ATTACHMENT 65001.C
INSPECTION OF THE ITAAC-RELATED
CONSTRUCTION TEST PROGRAM

PROGRAM APPLICABILITY: 2503

65001.C-01 INSPECTION OBJECTIVES

01.01 To determine whether construction testing activities are performed in accordance with programmatic requirements, approved procedures, and by qualified personnel.

01.02 To evaluate the adequacy of ITAAC-related construction testing activities.

01.03 To determine whether records reflect work accomplishments consistent with the design specifications and approved procedures.

01.04 To assess the implementation of the quality assurance program related to construction testing activities.

01.05 To verify that the licensee's corrective action program is identifying, evaluating, and resolving problems involving construction testing activities.

65001.C-02 INSPECTION REQUIREMENTS AND GUIDANCE

"Construction Testing" includes specific ITAAC tests that are associated with the quality of component fabrication and construction activities, and includes quality acceptance tests (e.g., concrete testing or simulated signal testing to confirm Class 1E division boundaries), baseline data checks (e.g., pre-service inspection, PSI), and field-work completion testing (e.g., "hydro's") or any other similar construction testing activities.

Completion of construction tests should assure that components and systems are ready for pre-operational testing.

02.01 Program and Procedure Reviews. Verify that the licensee is maintaining a program for the control and oversight of construction testing.

a. Review the licensee's and/or responsible primary contractors' management program(s) for the control, scheduling, and documentation of construction testing.

    1. Assess the adequacy of the controls that have been established for conducting and documenting construction tests conducted by the licensee and/or responsible contractor.

    2. Assess licensee management and QA controls for oversight of construction tests conducted by offsite contractors or component manufacturers.

b. Select a sample of construction test procedures from each applicable construction

discipline and perform a detailed review of each procedure's technical adequacy to accomplish the specified testing. The sample should include procedures applicable to the construction testing ITAAC identified for the design and site.

Guidance: Construction testing generally verifies that certain components pass specific tests as required, but it is not a test of system capability, especially systems that include non-electrical equipment.

a. Management control programs should provide for clear documentation of construction test activities that provides for a direct, traceable link between the raw test results and the licensee's conclusion that construction is complete and the component and/or system is ready for: 1) the next phase of construction, 2) documentation of completion of ITAAC-related construction testing, or 3) pre-operational testing.

   To support the licensee's ITAAC completion program, licensee and contractor procedures should provide identification of special requirements for completion of construction tests. (e.g., Identification of any required Quality Assurance (QA) or Authorized Nuclear Inspector (ANI) witness points.) Controls should include procedure(s) for the review of any design changes and approved modifications for impact on previously completed construction tests.

   Management control procedures should provide for clear documentation of construction test activities that provides for a direct, traceable link between the raw test results and the licensee's conclusion of ITAAC completion.

b. Assure that the following attributes are provided while performing the procedure reviews:

   1. Documentation of appropriate licensee staff review and management approval.

   2. Test objectives are clearly stated and are accomplished in the body of the procedure.

   3. The acceptance criteria against which the test will be judged are clearly identified. Where appropriate, the procedure requirements and stated acceptance criteria reflect the ITAAC's design commitments; inspections, tests, analyses; and acceptance criteria identified in the DCD.

   4. The procedure requires comparison of the test results to the acceptance criteria and a provision is made for the evaluator to indicate whether test data is or is not acceptable.

   5. Step-by-step instructions for the performance of the procedure are included to the extent necessary to ensure that test objectives are met and spaces are provided for initialing that all items, including prerequisites, are verified as having been performed.

6. Provision is made for recording details of the conduct of the test, including any observed deficiencies, their resolution, and any necessary retesting.

7. Provisions for isolating the equipment during testing are properly controlled.

8. The procedure provides for the identification of personnel conducting the test and evaluating the test data.

9. Test equipment range and accuracy are consistent with the application and comply with applicable licensing basis design calculations or code requirements.

