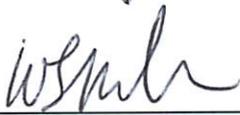
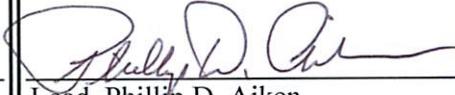


		Number: EA CRAD 31-05 Revision: Rev. 0 Effective Date: October 23, 2014
<b>System Operating Test Procedures          Criteria Review and Approach Document</b>		
Authorization and Approval	 Director, Office of Nuclear Safety and Environmental Assessments  Date: October 23, 2014	 Lead, Phillip D. Aiken Nuclear Engineer  Date: October 23, 2014

## 1.0 PURPOSE

Within the Office of Enterprise Assessments (EA), the Office of Environment, Safety and Health Assessments (EA-30) mission is to assess the effectiveness of those safety and emergency management systems and practices used by line and contractor organizations in implementing Integrated Safety Management; and to provide clear, concise, and independent evaluations of performance in protecting our workers, the public, and the environment from the hazards associated with Department of Energy (DOE) activities and sites.

In addition to the general independent oversight requirements and responsibilities specified in DOE Order 227.1, *Independent Oversight Program*, this criteria review and approach document (CRAD), in part, fulfills the responsibility assigned to EA in Public Law 112-74 - December 23, 2011; Consolidated Appropriations Act, 2012; Section 308: None of the funds made available in this title shall be used for the construction of facilities classified as high-hazard nuclear facilities under 10 Code of Federal Regulations (CFR) Part 830 unless independent oversight is conducted by the Office of Enterprise Assessments to ensure the project is in compliance with nuclear safety requirements.

A key to success is the rigor and comprehensiveness of our process; and, as with any process, we continually strive to improve and provide additional value and insight to field operations. Integral to this is our commitment to enhance our program. We continue to make CRADs available for use by DOE line and contractor assessment personnel in developing effective DOE oversight, contractor self-assessment, and corrective action processes; the current revision is available at: <http://energy.gov/iea/listings/criteria-review-and-approach-documents>.

## 2.0 APPLICABILITY

The following CRAD is approved for use by the Office of Nuclear Safety and Environmental Assessments.

## 3.0 FEEDBACK

Comments and suggestions for improvements on this CRAD can be directed to the Director, Office of Environment, Safety and Health Assessments, at (301) 903-5392.

## 4.0 CRITERIA REVIEW AND APPROACH

### **OBJECTIVE**

**TP.01.01:** Site contractor line management has established a construction test program and procedures that ensure effective testing of structures, systems and components (SSC) relied upon to function or support the function of preliminary documented safety analysis (PDSA or DSA if approved) credited SSC. (10 CFR 830.122, DOE O 420.1C, *Facility Safety*, with its associated guide, DOE G 420.1-1, *Nonreactor Nuclear Safety Design Criteria and Explosives Safety Criteria Guide for Use with DOE 420.1, Facility Safety*; and DOE O 414.1C, *Quality Assurance*)

**TP.01.02:** Startup test procedures accomplish the testing objectives and are consistent with the contractor's technical and administrative criteria, PDSA commitments, design documents, design control database (DCD), regulatory requirements, and Technical Specification Requirements (TSR).

**TP.01.03:** Startup tests are performed in accordance with the DCD, PDSA, and test procedures.

**TP.01.04:** Test records are in accordance with contractor procedural controls, and accurately depict the startup test procedures as modified during their implementation.

**TP.01.05:** Startup test results are evaluated in a consistent manner to ensure that test acceptance criteria are met.

### **CRITERIA**

**TP.02.01: Site contractor has established a construction test program.** The Site operational test program has been effectively implemented in support of the full scope of facility operations including decommissioning.

Verify that the contractor's test program includes requirements for testing consistent with PDSA commitments, TSRs, and regulatory requirements such as:

- a. The construction test program is documented and configuration controlled.
- b. The construction test program is maintained current with approved design changes.
- c. Tests to be performed have been identified and sequenced.
- d. Plant condition (operating mode) is specified.
- e. For tests that establish operability ensure that the full requirements for operability are covered, including required support systems, complete logic trains, and required instrumentation.

