INSPECTION PROCEDURE 51065

ELECTRIC CABLE - RECORD REVIEW

PROGRAM APPLICABILITY: 2512

51065-01 INSPECTION OBJECTIVES

By selective sampling and evaluation of quality records pertaining to safety-related cable systems, determine whether:

01.01 The licensee and contractor system for preparing, reviewing, and maintaining records is functioning properly.

01.02 The records reflect work accomplishment consistent with NRC requirements and SAR commitments.

01.03 The records indicate any potentially generic problems, management control inadequacies or other weaknesses of safety significance.

Inspection Schedule

Inspection	May Be Started	Must Be Started	Must Be Completed
First	After cable installation is 20% complete	Before cable installation is 30% complete	Before cable installation is 50% complete
Second	After cable installation is 60% complete	Before cable installation is 70% complete	Two months after cable installation is complete

51065-02 INSPECTION REQUIREMENTS

02.01 Record Control and Review. Review licensee and contractor requirements covering the span of records for safety-related electric cable, terminations and associated items.

a. Determine who prepares each quality-related record, who reviews the records for accuracy and who assures that the recorded information meets requirements.

b. Evaluate the information obtained above and determine whether the established record management system satisfies NRC requirements and SAR commitments.

02.02 Work and Inspection Records. Review and evaluate pertinent quality records in the areas listed below. Determine whether adequate preparation, control, review and evaluation of these records have been made, whether they reflect that appropriate requirements have been met and whether the system of records is functioning properly. The selection shall include records associated with various safety-related power, control and instrument cables (including thermocouple wire); cable connectors, splices, and support grips; terminations, lugs, tapes and pulling compounds; fire barriers, seals and retardants. The records selected shall represent a diversity of cable and associated items and include some cable and terminations located inside containment.

a. Receiving Inspection Records. For each of the two inspections, select records applicable to the receipt of six lots or shipments. Determine whether the records reflect:

    1. Receiving inspection documents properly and positively identify received cable, termination components and associated items.

    2. Applicable engineering and functional specifications (regarding size, type, material, etc.) of received items were met or otherwise noted.

    3. The required qualification, performance, and nondestructive test requirements were met or otherwise noted.

    4. Receiving inspection reports are complete, controlled and properly reviewed.

    5. Original records or certification system met requirements of applicable criteria.

b. Storage Records. For each of the two inspections, select records applicable to the storage and storage inspection of six lots or groups of cables and associated items, or fifteen individual cables and associated items. Determine whether the records reflect:

    1. Specified storage conditions were maintained.

    2. Storage inspections were properly made at specified intervals.

    3. Nonconforming items were properly identified, segregated, and maintained.

c. Installation Records. For each of the two inspections, select records applicable to the installation and inspection of thirty-five cables and associated terminations. Determine whether the records reflect:

    1. Cable, wire, terminations (lugs, tapes, stress cones, pot heads, connectors, terminal blocks, etc.) and associated items are installed in accordance with requirements using specified materials.
    2. Cable routing is as specified on latest approved drawings, pull schedule, pull cards, route slips, etc.

    3. Separation and independence requirements are met.

    4. Segregation requirements are met (power, control, instrument - as specified).

    5. Cable supports were provided as specified.

    6. Identification system is adequate, including integration of cable and raceway identification, to assure proper routing.

7. Acceptability of the installation was determined for both in-process and final inspection criteria.

8. The required inspections were properly performed, recorded, reviewed and evaluated by qualified personnel.

9. Specified fire barriers, compartment boundary seals and fire retardant materials are installed or applied where specified.

10. Documentation of completed installation and inspection activities are properly and timely completed.

11. Nonconforming conditions are handled in accordance with approved procedures, including adequate justification for use-as-is disposition.

12. Required protective measures were provided and maintained after installation.

d. Cable Testing Records. For each of the two inspections, select records applicable to the testing of fifteen cables, several of which shall be located inside containment. Determine whether:

1. Required tests were performed.

2. Records indicate that approved technical procedures were followed.

3. Test equipment was periodically checked and calibrated as specified.

4. Test data and results were properly documented and evaluated, and corrective action, if required, was taken.

02.03 Raceway Loading. For each of the two inspections, review and evaluate records applicable to raceway loading for sixteen cable trays and sixteen cable conduits. Determine whether:

a. Power cable raceways are properly loaded (thermal and mass loading).

b. Instrument and control raceways are properly loaded (mass loading).