10. The procedure provides for quality control verification (or independent verification) of critical steps or parameters as required by the licensee's administrative or quality assurance program requirements.

11. Equipment is properly restored upon test completion, including removal of installed jumpers and test equipment, and landing of lifted leads; or the procedure references their control by another procedure.

02.02 Test Performance Observations. The inspector shall observe the performance of the ITAAC construction tests and verify that the testing is conducted in accordance with approved procedures, and that test results meet regulatory requirements, the procedure's acceptance criteria, and the ITAAC.

In addition to the required ITAAC construction tests, the inspectors should observe a number (15-20) of construction tests which are designed to identify potential damage to equipment caused by the construction and/or installation processes, or by construction activities subsequent to the equipment installation. Examples of these tests are included in the attachments to this procedure.

Guidance: Inspection of ITAAC-related construction tests may be accomplished by focusing the inspection on critical attributes. Examine at least three critical attributes associated with each ITAAC selected for inspection. Wherever possible the inspection should include field inspections to witness all or portions of the construction tests specified by the ITAAC, in order to independently verify test data. Additionally the inspector should ensure appropriate system configuration for the testing to be performed, along with verification of required test equipment.

Where field inspection test witnessing is not possible, (e.g., tests are conducted at remote manufacturing facility,) review the licensee's records to determine the adequacy of the documentation in providing objective evidence that the ITAAC construction tests have been met.

The selection of critical attributes for inspection should be a part of the planning stage of the inspection, and as such, detailed in the individual inspection plan prepared by the inspector. Critical attributes may be associated with the specific ITAAC details delineated in the ITAAC "inspections, tests, analyses" or in the "acceptance criteria". Where the acceptance criteria specify a verifiable attribute, it should be selected for inspection.

Some critical attributes may not be clearly specified in the ITAAC table, but included by reference to fabrication or test code compliance, and/or reference to requirements contained in the Design Control Document (DCD) or the FSAR. It is expected that the inspector will exercise judgement not only in the selection of the critical attributes, but also in determining how much inspection is necessary to confirm that the ITAAC have been satisfied.

In any case, the ITAAC, as they are written, should provide sufficient details for guidance in the selection of critical attributes and in establishing what needs to be inspected to verify adequate licensee completion, compliance, and acceptance.

See appendices 01 through 05 for additional construction test details and guidance related to the referenced technical disciplines.

02.03 Licensee Acceptance and Documentation. Review the licensee's and/or contractor's program for the control of records that document the acceptance of construction tests. Select a sample of completed construction test records for review to assess the records control program(s).

Guidance: While the licensee's/contractor's record controls for ITAAC completion may be a subset of the overall QA program for quality records, the acceptance of the ITAAC should be documented in a manner that can facilitate audits and provides a clear paper trail of objective evidence that the ITAAC requirements have been met.

If a number of different, single-discipline, contractors are involved in the completion of construction testing, two (2) or three (3) records for each contractor may be sufficient to assess each program for control and documentation of testing activities. For large contractors involved in multi-discipline testing activities, five (5) or more samples may be required to assess the program.

The records selected for specific review should be representative of a cross-section of the five major areas of the matrix as delineated in the appendices to this procedure.

02.04 Problem Identification and Resolution. The inspector should confirm that problems identified during the inspection are entered into the licensee/constructor corrective action program in accordance with program requirements. The inspector may review licensee actions to address similar or related problems that were previously identified, in order to check the extent of condition and confirm the effectiveness of the licensee's corrective measures.

Guidance: This inspection is to assure that problems are entered into the applicable process to assure corrective actions appropriate to the circumstances are developed and prioritized. Inspections of Quality Assurance Program implementation, effectiveness of Problem Identification and Resolution, and Self-Assessment will be performed under the MC 2504 process.

65001.C-03 RESOURCE ESTIMATE

Resource estimates are currently under development for this inspection procedure. This document will be revised to add this information as it becomes available.