- f. For each of the identified tests, the following information (test abstract) should have been identified:
  - i. Scope of the test and test objectives
  - ii. Necessary prerequisites
  - iii. Test methods
  - iv. Related significant parameters & plant performance characteristics
  - v. Acceptance criteria

**TP.02.02: Review of Startup Test Procedures.** Verify that a test procedure exists for each element of the approved test plan. For the tests selected, review the startup test procedures for the following:

- a. Management approval is indicated. All test procedures shall include contractor operations management review regardless of who prepares the procedures.
- b. Safety review committee approval is indicated. The PDSA and TSR will identify those tests which require special committee review and will define the committee composition.
- c. Format and content is consistent with the contractor approved Writer's Guide or *Procedure Writers' Manual*, PPA AP-907-005, Revision 1.
- d. Lessons learned from prior testing is incorporated into test procedures and/or pre-test briefings.
- e. Test objectives are clearly stated along with all design documents/DCD and PDSA commitments.
- f. Pertinent prerequisites are identified; for example:
  - i) Required plant systems and conditions are specified.
  - ii) Proper facility procedures are specified.
  - iii) Completion of calibration checks, limit switch settings, protective device setting, are included where applicable.
  - iv) Special supplies and test equipment are specified.
- g. Special environmental conditions are identified.
- h. Acceptance criteria are clearly identified. The test shall require a comparison of the test results with the acceptance criteria.
- i. The sources of the acceptance criteria and critical steps in the test procedure are identified, for example, the design documents (DCD), PDSA, and TSR. Sources of acceptance criteria are only necessary for critical variables.
- j. Initial test conditions are specified, for example:
  - i) Valve lineups
  - ii) Electrical power and control requirements
  - iii) Temporary installations (instrumentation, electrical, and piping)
  - iv) Temperatures, pressures, flows
  - v) Water chemistry
  - vi) Other (temporary modifications, testing/operability of support systems)
- k. All references are listed, that is, PDSA, drawings, codes, and other requirements.
- l. Step-by-step instructions are provided to ensure that test objectives are met. Use of plant operating procedures by reference is permissible provided the operating procedures have been approved for use as stated in the PDSA and TS.
- m. All items, including prerequisites, can be initialed to indicate their completion. Signoffs of individual steps should include the date and time if the actual time is pertinent to the test. Initials and check marks or stamps may be used if they are traceable to an individual.
- n. Provisions and instructions are provided for recording details of test performance, that is, deficiencies, their resolution, and retest.
- o. Steps are provided to restore temporary connections, disconnections, or jumpers to their normal state or to control them.
- p. Test personnel conducting the testing and evaluating the test data are identified in the test records and are appropriately qualified.

- q. Quality assurance verification is provided for critical steps or parameters. Modifications of the tests from the specifications/requirements described in the PDSA, in any manner, shall require special review, evaluation, and approval by an authorized process.
- r. Each test procedure is consistent with the respective test description in the PDSA.
- s. Special precautions for personnel and equipment safety are specified. Instructions for testing a system or component over the full operating range/load are provided. For example, operation of the instrumentation and controls over the design operating range should be performed, and the effects of limiting malfunctions or failures should be simulated to demonstrate the adequacy of design and installation and the validity of accident analysis assumptions.
- t. Provisions are made for the data taker to indicate the acceptability of the data. The test procedure should prescribe the data to be collected and the form in which the data are to be recorded. All entries should be permanent.
- u. The administrative procedure controls should include an acceptable method for correcting an entry.
- v. Expected performance of automatic controls; for example, automatic actuation of process components and safety systems is specified.
- w. Provisions are made for using a mock-up or simulator as a training means for startup testing as appropriate and for updating training with data taken during the startup testing.
- x. The system is restored to the desired approved configuration.
- y. The tests shall meet the intent and operability requirements of the TSR and their bases.

**TP. 02.03 Witnessing Startup Tests.** The assessor shall witness the tests selected in Section 02.02 or another selection as approved by the team leader. Before witnessing a test, the assessor shall have completed a review of the test procedure per Section 02.02 of this CRAD. The assessor must be familiar with the test procedure in order to adequately witness the testing described in this CRAD. Communication must be maintained between the assessor and the contractor so that the contractor's test dates are known far enough in advance for the assessor to be ready to witness the selected tests. Contractors are not expected, nor are they to be asked, to delay conduct of a test pending the assessor's arrival.