02.04 Personnel Qualification Records. For each of the two inspections, review and evaluate records applicable to the qualification and training of five inspectors and five craftsmen. Determine whether the records reflect:

a. That the system of craft and inspection personnel qualification records meets stated requirements and is being maintained in a current status.

b. Sufficient data are available to reasonably support qualification in terms of certification, experience, proficiency, training, testing, etc., as applicable.

c. Action has been taken by responsible licensee or contractor organizations to independently authenticate the record material.

02.05 Nonconformance and Deviation Reports. For each of the two inspections, review and evaluate fifteen reports applicable to nonconformances or deviations in cables, terminations and cable system installation. Determine whether:

a. Records are legible, complete and promptly reviewed by qualified personnel.

b. Reporting requirements of Part 21 and Part 50 were recognized during evaluation and appropriate action was taken where necessary.

c. Records have been routinely processed, timely evaluated and controlled through established channels for resolution of the root cause as well as the immediate problem.

d. Records are properly identified and stored, indicate current status and can be retrieved in a reasonable time.

e. Nonconformance reports include the status of corrective action or resolution, and adequate justification is provided for use-as-is disposition.

02.06 Change Control Records. For each of the two inspections, review and evaluate five design and five field change records. Determine whether:

a. Records associated with design and field changes, as well as work and inspection procedure changes, reflect timely review and evaluation by qualified personnel and are of the type approved for that purpose.

b. Records of periodic inspections assure that only the most recent approved documents, including design changes, were used in the field.

c. Design changes are subject to adequate design control, including consideration of the impact of the change on the overall design and on as-built records.

d. Records of nonconformances to design requirements include preparation of a nonconformance report even if the nonconformance is resolved through the design change process.

02.07 Audit Records. For each inspection, review and evaluate licensee and electrical contractor audit records in general. Review and evaluate in detail two recent audits (one licensee audit and one electrical contractor audit).

a. For audit records in general, determine whether:

    1. Audits have been performed in accordance with the schedule and functional areas established in the audit plan.

    2. All elements of the QA program applicable to cable systems are being audited periodically.

    3. Auditing organizations and personnel are independent of the work being audited.

    4. Licensee is informed of the results of the electrical contractor(s) audits.

b. For the specific audit records, determine whether:

    1. Audit records are sufficient to verify that the intended purpose and scope of the audits were achieved.

    2. Audit findings have been reported in sufficient detail to permit a meaningful assessment by those responsible for corrective action, final disposition, and trending.

3. The licensee and contractor have taken proper and timely follow-up action on those matters in need of correction.

02.08 Additional Inspection. Additional inspections, as determined by Regional management, may be conducted in the inspection areas covered above when the licensee's 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 Sections 02.02c, 02.02d and 02.05.

51065-03 INSPECTION GUIDANCE

General Guidance

a. Pertinent portions of the SAR and licensee and contractor QA programs should be reviewed to determine documentation requirements before reviewing records in this area. The inspector should make this determination during inspection preparation. Refer to IP 51061, Section 03 for additional guidance, background material and references. Where possible, the record reviews of this procedure should be performed in conjunction with the work observation inspections of IP 51063.

b. Inspection records should provide the documentary evidence that qualitative or quantitative criteria have been met. As a minimum, they should contain:

   1. Date of activity.

   2. Inspector's or data-taker's name or identification.

   3. Type of observation.

   4. Results.

   5. Acceptability.

   6. Actions taken for any deficiencies noted, or reference the document containing this information.

c. While reviewing quality records, look for inadequacies that could lead to construction deficiencies and/or indicate an inadequate management control system.

d. Due to the importance and extent of electric cables and terminations, quality records are to be reviewed twice; once before the cable systems are about 50% complete and once near the completion of work. The results of the first inspection should be reviewed before starting the second inspection. Areas where deficiencies or problems were identified during the first inspection should be noted and reviewed during the second inspection to determine whether adequate corrective action was taken.

e. In general, the selection of quality records for review should be made on the basis of importance to operational safety. The sample sizes specified in Section 02 of this IP should be considered as the minimum. Actual samples selected should be of sufficient size and diversity to determine whether the objectives of this IP have

been met. It is recommended that records selected include, in part, those associated with items selected for as-built verification under IP 51063.

f. The inspector should bear in mind that the NRC's sample covers only a small portion of the records involved. Thus, substantive errors or departure from requirements identified in NRC's sample raise the issue of whether the licensee is adequately controlling the process.

g. Findings from this inspection activity should address each functional area as being satisfactory, being unresolved and requiring resolution, or being in violation and requiring correction. When significant inadequacies are identified in quality records, the inspector should inform cognizant Regional supervision. The issue should also be addressed at the appropriate level of licensee management.