65001.C-04 REFERENCES

Facility Final Safety Analysis Report (FSAR) and Design Control Document (DCD)

IMC 2503 Appendix B Site Specific ITAAC Matrix

IMC 2503 Appendix C Site Specific ITAAC Sample Selection Process

IP 65100, Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC) Matrix Inspections.

IP 35100, Implementation of Quality Assurance (QA) Program Described in the Final Safety Analysis Report (FSAR)

IP 40050, Identification and Resolution of Problems

65001.C-05 APPENDICES

General: The following attachments provide further discussions of anticipated ITAAC construction testing related to the technical disciplines listed in the ITAAC Matrix Rows. Each matrix row category (01) through (19) is covered in one of the five attachments, as noted below.

Appendix 1. Construction Test Inspection for Civil/Structural
- 01) Foundations & Buildings
- 02) Structural Concrete

Appendix 2. Construction Test Inspection for Piping
- 03) Piping
- 04) Pipe Supports & Restraints
- 05) Reactor Pressure Vessel & Internals

Appendix 3. Construction Test Inspection for Mechanical
- 06) Mechanical Components
- 07) Valves
- 11) Containment Integrity & Penetrations
- 12) Heating, Ventilation, & Air Conditioning
- 13) Equipment & Fuel Handling & Fuel Racks

Appendix 4. Construction Test Inspection for Electrical/I&C
- 08) Electrical Components & Systems
- 09) Electrical Cable
- 10) Instrumentation & Control Components & Systems

Appendix 5. Construction Test Inspection for Miscellaneous Program

14) Complex Systems with Multiple Components
15) Fire Protection
16) Engineering
17) Security
18) Emergency Preparedness
19) Radiation Protection

END

Appendix 1

Construction Test Inspection for Civil/Structural Systems and Components

01) Foundations & Buildings. Construction tests/inspections for foundations and buildings include the following:

- Foundation material: Foundation material placed and worked in the excavation should have current proctor test results. Current tests will denote what the correct moisture content range will be for achieving the desired rate of compaction, and new proctor results should be obtained as the material changes. Proctor results can vary due to changes in the stockpile conditions. Review of geotechnical testing reports should show consistency with material actually used on site, since these tests may have been performed on material no longer characteristic with the current working batch.

- Material Stockpiles: Stockpiles should be inspected for consistency with gradation test results. Stockpile gradations can vary, and conditions can change from where the material is collected from. If a borrow area is used, the working face should be observed for material consistency.

- Excavations: Excavations should be inspected for dewatering activities and ensure that foundation preparation activities achieve the specified subbase compaction percentage via the in-situ nuclear density field gauge. Inspect the subbase and foundation material for deleterious material, and remove where necessary.

    - Inspection of the slope of backfill against foundations for proper drainage,

    - Housekeeping inspections for cleanup of construction debris,

    - Inspection of water barriers and drains at walls and foundations,

    - Inspection of required location markings and signs,

    - All building and occupancy permits should be reviewed for application, completion, and signatures,

    - Completion and inspection of required building coatings and floor finishes.

02) Structural Concrete. Construction tests/inspections for structural concrete include the following:

- Concrete test cylinders: The inspector should inspect the curing conditions (e.g., temperature and humidity controls), for required structural concrete test cylinders. Curing conditions should be inspected for compliance with applicable site procedures and referenced industry standards.

Observations/inspections should be made of the testing of the cylinders to ensure that testing is being done in accordance with required procedures with calibrated testing equipment. A review of cylinder break test records should be made to determine if the represented structural concrete meets the required design strengths. The inspector should review the test records for tests that exceed the allowable acceptance criteria.

- Concrete Structures: Required water barriers for structural concrete placed below expected ground water levels should be inspected. Construction testing of structural concrete water barriers may require inspection before the placement of the structural concrete.

  (Note: For the AP1000 the ITAAC water barrier involves the inspection of the special concrete mix for the excavation wall liner which becomes the exterior form for the structural basemat and below-grade building walls.)