**a. Overall Crew Performance**

1. Current test procedure must be available and in use by all personnel.
2. The assessor should determine the proper procedure revision by examining the contractor's master index or the "up-to-date" procedure file. Assure by examination and discussions that personnel are using the test procedure with the proper revision number and are familiar with the procedural requirements, especially the limitations and precautions.
3. Minimum staffing requirements are met for both certified and non-certified operators.
4. Any test prerequisites and any initial conditions waived should be reviewed and approved in accordance with the test procedure or TSR. Verify that procedural prerequisites and initial conditions have been met by reviewing the required records; for example, valve lineup list, instrumentation calibration procedure, system checklist, or signoff item in the listed test procedure or by direct observation; for example, monitoring instrumentation indications, valve positions, equipment start position switches, or personnel actions. Additionally, if the test involves the use of a TSR Special Test Exception Limiting Condition for Operation (LCO), ensure that the LCO is adhered to and the applicable surveillance requirements are performed.
5. An appropriate pre-test briefing is attended by participants and includes lessons learned from prior testing or other sources.
6. Test equipment must be calibrated and ready for use. Test equipment is normally required for measuring important parameters that determine the functionality of components and systems. Verify that the equipment is not outside its calibration period.
7. Crew actions are correct, timely, and coordinated. Crew coordination is an important part of any test since many of the steps involve coordinated activities between two or more crew members.

The individual directing the test activities must have knowledge of the activities of each testing crew member and of the time sequence of activities when necessary. The test sequence may need to be interrupted or modified. These interruptions or changes must be communicated to crew members and any changes must be handled in accordance with existing procedures. On a sampling basis, verify adherence to the procedural limitations and precautions, and the individual test steps.

8. Summary analysis is made to assure proper plant response to the test. The acceptance criteria should be stated in the test procedure. Crew members should be knowledgeable of the expected events at their stations and the expected responses. Events or data individually within expectations may be collectively indicating unexpected results.
9. All data are collected for final analysis by the proper personnel. All necessary raw data must be gathered in a timely manner following the test. The person in charge must ensure that these data are collected, assembled, and transferred to person(s) performing the final analysis.

- b. **Test Results.** The assessor should also, independent from the contractor evaluation, observe and evaluate certain events or data gathering during and following the tests. These events or data gathering activities should be selected during the assessor's review of the test procedure. The assessor should be knowledgeable of the expected measurements for important test parameters; for example, (1) the flow rate drops to 1/10 of the initial value for x seconds and returns to some other value within 2 minutes, (2) a specific reactivity change occurs during a specified time interval, or (3) computer printout values are read to be within the acceptance criteria. At least two of the most important events or data gathering activities shall be observed or evaluated by the assessor and the assessor shall verify the following:
1. That all test acceptance criteria have been met.
  2. That contractor's preliminary test evaluation is consistent with assessor observation.
  3. Adherence to the requirements of any TSR LCOs affected during the test.

**TP.02.04: Startup Test Program Review and Evaluation.** Performance of these activities will ensure the assessor is cognizant of test activities, test results, and test discrepancies or other plant problems affecting testing, including their disposition. These inspection requirements will normally be accomplished by the DOE facility representative. The assessor is concerned with potential problems that affect the implementation of the contractor's startup test program.

- a. Review the test sequencing document (or test procedure) including changes (daily).
- b. Review the Startup Test Engineers Log (or equivalent), the Control Room Log, and the Shift Supervisor's Log, as applicable (daily).
- c. Review Plant Information Reports or equivalent (daily).
- d. Attend meetings of the Test Data Evaluation Group and the Plant Operations Review Committee or their equivalents.

**TP.02.05: Evaluation of Test Results.** This CRAD provides standard review expectations for startup test results. Following the contractor's evaluation and acceptance of the test results, inspect the contractor's completed test data by doing the following:

- a. **Review All Test Changes Including Deletions.** All changes including deletions to the test program should be reviewed for conformance to the requirements established in the PDSA. If a change results in failure to satisfy PDSA commitments or eliminates testing, the change should have been reviewed and approved pursuant to 10 CFR 830.203, *Unreviewed Safety Question (USQ)*.
  1. Verify that each change was approved in accordance with the pertinent administrative procedures and that the basis for the change is documented.
  2. Verify that the test procedure is annotated to identify test changes.
  3. Verify that the test change has been completed if it entails specific actions.