03.01 Specific Guidance

a. Inspection Requirement 02.02a

1. Receiving inspection procedures should reflect the requirements of RG 1.38/ANSI N45.2.2 or equivalent requirements.

2. The SAR should identify and describe all cable systems which must operate in a hostile environment (e.g., high radiation, temperature, pressure, humidity) during or subsequent to an accident (e.g., loss-of-coolant, steam line break, etc.). Where environmental qualification testing, or other qualification provisions (such as seismic) are specified, records should be available to verify that required testing has been satisfactorily completed. If these records are not available when the items are received, the receiving inspection records should identify the need for subsequent receipt and review of these documents.

3. It is important to assure that qualification testing has been successfully completed. Qualification documents should be reviewed to substantiate that the item is qualified to applicable standards and to the appropriate environment. When items are qualified by "type testing", determine whether the testing environment meets or exceeds all service conditions postulated to occur during its installed life. The following types of tests may be required: radiation, temperature, humidity, water impingement, submergence, steam, fire resistance, continuity, high potential, insulation resistance, chemical/soil compatibility, aging and pressure. The sequence in which these tests are performed and the synergistic behavior should be conservatively accounted for in the qualification.

4. Fire barriers and cable penetration seals require qualification. The tests and criteria are contained in 10 CFR 50 Appendix R, Section M; IEEE 634, Cable Penetration Fire Stop Qualification Test; and ANSI/ASTM E-119, Fire Tests of Building Construction and Materials.

5. A variety of terms are used for documentation to confirm that certain specifications are met or that specific tests have been satisfactorily performed. For the acceptability of these documents, refer to the requirements of RG 1.123, QA Requirements for Control of Procurement of Items and Services for Nuclear Power Plants (ANSI N45.2.13).

b. Inspection Requirement 02.02b

1. Special storage requirements are typically specified by the manufacturer.

2. Control of storage conditions for cable system items and cable segments stored in place usually requires special effort. The inspector should note whether the specified storage conditions are reflected in the storage inspection records. Refer to RG 1.38 (ANSI N45.2.2, Section 6.5) for guidance applicable to in-place storage.

c. Inspection Requirement 02.02c

1. A checklist or other means should be used by licensee and contractor inspection (QC) personnel to assure proper identity of installed items. Checklists or records of inspection should be generated during the inspection, and these records should be readily retrievable for review by the NRC inspector. Properly installed means that the installation meets applicable NRC requirements and licensee commitments in the SAR and requirements of approved site procedures, including adequate separation or installation of protective barriers. The as-installed inspection records should match the applicable requirements. In order for the inspector to assure that the records reflect actual conditions (identification, location, routing, etc.), some sample items selected for this procedure should be the same as those selected in IP 51063. (If the installation differs from the approved installation documents, a nonconformance report and a design change should have been generated.)

2. Installation and inspection records must contain sufficient detail to permit identification of the specific revisions or change notices to documents used for these activities. The permanent records package must provide a clear audit trail to any applicable change or nonconformance documentation.

3. The inspection records must confirm that all safety-related characteristics have been satisfactorily inspected or otherwise verified. The NRC inspector should be alert to systems or parts of systems which have been QC accepted before inspection of all characteristics, and vendor supplied equipment that does not receive licensee or contractor inspection of safety-related characteristics.

d. Inspection Requirement 02.02d

1. This item does not include preoperational testing. Construction testing generally verifies that certain components pass specific tests as required but is not a test of system capability. Generally, only a small portion of overall system testing is done by construction personnel.