  Inspections should be made of exposed structural concrete surfaces (e.g., floors, walls and ceilings) for evidence of exposed aggregate or reinforcing steel. All incidents of exposed reinforcing steel should be evaluated and repaired prior to acceptance of the structure. The licensee may have a standard which allows for the acceptance of small areas of exposed aggregate, but they should be documented and evaluated prior to acceptance.

Problems which have been identified during past construction include the following issues:

- Improper curing of concrete test cylinders.
- Cylinder break test records exceed allowable coefficient of variation.
- Voids during concrete placement, particularly in dense rebar installations.
- Excessive time between pours.
- Ambient temperatures within specifications and other environmental factors.
- Inadequate concrete curing.
- Exposed aggregate caused by improper use of vibration during the concrete placement.
- Exposed reinforcement steel caused by movement of the steel before or during concrete placement, or by improper vibration during concrete placement.

Appendix 2

Construction Test Inspection for Piping Systems and Components

03) Piping. Construction testing and inspection for piping systems include the following:

- Cleaning and flushing. Completed piping systems should be cleaned and flushed prior to any required system hydrostatic or operational testing. Portions of piping systems which are completed as a part of a pre-fabricated module should be cleaned and flushed at the module fabrication facility prior to shipment. For these cases the construction cleaning and flushing inspection may consist of witnessing of portion of a receipt-inspection, visual-inspection of the received module's piping system(s).

  For cleaning and flushing conducted at the site, the inspector should observe the activities for proper procedure controls, (e.g., water quality, control of foreign materials, controls over the installation/removal of cleaning and flushing devices, and protection of plant equipment.)

- Hydrostatic testing. Construction tests involving hydrostatic testing should involve the review of procedures against applicable fabrication codes and/or standards as called out in the design and construction specifications, witnessing of pertinent portions of selected hydrostatic tests, and review of completed test records. For testing of completed piping systems, the inspection should include the following steps:

  (Note: For hydrostatic testing of individual components, the inspection steps should be abbreviated to not include those steps applicable to completed systems.)

Determine that the test procedure(s) includes the following:

a. The system boundary includes all pressure vessels, piping, pumps, and valves which are part of the piping system to be tested, up to and including:

   1. The outermost containment isolation valve in system piping that penetrates primary reactor containment.

   2. Any applicable system safety and relief valves.

b. The system is vented during the filling operation.

c. Water quality is specified as required by the latest licensee approved specifications for the temperatures to be present during the test.

d. Temperature requirements are stated to ensure that components are maintained above the nil ductility transition temperature.

e. The minimum hydrostatic test pressure is as specified in the applicable design and/or fabrication specification.

f. The maximum hydrostatic test pressure is less than the limits in the applicable design and/or fabrication specification.

g. The hydrostatic test pressure is maintained for a minimum of 10 minutes before initiation of the examination for leakage.

h. The examination for leakage includes all joints, connections, and regions of high stress, such as openings, attachments, and thickness transition sections. This examination shall be at a pressure equal to the design pressure or three-fourths of the test pressure, whichever is greater.

i. The examination of pumps and valves shall be at test pressure.

j. All portions of the piping system within the hydro boundary should have the same design pressure.

k. Flow rate of pressure relief device(s) must exceed the flow rate of the hydro supply pump.

Verify that the testing is conducted in accordance with approved procedures, and verify the adequacy of test program records, including preliminary evaluation of test results. During conduct of the witnessed test(s) verify the following:

a. The latest revision of the test procedure(s) is available and in use by all crew members.

b. The minimum crew requirements are met.

c. The test prerequisites are met:

    1. Joints, including welded joints, are left uninsulated and exposed for examination during the test.

    2. The valve lineup/system checklists are complete.

    3. Water quality and temperature are as stated in the procedure(s).

    4. Properly calibrated pressure gauges of the required range are installed where required.

    5. Properly calibrated relief valves of the required set point and capacity are installed where required.

d. Verify that pump and valve hydrostatic test requirements were either met on a shop hydrostatic test or during a field hydrostatic test.

e. Required plant systems are in service.

f. Special test equipment required by the procedure is calibrated and in service.

g. Test is performed as required by the approved procedure.

h. Criteria for interruption of testing and continuation of an interrupted test are adhered to.