4. Verify that nothing changed the basic objectives of the test.
- b. **Review Test Deficiencies.** In some cases, the test data will not be within the written predicted acceptance criteria. If this occurs, determine if further contractor actions will or have been taken. These actions may require (1) plant design changes, (2) evaluation by a manufacturer of the error between the design and predicted plant performance, or (3) restriction of plant operations because of the difference in plant performance and predicted acceptance criteria. The assessor must determine that for each of the above type actions, contractor follow-up corrective actions have been correctly performed, that is, USQ review, DOE approval if required, and subsequent testing for each design change and do the following:
    1. Verify that the test deficiency has been resolved, that the resolution has been accepted by appropriate management, and that retest requirements have been completed.
    2. Verify that any system or process changes necessitated by a test deficiency have been properly documented and reviewed.
    3. Verify that deficiencies which constitute a reportable occurrence as defined by the TSR have been properly reported (follow-up on reportable deficiencies is done by the assessors).
  - c. **Review 'test exceptions'** which are inconsequential errors; for example, typo-like errors in the test procedure which the contractor believes will not invalidate the test or create a test deficiency by doing the following:
    1. Verify that they were documented during the test.
    2. Verify that they were subsequently approved after the test is completed.
    3. Confirm that contractor has administrative and procedural controls in place to address such errors.
  - d. **Review "As-run" Copy of Test Procedure.** Make an independent technical analysis and use technical judgment to assure that the contractor's analysis has been performed correctly. Confirm that all test results have been compared with acceptance criteria and do the following:
    1. Verify that data sheets have been completed (25% sample).
    2. Verify that all data are recorded where required and are within acceptance tolerances (25% sample).
    3. Verify that all test changes, deficiencies, and exceptions are noted.
    4. Verify that individual test steps and data sheets have been properly initialed and dated.
  - e. **Review the Test Summary and Evaluation.** Review the test data packages assembled by contractors to ensure that the package is complete (as defined in contractor procedures). Ascertain that the contractor has verified that the acceptance criteria of the test procedure have been met. The assessor should use the appropriate means, for example, computer software, available for ensuring that test data supports the conclusion that test acceptance criteria have been met. The assessor should also do the following:
    1. Verify that the cognizant engineering function has evaluated the test results, and has signified that the testing demonstrated that the system or component met design requirements.
    2. Verify that the contractor specifically compared test results with established acceptance criteria.
    3. Verify that those personnel responsible for review and acceptance of test results have documented their review and acceptance of the data package and the evaluation.
    4. If the offsite review committee or equivalent has audited the test package, verify that the records reflect this audit and that their comments are included and corrective action has been taken.
    5. Verify that the Quality Assurance/Safety Group or another independent organization had reviewed the test results as prescribed in PDSA or other commitments.
  - f. **Verify That the Test Results Have Been Approved.** Verify that those personnel charged with responsibility for review and acceptance of test results have documented their review and acceptance of the data package and the evaluation. Normally, the test results are reviewed through the startup

organization, culminating in review by a committee comprised of the facility manager, the DOE site manager, the construction site manager, or their designees. PDSA or other commitments frequently require review by quality assurance, safety review, or other independent organization. Frequently, test review committees will also have examined the results in accordance with TSR requirements.

**NOTE: Test Specific Inspection Requirements and Guidance.** Refer to NRC Regulatory Guide 1.68, *Initial Test Programs for Water-Cooled Nuclear Power Plants, Appendix C-1, Preoperational Test Procedures* for examples of test specific inspection requirements and guidance for specific SSC types covered by the startup test program. The URL link for Regulatory Guide 1.68 is as follows: <http://pbadupws.nrc.gov/docs/ML1305/ML13051A027.pdf>. The assessor should be aware that the test requirements for a particular test are subject to change. The primary purpose of the inspection requirements and guidance is to focus the attention of the assessors and to provide insight into the specific aspects of each startup test. The inspection requirements are not binding requirements on any aspects of the contractor's startup tests. The RG is recommended for use for test procedure review, witnessing, and results evaluation.

## **APPROACH**

### Record Review:

- Site contractor assessment records associated with the startup testing program
- Site Contractor Test Program description
- Testing plan and schedule
- Test procedures
- (Preliminary) Documented Safety Analysis
- Technical Safety Requirements
- Design Criteria Database (DCD)
- Configuration control program for testing
- Training program and records for test participants
- Procedures that establish review requirements for procedures and test results
- Records of testing
- Records of any prior assessments of testing program and procedures
- Equipment calibration program description and procedures

### Interviews:

- Test Program Director
- Test engineers
- Facility Manager
- QA/QC Manager for the facility
- Procedure writers
- Cognizant System Engineer(s) who support the facility systems
- Selected facility operational and support personnel

### Observations:

- Facility testing performance, demonstrations, walk-through, or simulation
- Facility and building walkdowns and reviews
- Testing equipment calibration procedures