

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

### APR1400 Design Certification

Korea Electric Power Corporation / Korea Hydro & Nuclear Power Co., LTD

Docket No. 52-046

**RAI No.:** 513-8663  
**SRP Section:** 14.02 - Initial Test Program  
**Application Section:** 14.02  
**Date of RAI Issue:** 08/08/2016

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### **Question No. 14.02-67**

In NRC Question 14.02-8 in RAI 7867, the NRC staff determined that the DC applicant did not meet the guidance of RG 1.68, Revision 4, Sections A, B, and C and NUREG-0800, SRP section 14.2. Specifically, the NRC staff concluded that the DC applicant should reference an ITP administrative control document or Startup Administration Manual (SAM) in APR1400 DCD 14.2.3 and place this document on the docket which covers the DC applicant's responsibilities for ITP administrative controls that govern the development and conduct of the APR1400 Design Certification ITP. The COL applicant will then complete the ITP administrative manual or Startup Administrative Manual (SAM) for the COL applicant's portion of responsibilities for conducting and implementing the APR1400 ITP. This question is part of Open Item 14.2.13-1.

On December 9, 2015 and June 30, 2016, the DC applicant responded to Question 14.02-8 in RAI 7867 with the following information:

The objectives of the ITP in the DC application are to provide an adequate test plan for the development and safe execution of the ITPs by the COL applicant(s). (Initial copy attached). The COL applicant's portion of responsibilities for conducting and implementing the APR1400 ITP is detailed in COL item 14.2(3). The SAM is to be prepared to implement the detailed individual procedures. Preparation of the SAM is detailed as COL 14.2(3).

As a reference, the general contents in SAM in COL step are listed below (see Attachment for draft SAM):

1. Purpose
2. Responsibilities
  - Commissioning Director
  - Commissioning Control Team General Manager
  - Quality Assurance Team General Manager
  - Commissioning Team General Manager

3. Procedure
  - Manual Format
  - Procedure Format
  - Preparation, Review, and Approval
  - Revision
  - Distribution and Control
4. Attachment (Each document format is to be provided)

The NRC staff determined that this KHNP response is not acceptable. NUREG-0800, SRP Section 14.2, Page 4, states the following:

### **3. Initial Test Program Administrative Procedures**

#### DC Applicant

The applicant should provide a summary description of the following areas in the SAM:

- A. The applicant should provide general guidance to control ITP activities, including administrative controls that will be used to develop, review, and approve individual test procedures, coordination with organizations involved in the test program, participation of plant operating and technical staff, and review, evaluation, and approval of test results.
- B. The applicant should include general guidance for the review of relevant operating and testing experiences at other facilities. This guidance should recognize reportable occurrences of repeatedly experienced safety concerns and other operating experiences that could potentially impact the performance of the test program.
- C. The applicant should include general guidance about how, and to what extent, the test program will use and/or test plant operating, emergency, and surveillance procedures.
- D. The applicant should provide test abstracts of SSCs and unique design features that will be tested to verify that system and component performance is in accordance with the design. These test abstracts should include the objectives, tests, and acceptance criteria that will be included in the test procedures.

Based on this guidance in SRP 14.2, the DC applicant should provide more information in the SAM to cover Items A through D above including administrative controls for the list test abstracts in DCD Section 14.2. The list of test abstracts in DCD Section 14.2 should also be included in the SAM.

### **Response**

A revised Startup Administration Manual (SAM) is being provided as an attachment to this response which incorporates the items specified in NUREG-0800, Standard Review Plan Section 14.2 which includes items A – C in the above request. The test abstracts of SSCs, item D above, have been included in DCD Tier 2 Section 14.2 and have been revised and added to in accordance with KHNP's responses to the various NRC RAIs. The revised SAM

also includes the list of test abstracts and the administrative controls for that list.

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**Impact on DCD**

There is no impact on the DCD. DCD Tier 2 Section 14.2.3 was changed via KHNP submittal MKD/NW-16-0714L dated June 30, 2016, (ref. ML16182A554) in response to RAI 91-7867 and no additional changes are deemed necessary as a result of this response.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical Specifications**

There is no impact on Technical Specifications.

**Impact on Technical/Topical/Environmental Report**

There is no impact on any Technical, Topical, or Environment Reports.