I. Significant events, unusual conditions, test discrepancies or interruptions to testing are documented.

j. Crew actions are correct and timely during the performance of the test. Adequate coordination exists among crew members to conduct the test properly.

k. All data are collected by the proper personnel.

l. Temporary modifications such as jumpers, strainers, spool pieces, or blank flanges are installed and tracked per established administrative controls.

m. The post-test valve lineup/system checklists are complete.

Independently verify that overall test acceptance criteria have been met by:

a. visually examining 10% of all joints, connections, and regions of high stress, such as regions around openings and thickness transition sections.

b. visually examining 20% of the pumps and valves located within the test boundaries.

c. verifying that leakage from temporary seals or leakage permitted by the design specification is being directed away from the surface of the component to avoid masking leaks from other joints.

Review the preliminary test results to assure that licensee's preliminary test evaluation is consistent with inspector's observations.

Review all test deficiencies, their resolution, and retest. Verify that all are reviewed by appropriate management.

Review data sheet entries for legibility, traceability, and permanence.

04) Pipe Supports & Restraints. Construction test/inspections of pipe supports and restraints should include the following types of inspections:

- Visual Inspection of pipe supports and restraints on piping systems prior to construction test hydrostatic testing or operational test hot functional testing, to ensure that supports and restraints are in the proper configuration for the test. Visual inspections should include at least the following attributes:

    a. Dynamic piping supports (snubbers, shock suppressors, restraints, and vibration arresters).

        1. Hydraulic fluid in snubbers, shock suppressors, and restraints is at the proper level.

        2. Fluid leaks through seals or elsewhere are not evident.

        3. No evidence of deterioration, corrosion, physical damage, or deformation.

        4. Lubricants are applied wherever required.

        5. All required bolts, locking devices, nuts, and washers are installed. Fasteners should be tight, secure, and of the correct material and size.

        6. Support plates, extension rods, and connecting joints are not bent, deformed, loose, or otherwise out of specification.

        7. Connecting joints, moving parts, piston shafts, seals, etc. are free from arc strikes, weld spatter, paint, scoring, roughness, general corrosion, or other materials that may obstruct proper operation.

        8. Snubber position is at or near its predicted position and it is not near the limits in either extension or compression.

    b. Fixed piping support (hangers, brackets, clamps, braces, lugs, cradles, saddles, straps, turnbuckles, clevis and base supports).

        1. No evidence of deterioration and corrosion.

        2. Pipe supports, including associated equipment, are not deformed or loose.

        3. If pipe clamps are used to support vertical lines, shear lugs welded to the pipe are provided as specified.

        4. Springs in hangers are not obstructed by foreign material.

        5. Spring hangers provided with indicators show either "cold" or "hot" position, consistent with plant condition.

        6. Threaded connections are secured by locknuts, fasteners, cotter pins, or similar locking devices and conform to the as-built drawings.

7. Sliding or rolling supports are provided with material and/or lubricants suitable for the environment and compatible with sliding contact surfaces.

c. Component support structures (brackets, frames, and plates).

1. Deformation is not present.

2. Grooves, abrupt ridges, valleys, undercuts, cracks, discontinuities, or other detrimental indications that appear to exceed ASME Code limitations are not observed on welded surfaces. See the design and construction specifications for proper code references used.

- Visual inspection of installed pipe supports and seismic restraints in areas with continuing or expected additional construction activity, to ensure that equipment is being protected from damage.

05) Reactor Pressure Vessel & Internals. Construction tests/inspections of the RPV and internals should include housekeeping, cleanliness, and any required pressure testing.

