phase of Nuclear Power Plants.

ANSI/ASME N45.2.20, Supplementary Quality Assurance Requirements for Subsurface Investigations for Nuclear Power Plants.

U.S. Army Corps of Engineers, Instrumentation of Earth and Rock-Fill Dams (Groundwater and Pore Pressure Observations), Engineer Manual EM 1110-2-1908.

U.S. Army Corps of Engineers, Soil Sampling, Engineer Manual EM 1110-2-1907.

U.S. Army Corps of Engineers, Foundation Grouting and Planning, Engineer Manual EM 1110-2-3501.

U.S. Army Corps of Engineers, Foundation Grouting and Field Technique and Inspection, Engineer Manual EM 1110-2-3503.

U.S. Department of the Army, Dewatering and Groundwater Control for Deep Excavations, Technical Manual TM 5-818-5.

U.S. Department of the Army, Grouting Methods and Equipment, Technical Manual TM 5-818-6.

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