**STARTUP ADMINISTRATIVE MANUAL (SAM)**

**DESCRIPTION**

REVISION NO.	KOREA HYDRO & NUCLEAR POWER CO., LTD	PROCEDURE NO.
REV. 0		SAM - XX
<b>STARTUP ADMINISTRATIVE MANUAL</b>		
TITLE	STARTUP ADMINISTRATIVE MANUAL DESCRIPTION	
Commissioning Control Team General Manager	_____ / _____ / _____	
Reactor Commissioning Team General Manager	_____ / _____ / _____	
Turbine Commissioning Team General Manager	_____ / _____ / _____	
BOP Commissioning Team General Manager	_____ / _____ / _____	
Operation Commissioning Team General Manager	_____ / _____ / _____	
QA Team General Manager	_____ / _____ / _____	
Commissioning Director	_____ / _____ / _____	
	(NAME)	(SIGNATURE)
		(DATE)

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<p><b>1.0 INTRODUCTION</b></p> <p>1.1 The Startup Administrative Manual (SAM) provides general guidance to startup personnel on the control of ITP activities and the conduct of the startup program.</p> <p>1.2 The major aspects included in the SAM contents are:</p> <ul style="list-style-type: none"> <li>a. Instructions for preparing, reviewing and approving individual test procedures.</li> <li>b. Instructions for certification and qualification of test personnel.</li> <li>c. Mechanisms for the coordination of organizations involved in the startup program, the participation of plant operating and technical staffs, the identification and resolution of deficiencies, and the means for requesting assistance by outside organizations.</li> <li>d. Mechanisms for identifying equipment status and for providing safety precautions for workers.</li> <li>e. Programs for equipment checkout, calibration, and testing.</li> </ul> <p>1.3 The SAM is divided into sections as follows:</p> <ul style="list-style-type: none"> <li>a. Introduction Introduction to the SAM.</li> <li>b. Organization Organization and responsibilities of the startup organization and support organizations such as the Test Working Group (TWG).</li> <li>c. Administrative Controls Startup administrative manual control, correspondence and filing controls, document controls and related subjects.</li> <li>d. Technical Controls This section constitutes the main portion of the startup manual and describes the startup programs, testing procedures, mechanisms for identifying and resolving deficiencies, and other pertinent topics.</li> </ul>			

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<p><b>2.0 <u>ORGANIZATION AND RESPONSIBILITIES</u></b></p> <p>2.1 Commissioning Director</p> <p>The commissioning director has overall responsibilities for startup activities as follows:</p> <ul style="list-style-type: none"> <li>a. The efficient construction checkout, initial operation, flushing (where applicable), preoperational testing, and other startup activities for all plant systems.</li> <li>b. The conduct of startup activities in a methodical and thorough manner to ensure and demonstrate that the highest standard of quality is maintained in all such activities.</li> <li>c. The coordination with other organizations as necessary to efficiently, accomplish startup activities.</li> <li>d. Ensuring the qualification of startup personnel.</li> <li>e. The approval of test procedures.</li> </ul> <p>2.2 Commissioning Control Team General Manager</p> <p>The commissioning control team general manager reports to and takes direction from the commissioning director. He/she is responsible for startup control activities such as:</p> <ul style="list-style-type: none"> <li>a. System turnover coordination</li> <li>b. System scoping</li> <li>c. Scheduling</li> <li>d. Procedure preparation, review and coordination activities.</li> <li>e. Document control</li> </ul>			

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<p>2.3 Operations Commissioning Team General Manager</p> <p>The operations commissioning team general manager reports to and takes direction from the commissioning director. He is responsible for the associated activities related to safe operation of the plant systems while systems are under startup custody, prior to turnover to the plant operations team. These activities include: establishing operations support in the areas of safety tagging, chemistry, operator licensing, and for other duties as assigned by the commissioning director.</p>			
<p>2.4 Other Commissioning Team General Managers</p> <p>The commissioning team general managers are responsible for the construction checkout, initial operation, flushing, preoperational testing, and other activities associated with systems assigned to them by commissioning director. Additionally, each general manager is responsible for maintenance of assigned systems pending assumption of these duties by plant personnel, and for other duties as assigned by the commissioning director.</p>			
<p>2.5 Commissioning Team Senior Manager</p> <p>Each commissioning team senior manager reports to and takes direction from their respective commissioning team general manager. The general manager shall assign duties to the team manager as he deems necessary to carry out the team responsibilities.</p>			
<p>2.6 Quality Assurance Team General Manager</p> <p>The Quality Assurance (QA) team general manager is responsible for ensuring that appropriate quality standards have been included and are consistently applied. The QA team general manager reports to the site vice president. The QA personnel are provided to the startup organization as necessary to ensure the established processes and procedures are complied with by the startup teams. Daily work (direction and schedule) for the QA personnel assigned to startup will be from the commissioning director, but ultimate direction and responsibility for the QA for all site matters shall be through the QA team general manager.</p>			
<p>2.7 Test Working Group</p> <p>The Test Working Group (TWG) is responsible for reviewing preoperational test, startup and power ascension test procedures and their results, and advising the startup manager on the acceptability of such procedures and results.</p>			