- Housekeeping. Personnel entry and foreign material exclusion controls for the interior of the reactor vessel should be meet the requirements of a Class A clean area.
- Cleaning. Final cleaning of the RPV internals, and interior surfaces of the vessel should be done with lint-free cloth and de-ionized water that meets licensee purity specifications. Cleaned surfaces should be tested for evidence of residual contaminants in accordance with licensee-approved specifications.
- Pressure Testing. Fabrication Code-required hydrostatic testing will most likely be conducted at the vessel fabrication facility prior to installation of internals. Inspection of the pressure tests will involve witnessing of the tests in process or evaluation of the final pressure test documentation package.

  If the pressure test is to be witnessed, the pressure test inspection points listed above for piping can be used as a basic outline for inspection. In preparation for the inspection, the inspector should be familiar with the requirements of the fabrication code referenced in the design and construction documents or specifications, and any licensee-approved test procedure(s).

  An additional requirement for the inspection of pressure vessels involves the following observation of selected weld and weld repair area surface examinations after the hydrostatic test. After the hydrostatic test of a vessel, observe the examination of at least two weld joints and two heat-affected zones of Categories A, B, C, and D.

Construction Test Inspection for Mechanical Systems and Components

06) Mechanical Components. Mechanical components in primary systems include pressure-retaining components such as steam generators and pressurizers in pressurized-water reactors. In other systems, mechanical components include heat exchangers, tanks, etc. Construction tests for these components involve final cleaning after assembly, Code-required pressure testing, and miscellaneous tests such as fly-wheel integrity tests for large pumps such as main coolant pumps.

- Housekeeping and cleaning. The inspectors should observe foreign material controls and internal cleaning procedures during final close-up of components such as heat-exchangers, tanks, etc.

- Pressure testing. Code-required pressure testing for some major components (e.g., steam generators and other heat exhangers, pressurizers, etc.) will most likely be conducted at the fabrication facility. Components fabricated at the site, (e.g., tanks, etc.) may be tested in place prior to piping installation.

  Inspectors should be familiar with the fabrication code requirements called out in the licensee-approved specifications or procedures for the pressure testing to be observed. Guidelines provided in Attachment 2, above, for piping inspections should be used for guidance during witnessing of component pressure tests.

- Miscellaneous Tests. Construction testing for some mechanical components involves type-testing of particular sub-components such as:

  a. Testing of fly-wheels for large pumps such as PWR reactor coolant pumps
.

  b. Testing of anti-rotation devices for pumps.

  c. Testing of individual pump flows.

  d. Testing of flow through heat exchangers for tube or baffle plate vibration.

  Inspectors should become familiar with design requirements as well as the test procedure requirements prior to observing mechanical component construction tests.

07) Valves. Construction testing/inspections of valves includes component integrity tests and operational inspections.

- Component Integrity Tests. Component integrity tests include Code-required pressure tests of valve bodies during fabrication activities and leak testing of assembled valve mechanical joints during pressure testing of piping systems.

The inspector should be familiar with fabrication codes called out in the design specifications, and licensee-approved procedures prior to inspection of component integrity tests. Guidance for the observation of pressure tests is contained in Attachment 2 for Piping.

- Operational Tests/Inspections. Operational tests and inspections include the following:

  a. Proper installation and adjustment of motor operated valve torque switches, limit switches and bypass switches.

  b. Loss of power testing to ensure that the valve either stays in, or moves to, the required safety position on a loss of motive power.

  c. Accumulator capacity tests to validate that safety-related accumulators have the necessary capacity for accident analyses required number of valve actuations.

  d. Bench testing of safety and relief valves for proper set pressure and/or capacity.

  e. Leak testing of system isolation valves such as main steam isolation valves.

  f. Check component orientations for correct flow direction.

  Inspectors conducting valve operational test inspections should be familiar with the operational, (and accident if applicable) design requirements, applicable piping specifications, and the installation and/or testing work procedure pre-requisites and requirements.

11) Containment Integrity & Penetrations. Construction testing and inspections of containment integrity and penetrations include the following types of tests:

- Visual inspection of housekeeping and cleanliness, and examination of containment and penetration materials for evidence of construction-related degradation.

  a. Bellows provided for thermal expansion of piping associated with penetrations should be protected from damage after installation.

  b. Visual inspections should be made to verify removal of bellows-protection assemblies prior to pre-operational testing.