2. The intent of this requirement is to determine whether specified tests have been satisfactorily completed and corrective action, if required, has been properly performed.

e. Inspection Requirement 02.03. Specific thermal loading data may not be available at the site. However, some site documentation should be available to indicate that thermal loading requirements were considered and met.

f. Inspection Requirement 02.04. It is particularly important that licensee management has an established program for ensuring that all personnel involved in cable system installation activities are suitably proficient, skilled, or otherwise qualified by experience or training to perform their assigned duties.

1. The records should reflect that an effective indoctrination and training program is in place to assure that suitable proficiency is achieved and maintained for craft personnel. This is especially true for electricians conducting special tests.

2. Inspection personnel should be qualified in accordance with RG 1.58 (ANSI N45.2.6) or similar requirements.

g. Inspection Requirement 02.05

1. The sample size and diversification of selection should be sufficient to determine whether the system used to handle and control nonconformances is working in an effective manner.

2. The effectiveness of the management control system in this area can be determined, in part, by how adequately and promptly the root cause of nonconforming activities are identified and corrected.

3. Promptly reviewed means review and evaluation prior to continued or additional work associated with the identified nonconformance.

h. Inspection Requirement 02.06. Cable routing changes are made quite frequently after cable pulling has started. The records in this area should reflect prompt and correct changes to pull cards, or other means, used by electricians and inspectors to determine correct and current cable routing.

i. Inspection Requirement 02.07. The records should reflect that adverse audit findings were promptly evaluated and corrected in an adequate manner. The root cause involved should be identified to preclude repetition.

51065-04 REFERENCES

10 CFR 21, "Reporting of Defects and Noncompliance"
10 CFR 50, Appendix A - General Design Criteria for Nuclear Power Plants, Criteria 1, 2, 3, 4, 5, 17, 18, 19, 20, 22, 24, 34, 38, 39, 40 and 46

10 CFR 50, Appendix B - Quality Assurance Criteria for Nuclear Power Plants

Facility Safety Analysis Report, Chapters 1, 3, 6, 7, 8, 9, and 17, including pertinent codes and standards referenced in these chapters

Regulatory Guide 1.6, Independence Between Redundant (Onsite) Power Sources and Between Their Distribution Systems

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

Regulatory Guide 1.29, Seismic Design Classification

Regulatory Guide 1.30, Quality Assurance Requirements for the Installation, Inspection and Testing of Instrumentation and Electric Equipment (ANSI N45.2.4/IEEE 336)

Regulatory Guide 1.32, Criteria for Safety-Related Electric Power Systems for Nuclear Power Plants (IEEE 308)

Regulatory Guide 1.38, Quality Assurance Requirements for Packaging, Shipping, Receiving, Storage, and Handling of Items for Water-Cooled Nuclear Power Plants

Regulatory Guide 1.39, Housekeeping Requirements for Water-Cooled Nuclear Power Plants

Regulatory Guide 1.53, Application of the Single-Failure Criterion to Nuclear Power Plant Protective Systems (IEEE 279 and IEEE 379)

Regulatory Guide 1.58, Qualification of Nuclear Power Plant Inspection, Examination and Testing Personnel (ANSI N45.2.6)

Regulatory Guide 1.64, Quality Assurance Requirements for the Design of Nuclear Power Plants

Regulatory Guide 1.75, Physical Independence of Electric Systems (IEEE 384)

Regulatory Guide 1.81, Shared Emergency and Shutdown Electric Systems for Multi-Unit Nuclear Power Plants

Regulatory Guide 1.88, Collection, Storage and Maintenance of Nuclear Power Plant Quality Assurance Records (ANSI N45.2.9)

Regulatory Guide 1.89, Qualifications of Class 1E Equipment for Nuclear Power Plants (IEEE 323)

Regulatory Guide 1.123, Quality Assurance Requirements for Control of Procurement of Items and Services for Nuclear Power Plants (ANSI N45.2.13)

Regulatory Guide 1.131, Qualification Tests of Electric Cables, Field Splices, and Connections for Light-Water-Cooled Nuclear Power Plants (IEEE 383)

Regulatory Guide 1.144, Auditing of Quality Assurance Programs for Nuclear Power Plants (ANSI N45.2.12)

Regulatory Guide 1.146, Qualification of Quality Assurance Program Audit Personnel for Nuclear Power Plants (ANSI N45.2.23)

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