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<p>2.8 Tagout Permit Office</p> <p>The organization that controls and issues the appropriate tagging for protection of personnel and equipment. Any special instructions necessary for the safety of personnel or equipment during startup is issued by the Tagout Permit Office (TPO).</p> <p>2.9 Startup System Engineer</p> <p>The startup system engineer is the individual assigned by team manager supervision to have overall responsibility for conducting a test procedure. The startup system engineer shall conduct the test in accordance with the individual steps of the procedure, and in accordance with the requirements of the procedure.</p> <p><b>3.0 <u>TESTING</u></b></p> <p>3.1 Construction Acceptance Test Program</p> <p>Construction Acceptance Test (CAT) procedures are of two types, generic and specific :</p> <ol style="list-style-type: none"> <li>a. Generic - A generic CAT procedure is intended to have general applicability to many pieces of equipment of a general type; for example, a generic test procedure for "Electric Motors" would generally be applicable to most electrical motors.</li> <li>b. Specific - A specific CAT procedure is intended to have specific applicability to one or more pieces of equipment of a specific type. Specific procedures may also describe special operations such as energization or equipment maintenance.</li> </ol> <p>The CAT program accomplishes the following:</p> <ol style="list-style-type: none"> <li>a. It verifies the adequate design and construction of plant equipment.</li> <li>b. It adjusts and aligns plant equipment (when appropriate) and places equipment in operation.</li> <li>c. It prepares plant equipment for the performance of preoperational testing.</li> <li>d. It describes test performance and results review and approval.</li> </ol>			

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3.2	Flush Program		
	<p>The startup flush program is accomplished in two major steps. The first step is the preparation, review and approval of flush procedures. The second step is the performance of the flush test procedures.</p> <p>Procedure preparation is done in an orderly manner and usually adheres to the following sequence:</p> <ol style="list-style-type: none"> <li>a. System cleanliness class and type of water or cleaning fluid to be used is determined.</li> <li>b. Flush prerequisites such as supporting systems, pump strainer mesh, construction turnover requirements, etc., are finalized.</li> <li>c. Flush paths as well as cleaning methods are determined.</li> <li>d. Sampling methods and location are decided upon.</li> <li>e. System restoration and layup conditions are determined.</li> <li>f. Flush procedure undergoes the review and approval cycle.</li> </ol> <p>Flush test procedures are normally performed after the system or subsystem has been turned over to startup. If deemed appropriate, flushing activities may be performed prior to system turnover to startup.</p> <p>If pre-turnover flushing activities are done, they shall be performed with an approved procedure and the verifications shall be witnessed and signed by the startup system engineer. To assure that cleanliness acceptance criteria are maintained through turnover to startup, construction supervision must be made aware of flushed areas, and controls such as tagging needed by startup or construction personnel of applicable boundary valves or other control methods, as appropriate, must be provided. Additionally, the startup system engineer should coordinate with the construction system engineer to prepare for the flush.</p>		
3.3	Preoperational and Startup Test Program		
	<p>Preoperational test procedures are performed prior to initial fuel loading and plant operation to demonstrate the individual and integrated capability of structures, systems, and components to meet design criteria. Many of these tests will also be used to satisfy ITAAC requirements.</p>		

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<p>Startup test procedures are performed during the plant startup phase. The plant startup phase occurs after the preoperational test phase, roughly between fuel load and commercial operation. Startup tests are intended to verify adequate functioning of the reactor plant during power ascension.</p> <p>Preoperational test procedures which affect safety related systems shall be reviewed by TWG.</p> <p>The purpose of this procedure is to provide the means and methods for establishing a preoperational and startup Test program that will meet the criteria specified by Regulatory Guide 1.68 and applicable vendor instructions and recommendations.</p> <p><b>4.0 <u>JURISDICTIONAL CONTROLS</u></b></p> <p>This section defines the working relationship and key startup related activities to be performed by the organizational group participating in the startup of an APR1400 plant.</p> <p>4.1 Areas of Jurisdiction</p> <p>The overall startup program is divided into two major areas of jurisdiction:</p> <ol style="list-style-type: none"> <li>a. The construction area of jurisdiction - Work is performed by construction contractors.</li> <li>b. The startup area of jurisdiction - Work is performed under the direction of the startup organization.</li> </ol> <p>4.2 Turnover Procedure</p> <p>4.2.1 Finish Construction Phase</p> <p>During this phase, construction completes the installation of components by predefined functional systems. Associated piping, wiring, equipment, and controls are completed per design drawings. This procedure is not applicable to the control of the finish construction phase.</p> <p>4.2.2 Construction Testing Phase</p> <p>During this phase, the construction organization performs static testing on components and/or systems in preparation for turnover. This procedure is not applicable to the control of the construction testing phase.</p> <p>4.2.3 Component Inspection and Testing Phase</p> <p>During this phase, the startup organization prepares system components for dynamic testing. At this time all systems are "green tagged" thus indicating that the startup organization now has jurisdictional responsibility for the system.</p>			