- Inspection and/or witnessing of Fabrication-Code required structural integrity tests and integrated leak-rate tests of completed containment structures.

  The inspector should be familiar with the ASME Code requirements for structural integrity testing and integrated leak-rate testing, and should review the applicable

licensee-approved procedure(s) for the test to be observed. Also, the inspector should review CFR 50 Appendix J for leakage testing and local leak rate testing. Inspection checks for boundary doors and hatches, as well as installation of coatings, screens, baskets, and filters should also be completed.

12) Heating, Ventilation, & Air Conditioning. Construction testing of HVAC systems should include the following types of activities:

- Testing of installed air ducts for excessive leakage, particularly around access doors and panels.
- Functional testing of air regulating dampers,
- Flow balancing of HVAC systems to provide required air flows where needed.
- Installation and calibration of required HVAC instrumentation.
- Installation testing, including pressure testing where required, of service water system which provide heat-transfer support for HVAC systems such as vital room and containment coolers.
- Verification that the air flow is from low contamination areas to progressively higher potential contamination areas, and as per the HVAC system design specifications.

The inspector should review design and fabrication documents to determine fabrication and testing requirements for inspection.

13) Equipment & Fuel Handling & Fuel Racks. Construction tests for equipment and fuel handling and fuel racks include the following types of tests/inspections:

- Visual inspection of completed cranes and hoists for proper configuration,
- Operation of crane/hoist controls for assurance that equipment has been assembled correctly.
- Nondestructive examination (i.e., Liquid penetrant or magnetic particle examination) of hooks prior to and/or after load testing of cranes/hoists,
- Testing of crane/hoist safety interlocks which provide overload protection,
- Testing of crane safety interlocks which restrict movement of loads (e.g., Interlocks on Reactor Building crane which prevents movement of loads over spent fuel storage portion of fuel pool.)
- Testing of pool leakage detection, collection system testing, fuel pool anti-syphon devices, and fuel rack nuclear characteristics

- Fuel racks should be visually inspected for final configuration - racks should be plumb and properly spaced,

- Fuel racks should be visually inspected to ensure that they have been cleaned after installation and that there is no evidence of construction debris left within the racks which could cause problems with insertion or removal of spent fuel.

- Fuel rack support feet not sitting on liner seams or welds.

Inspectors should be familiar with design requirements and test procedure requirements prior to witnessing construction tests and inspections.

Appendix 4

Construction Test Inspection for Electrical/I&C Systems and Components

08) Electrical Components & Systems. Construction tests for electrical components and systems include the following types of inspections and tests:

- Initial energization of electrical components
- "Bumping" of DC motors as well as 3-phase AC motors to ensure that they turn in the right direction,
- Introduction of electrical signals into individual electrical divisions to ensure that components from different trains are wired into the separate and correct divisions,
- Tests of components (i.e., breakers) which are required to react to degraded voltage conditions,
- Tests of emergency battery chargers for loss of ac power reactions,
- Verify breakers and fuse coordination,
- Verify that protective relay settings and thermal overload devices are set at design specifications.

Some of the tests, such as initial energization and bumping of AC and DC motors may be steps in the installation procedure or work package. Inspectors should be knowledgeable of component and system design requirements as well as understanding individual procedure requirements and acceptance criteria.

ITAAC-required tests such as the introduction of test signals into Class 1E electrical divisions to verify that components are wired into the correct division may be conducted by system or may be conducted by division. Inspectors should review the test procedure(s) to understand the full scope of the test. If the test is by electrical division, there may be a number of system-related ITAAC satisfied by one test.