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<p>4.2.4 Initial System Operating Phase</p> <p>During this phase, the startup organization conducts the initial system operation with the assistance of the construction organization. The applicable system is flushed, tuned, and made ready for preoperational testing.</p>			
<p>4.2.5 System and Integrated Testing Phase</p> <p>During this phase, the startup organization performs system preoperational testing and various integrated plant tests in preparation for fuel load and power ascension.</p>			
<p>4.2.6 Fuel Load and Power Ascension Phase</p> <p>During this phase, the operations organization has operational control and performs the fuel loading and power ascension to commercial operations. At this time, systems are "blue tagged" indicating that the operations organization has jurisdictional responsibility for the system.</p>			
<p><b>5.0 <u>TEST PROCEDURES</u></b></p> <p>All test steps shall be performed in accordance with CAT procedures, flushing procedures, preoperational procedures or startup &amp; power ascension test procedures. The test procedure index (see Attachment 1) should agree with FSAR Chapter 14, Regulatory Guide 1.68, and other engineering test requirements.</p>			
<p>5.1 Procedure Preparation</p> <p>Procedure preparation is coordinated by the procedure coordinator under the direction of the control team general manager. The lists of tests are shown in Attachment 1.</p> <p>Originator (usually the startup system engineer) shall prepare a draft test procedure in accordance with the process described in the procedure guideline prepared by design originators. Each procedure guideline should be provided at least 8 months prior to the test commencement date. The procedure development should consider the following:</p>			
<ul style="list-style-type: none"> <li>a. Review of relevant operating and testing experiences at other facilities.</li> <li>b. Repeatedly experienced safety concerns and other operating experiences that could potentially impact performance to the test.</li> <li>c. The use of operating, emergency, and surveillance procedures if appropriate.</li> </ul>			

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<p>5.2 Procedure Review/Approval Process</p> <p>After preparing a draft procedure, the originator shall route the procedure to a technical advisor for review and comment.</p> <p>The originator shall route the draft procedure to the applicable technical team general manager, operations team general manager and the QA team general manager.</p> <ol style="list-style-type: none"> <li>a. Commissioning team general manager or his/her designee should mark on the procedure whether TWG review is required.</li> <li>b. Operations team general manager reviews the procedures (except CAT and flushing).</li> <li>c. Operations team general manager and the QA team general manager shall ensure that a high priority is placed on these procedures reviews and the review sheets are submitted to the originator for resolution.</li> <li>d. The routing of procedures and incorporating comments during the review cycle shall be performed by the procedure originator.</li> <li>e. The review process shall be documented by printing the reviewer's name and signature on the procedure cover sheet when comments have been addressed.</li> </ol> <p>After the review process is completed and if TWG review is not required, procedure approval can be obtained from the commissioning director.</p> <p>If TWG review is required, the procedure coordinator shall process it through the appropriate group. When all TWG comments have been resolved, the commissioning director will approve the procedure for issuance.</p> <p>The procedure coordinator shall maintain control of the approved procedures in a master file, the procedure index list, and is responsible for control and distribution of copies to be used as a working copy, for training, information only, etc., as appropriate.</p> <p>A working copy should be issued when requested by an appropriate startup system engineer.</p>			

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<p><b>6.0 <u>CONDUCT OF TESTING</u></b></p> <p>6.1 Organization</p> <p>The staff performing testing should be knowledgeable in the particular testing, have attended pre-job briefs, and have been trained, certified and controlled in accordance with the startup training and indoctrination procedure.</p> <p>6.2 Measuring and Test Equipment</p> <p>Measuring and Test Equipment (M &amp; TE) needed in performing testing should be purchased with approved specifications. M &amp; TE shall be stored, maintained and calibrated in accordance with the calibration and control of startup measuring and test procedure.</p> <p>6.3 Procedure Control</p> <p>6.3.1 Revision</p> <p>A procedure revision shall proceed through the same process as the initial preparation. Review and approval of revised test procedures is also described in the test procedure preparation procedure. When preparing a revision, the startup system engineer may mark up a copy of the existing revision. The revision shall be controlled in the same manner as the original procedure.</p> <p>6.3.2 Emergent Changes</p> <p>Procedure changes may be made during the conduct of the test, or shortly before the test if insufficient time is available to issue a revision.</p> <p>All changes shall be documented on Test Change Notice (TCN) forms. Information shall be provided on the TCN forms to describe the location of the change (by step number if applicable), the type of change (minor or major), and why the change was necessary.</p>			

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<p>6.4 Test Performance</p> <p>When all verification blanks have been completed in the procedure (unless specifically noted to be necessary only for certain portions of the test), and when the commissioning director has authorized commencement in the prerequisite section, the test may begin.</p> <p>All test procedures shall be strictly followed and shall be performed in accordance with the following rules:</p> <ol style="list-style-type: none"> <li>a. Test steps and data entries, as completed, are verified by entering the initials of the test personnel and the date in the procedure. These entries are to be made in black ink (pencil entries are not acceptable).</li> <li>b. The test summary sheets shall be maintained current, logging events and describing problems and resolutions as per instructions for the test summary sheet.</li> <li>c. Each step of a test procedure shall be completed sequentially, or in accordance with specific instructions noted in the procedure.</li> <li>d. If a test procedure directs personnel to take specific actions (e.g., start a pump, turn a valve, jump a battery cell, etc.) and those actions cannot be taken, then a deviation to the procedure is required prior to continuing with the test and documented on a deviation sheet.</li> <li>e. Corrections to erroneous entries shall be made in black ink by single lining out the incorrect entry, entering the correct entry nearby, and initialing and dating the change.</li> <li>f. When test steps must be repeated, repeating can be done by one of the following methods: <ol style="list-style-type: none"> <li>1) A clean replacement sheet for the portion of the test to be repeated may be obtained from the procedure coordinator and inserted into the working copy; the old sheets shall be retained in support of an explanation that shall be documented in the test summary sheets.</li> <li>2) The entries to be repeated may be single lined out and the steps may be treated as a test deviation to be completed at a later date. An explanation shall be given on a deviation sheet.</li> <li>3) Where repetition is performed to reestablish conditions and not to re-verify test performance, the verification initials should not be disturbed and the repeated steps and reason for repetition should be described in the test summary sheets. In all cases, care shall be taken to ensure the repeated steps begin from a logical starting point so that appropriate preparatory steps are accomplished.</li> </ol> </li> </ol>			

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<p>In cases of emergency or safety situations, the startup system engineer should stop the test. However, if the test cannot be stopped, the startup system engineer is authorized to depart from the approved procedures where necessary to prevent injury to personnel or damage to the facility, but only as required to place the system or equipment in a safe, stable condition. Such a departing shall be documented in the test summary sheets.</p>			
<p>6.5 Deviations</p> <p>A procedure deviation is the inability to meet acceptance criteria or to perform test steps. Deviations are logged sequentially, as encountered, on a deviation sheet which shall be attached to the procedure. "D-X" is noted alongside the incomplete verification blank in the procedure body (where X corresponds to the sequential deviation number).</p> <p>As deviations are encountered, the startup system engineer shall describe them on the deviation sheet, and shall evaluate the effect of the deviation on further testing and the advisability of continuing testing.</p> <p>If successful testing can proceed with no deterioration in personnel or equipment safety, the startup system engineer should continue the test.</p> <p>In general, deviations are used to document problems encountered during the test. All deviations must eventually be resolved by the startup system engineer by approved methods.</p> <p>Resolution shall be documented on the deviation sheet and explained, as necessary, in the test summary sheets. Part of the resolution may involve repeating sections of the test procedure to show that the deviation no longer exists. All deviations must be resolved prior to final approval of test procedure results.</p>			
<p><b>7.0 <u>TEST RESULTS</u></b></p>			
<p>7.1 Review and Approval of Test Results</p> <p>Upon completion of the test and test summary, the test results shall be submitted to the original reviewers for review. A comprehensive review of all test results shall be performed. Results shall be analyzed and evaluated to verify completeness of results, achievement of inspection and test objectives, and operational proficiency of equipment and systems, to identify additional inspection and/or test requirements and to identify necessary changes to check out or test procedures. Approval recommendations shall be documented by the signatures on the test endorsement record.</p>			