09) Electrical Cable. Construction tests of electrical cables include visual inspections and tests to confirm that cables are correctly installed and connected, and have not been damaged during installation, or by construction activities after installation. Construction tests and inspections include the following:

- Continuity tests should be performed on all cables prior to testing or terminating,
- Visual inspection of installed cable to look for evidence of damage by workers (including cable installation crews) walking on previously installed cable, or by welding activities above installed cable,

- Visual inspection and testing of cables after installation including terminations, connectors, and splices before ultimate connection to equipment,

- Insulation resistance (megger) tests, and high potential (hi-pot) tests on power cables as required by installation specifications and procedures. The tests should measure the insulation resistance between any possible combination of conductors in the same circuit and between each conductor and station ground,

- Megger tests should be performed on signal cables, if circuit performance is dependent on insulation resistance.

- Verify specialized testing to verify adequate termination and acceptable signal degradation of fiber optic cable.

The inspector(s) should be familiar with system and component design requirements as well as cable manufacturers specifications/requirements for megger and hi-pot testing.

10) Instrumentation & Control Components & Systems. Construction tests of I&C components and systems includes the following:

- Initial calibration of instrumentation and systems,

- Introduction of simulated actuation signals for safety-related actuators (e.g., squib valves, motor-operated safety valves, etc.) from main control rooms and from remote shut-down stations,

- Verify that all devices respond as expected in response to simulated actuation signals.

The inspector should review the specified requirements and procedures before observing these activities. If special calibration requirements are specified, such as density compensation during liquid level instrument calibration, the inspector should determine whether these requirements are being adhered to.

Appendix 5

Construction Test Inspection for Miscellaneous Program Systems and Components

14) Complex Systems with Multiple Components. Construction tests and inspections for complex systems will be conducted to demonstrate that components and systems are correctly installed and operational.

In this program, various electrical and mechanical tests are performed including the following:

- Cleaning and Flushing
- Hydrostatic testing
- Checks of electrical wiring
- Valve testing
- Energization and operation of equipment
- Calibration of instrumentation

On a system basis, completion of this program demonstrates that the system is ready for pre-operational testing. Portions of the system construction tests may be conducted on a component basis.

15) Fire Protection. Construction testing of fire protection systems should include the following:

- Cleaning, flushing, and pressure testing of fire protection piping systems,
- Calibration and testing of fire detection and alarm systems,
- Testing to ensure that fire detection and alarm systems are powered from non-Class 1E uninterruptible power supply,

On a system basis, completion of this program demonstrates that the system is ready for pre-operational testing.

16) Engineering.

No construction testing is envisioned for engineering systems for currently approved designs. If future designs require testing in this area, the procedure will be amended.

17) Security. Construction testing of security systems will include various electrical and mechanical tests such as the following:

- Final walk-down of vehicle and personnel barriers,
- Operational checks of vehicle barriers, etc.
- Checks of electrical wiring,
- Energization and operation of equipment,
- Calibration of instrumentation

On a system basis, completion of this program demonstrates that the system is ready for pre-operational testing.

18) Emergency Preparedness. Construction testing of emergency preparedness systems will include various tests such as the following:

- Initial calibration of instrumentation provided in emergency preparedness locations such as the Telecommunications Service Center (TSC) and the Operations Support Center (OSC).
- Electrical supply, signal connections, and operability testing of required emergency sirens,
- Testing of the voice communications equipment for communication between the TSC and the Main Control Room, Emergency Operations Facility, the OSC, and NRC Headquarters Operation Center.

19) Radiation Protection. Construction tests and inspections for radiation protection will include various tests such as the following:

- Initial calibration of radiation alarm systems and radiation measuring instrumentation,
- Flushing and testing of fluid sampling systems,
- Initial calibration and testing of health physics laboratory equipment,
- Flushing and testing of plant drain systems to ensure that there are no cross connections between sanitary system drains and rad-waste drains,
- Manipulation and testing of mechanical equipment for handling of solid radioactive materials and rad-waste containers.

Appendix 6

Revision History For IP 65001.C

Commitment Tracking Number	Issue Date	Description of Change	Training Needed	Training Completion Date	Comment Resolution Accession Number
N/A	10/03/07 CN 07-030	Researched commitments for 4 years and found none. Initial Issuance	N/A	N/A	N/A