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<p>The commissioning director is then responsible for the final review and approval of the test results which shall be documented by his/her signature on the test endorsement record sheet. Should the test results be approved with outstanding deviations (interim approval), the test procedure shall be resubmitted to the original reviewers when those deviations have been resolved. The deviation resolutions shall be reviewed, and upon acceptance, final approval recommended. This shall be documented by signature on the "Final Approval" space on the test endorsement record sheet. The test result is then sent to the commissioning director for final review and approval of the deviation resolutions. Approval is documented by his/her signature on the test endorsement record sheet.</p>			
<p>7.2 Records</p> <p>All test procedures and their revisions, completed procedures, data sheets and other documentation certifying test activities shall be retained as startup records. These startup records shall be forwarded to the procedure coordinator for logging and retention until processing into the plant's record management system.</p>			
<p><b>8.0 <u>CERTIFICATION AND QUALIFICATION OF TEST PERSONNEL</u></b></p> <p>To comply with the regulatory requirements described in the Quality Assurance Program (QAP), an indoctrination, training and certification program is established for onsite startup personnel performing activities affecting quality.</p> <p>This program ensures that startup personnel are thoroughly familiar with startup related procedures and are proficient in their implementation.</p>			
<p>8.1 Training</p>			
<p>8.1.1 Individual Training</p> <p>Each commissioning team shall perform the following when a new individual has been assigned to their team.</p> <ol style="list-style-type: none"> <li>a. Establish and execute a training plan in accordance with the qualification training program.</li> <li>b. Upon completion of receiving the indoctrination, the trainee shall fill out the following documents and submit them to the operation commissioning team to request evaluation testing be performed on the individual:             <ul style="list-style-type: none"> <li>- Startup indispensable reading list</li> <li>- Qualification checklist</li> <li>- Certification level requirement</li> <li>- Qualification review sheet</li> <li>- Startup training report</li> </ul> </li> </ol>			

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<p>8.1.2 Collective Training</p> <p>The operation commissioning team shall perform the following when new individuals have been assigned to the startup organization.</p> <ol style="list-style-type: none"> <li>a. Establish a training plan, assign the instructors and execute the training plan in accordance with the qualification training program.</li> <li>b. Upon completion of receiving the indoctrination, the trainee shall fill out the following: <ul style="list-style-type: none"> <li>- Startup indispensable reading list</li> <li>- Startup training report</li> </ul> </li> <li>c. Each pertinent commissioning team general manager shall prepare the following for the startup personnel in his/her team based on their education, experiences and assignments, etc., and send them to the operation commissioning team general manager to request evaluation testing be performed on the individual: <ul style="list-style-type: none"> <li>- Qualification checklist</li> <li>- Certification level requirement</li> <li>- Qualification review sheet</li> </ul> </li> </ol> <p>8.2 Qualification Certificate and Control</p> <p>8.2.1 Qualification Certificate</p> <p>Each commissioning team general manager shall review the qualification and the test results of the candidates for promotion to a higher certification Level in his/her team. When satisfied, each commissioning team general manager shall prepare and submit the certification review sheets to the operation commissioning team.</p> <p>The operation commissioning team general manager shall prepare the qualification certificates, and submit them with the certification review sheets attached thereto to the commissioning director for approval.</p> <p>The commissioning director shall review the education, job experiences and the certification review sheets of the candidates and, when satisfied that they are sufficiently qualified, approve the qualification certificates.</p> <p>The operation commissioning team general manager shall record the qualified candidates on the qualification certificate control log, and forward the qualification certificates to the qualified candidates. The operation commissioning team general manager shall maintain the related qualification documents.</p>			

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<p>8.2.2 Validity of Certificate</p> <p>The qualification certificate is valid for three years. At least every three years each team general manager shall re-evaluate the qualification of the startup personnel on his/her team using the re-qualification checklist. If the results of re-evaluation meet the pass criteria, the validity of the qualification certificate will be extended for three more years. If not, the startup personnel cannot continue to work on his/her assigned task until they obtain a valid qualification certificate.</p> <p>When startup personnel has not performed startup activities for more than a year, his/her qualification shall be re-evaluated.</p> <p>If the annual medical checkup required by the company has determined a startup personnel as inadequate to perform startup activities, the validity of his/her qualification certificate shall be suspended temporarily until his/her health problem is cleared.</p>			

## Attachment 1 List of Individual Tests in DCD Section 14.2

Table 14.2-1 (1 of 5)

Preoperational Tests

Subsection	Test
14.2.12.1.1	Reactor coolant pump motor initial operation test
14.2.12.1.2	Reactor coolant system test
14.2.12.1.3	Pressurizer pilot-operated safety relief valve test
14.2.12.1.4	Pressurizer pressure and level control systems test
14.2.12.1.5	Chemical and volume control system letdown subsystem test
14.2.12.1.6	Volume control tank subsystem test
14.2.12.1.7	Chemical and volume control system charging subsystem test
14.2.12.1.8	Chemical addition subsystem test
14.2.12.1.9	Reactor drain tank subsystem test
14.2.12.1.10	Equipment drain tank subsystem test
14.2.12.1.11	Boric acid batching tank subsystem test
14.2.12.1.12	Concentrated boric acid subsystem test
14.2.12.1.13	Reactor makeup subsystem test
14.2.12.1.14	Holdup subsystem test
14.2.12.1.15	Boric acid concentrator subsystem test
14.2.12.1.16	Gas stripper subsystem test
14.2.12.1.17	Boronometer subsystem test
14.2.12.1.18	Process radiation monitor subsystem test
14.2.12.1.19	Gas stripper effluent radiation monitor subsystem test
14.2.12.1.20	Shutdown cooling system test
14.2.12.1.21	Safety injection system test
14.2.12.1.22	Safety injection tank subsystem test
14.2.12.1.23	Engineered safety features – component control system test
14.2.12.1.24	Plant protection system test
14.2.12.1.25	Ex-core neutron flux monitoring system test
14.2.12.1.26	Fixed in-core nuclear signal channel test

## Attachment 1 List of Individual Tests in DCD Section 14.2

Table 14.2-1 (2 of 5)

Subsection	Test
14.2.12.1.27	Digital rod control system test
14.1.12.1.28	Reactor regulating system test
14.2.12.1.29	Steam bypass control system test
14.2.12.1.30	Feedwater control system test
14.2.12.1.31	Core operating limit supervisory system test
14.2.12.1.32	Reactor power cutback system test
14.2.12.1.33	Fuel Storage and Handling System Test
14.2.12.1.34	Auxiliary feedwater system test
14.2.12.1.35	Reactor coolant system hydrostatic test
14.2.12.1.36	Control element drive mechanism cooling system test
14.2.12.1.37	Reactor coolant gas vent system test
14.2.12.1.38	Containment spray system test
14.2.12.1.39	Integrated engineered safety features / loss of power test
14.2.12.1.40	In-containment water storage system test
14.2.12.1.41	Internals vibration monitoring system test
14.2.12.1.42	Loose parts monitoring system test
14.2.12.1.43	Acoustic leak monitoring system test
14.2.12.1.44	Information processing system and qualified information and alarm system test
14.2.12.1.45	Turbine generator building open cooling water system test
14.2.12.1.46	Pre-core hot functional test controlling document
14.2.12.1.47	Pre-core instrument correlation
14.2.12.1.48	Remote shutdown console test
14.2.12.1.49	Diverse protection system test
14.2.12.1.50	Pre-core test data record
14.2.12.1.51	Pre-core reactor coolant system expansion measurements
14.2.12.1.52	Pre-core reactor coolant and secondary water chemistry data
14.2.12.1.53	Pre-core pressurizer performance test

## Attachment 1 List of Individual Tests in DCD Section 14.2

Table 14.2-1 (3 of 5)

Subsection	Test
14.2.12.1.54	Pre-core control element drive mechanism performance test
14.2.12.1.55	Pre-core reactor coolant system flow measurements
14.2.12.1.56	Pre-core reactor coolant system heat loss measurement
14.2.12.1.57	Pre-core reactor coolant system leak rate measurement
14.2.12.1.58	Pre-core chemical volume control system integrated test
14.2.12.1.59	Pre-core safety injection check valve test
14.2.12.1.60	Pre-core boration / dilution measurements
14.2.12.1.61	Downcomer feedwater system water hammer test
14.2.12.1.62	Main turbine systems test
14.2.12.1.63	Main steam safety valve test
14.2.12.1.64	Main steam isolation valves and MSIVBVs test
14.2.12.1.65	Main steam system test
14.2.12.1.66	Steam generator blowdown system test
14.2.12.1.67	Main condenser and condenser vacuum systems test
14.2.12.1.68	Feedwater system test
14.2.12.1.69	Condensate system test
14.2.12.1.70	Turbine steam seal system test
14.2.12.1.71	Circulating water system test
14.2.12.1.72	Steam generator hydrostatic test
14.2.12.1.73	Heater drains system test
14.2.12.1.74	Chilled water system test
14.2.12.1.75	Essential service water system test
14.2.12.1.76	Component cooling water system test
14.2.12.1.77	Spent fuel pool cooling and cleanup system test
14.2.12.1.78	Turbine generator building closed cooling water system test
14.2.12.1.79	Condensate storage system test
14.2.12.1.80	Normal lighting system test
14.2.12.1.81	Emergency lighting system test

## Attachment 1 List of Individual Tests in DCD Section 14.2

Table 14.2-1 (4 of 5)

Subsection	Test
14.2.12.1.82	Compressed air system test
14.2.12.1.83	Process sampling system test
14.2.12.1.84	Heat tracing system test
14.2.12.1.85	Fire protection system test
14.2.12.1.86	Emergency diesel generator mechanical system test
14.2.12.1.87	Emergency diesel generator electrical system test
14.2.12.1.88	Emergency Diesel Engine Fuel Oil System Test
14.2.12.1.89	Alternate AC source system test
14.2.12.1.90	Alternate AC source support systems test
14.2.12.1.91	Containment polar crane test
14.2.12.1.92	Fuel handling area cranes test
14.2.12.1.93	Reactor containment building HVAC system test
14.2.12.1.94	Reactor containment purge HVAC system test
14.2.12.1.95	Control room area HVAC system test
14.2.12.1.96	Turbine generator building HVAC system test
14.2.12.1.97	Emergency diesel generator area HVAC system test
14.2.12.1.98	Fuel handling HVAC system test
14.2.12.1.99	Compound building HVAC system test
14.2.12.1.100	Balance of control room HVAC system test
14.2.12.1.101	Hydrogen mitigation system test
14.2.12.1.102	Containment hydrogen recombiner system test
14.2.12.1.103	Liquid waste management system test
14.2.12.1.104	Solid waste management system test
14.2.12.1.105	Gaseous waste management system test
14.2.12.1.106	Process and effluent radiological monitoring system test
14.2.12.1.107	Area radiation monitoring system test

## Attachment 1 List of Individual Tests in DCD Section 14.2

Table 14.2-1 (5 of 5)

Subsection	Test
14.2.12.1.108	4,160V Class 1E auxiliary power system test
14.2.12.1.109	480V Class 1E auxiliary power system test
14.2.12.1.110	Unit main power system test
14.2.12.1.111	13,800V non-Class 1E auxiliary power system test
14.2.12.1.112	4,160V non-Class 1E auxiliary power system test
14.2.12.1.113	480V non-Class 1E auxiliary power system test
14.2.12.1.114	Non-Class 1E dc power systems test
14.2.12.1.115	Class 1E dc power systems test
14.2.12.1.116	Offsite power system test
14.2.12.1.117	Balance-of-plant piping thermal expansion measurement test
14.2.12.1.118	Balance-of-plant piping vibration measurement test
14.2.12.1.119	Containment integrated leak rate test and structural integrity test
14.2.12.1.120	Fuel transfer tube functional test and leak test
14.2.12.1.121	Equipment hatch functional test and leak test
14.2.12.1.122	Containment personnel airlock functional test and leak test
14.2.12.1.123	Containment electrical penetration assemblies test
14.2.12.1.124	Containment isolation valves leakage rate test
14.2.12.1.125	Loss of instrument air test
14.2.12.1.126	Mid-loop operations verification test
14.2.12.1.127	Seismic monitoring instrumentation test
14.2.12.1.128	Auxiliary steam system test
14.2.12.1.129	Containment isolation valves test
14.2.12.1.130	Post-accident monitoring instrumentation test
14.2.12.1.131	Electrical and I&C equipment areas HVAC system test
14.2.12.1.132	Auxiliary building controlled area HVAC system test
14.2.12.1.133	Auxiliary building clean area HVAC system test
14.2.12.1.134	Leakage detection system test
14.2.12.1.135	Leakage control and detection of system outside of containment



## Attachment 1 List of Individual Tests in DCD Section 14.2

Table 14.2-1 (5 of 5)

Subsection	Test
14.2.12.1.136	RCP Vibration Monitoring System
14.2.12.1.137	NSSS Integrity Monitoring System (Pre-core)
14.2.12.1.138	Core Protection Calculator System Test
14.2.12.1.139	Diverse Indication System Test
14.2.12.1.140	Pre-core pressurizer surge line stratification test

## Attachment 1 List of Individual Tests in DCD Section 14.2

Table 14.2-2

Post-Core Hot Functional Tests

Subsection	Test
14.2.12.2.1	Post-core hot functional test controlling document
14.2.12.2.2	NSSS Integrity Monitoring System (post-core)
14.2.12.2.3	Reactor coolant system flow measurements
14.2.12.2.4	Post-core control element drive mechanism performance
14.2.12.2.5	Post-core reactor coolant and secondary water chemistry data
14.2.12.2.6	Post-core pressurizer spray valve and control adjustments
14.2.12.2.7	Post-core reactor coolant system leak rate measurement
14.2.12.2.8	Post-core in-core instrumentation test
14.2.12.2.9	Post-core instrument correlation
14.2.12.2.10	Post-core acoustic leak monitor system test

## Attachment 1 List of Individual Tests in DCD Section 14.2

Table 14.2-3

Low-Power Physics Tests

Subsection	Test
14.2.12.3.1	Low-power biological shield survey test
14.2.12.3.2	Isothermal temperature coefficient test
14.2.12.3.3	Shutdown and regulating control element assembly group worth test
14.2.12.3.4	Differential boron worth test
14.2.12.3.5	Critical boron concentration test
14.2.12.3.6	Control element assembly symmetry

## Attachment 1 List of Individual Tests in DCD Section 14.2

Table 14.2-4

Power Ascension Tests

Subsection	Test
14.2.12.4.1	Variable $T_{avg}$ (isothermal temperature coefficient and power coefficient) test
14.2.12.4.2	Unit load transient test
14.2.12.4.3	Control systems checkout test
14.2.12.4.4	Reactor coolant and secondary chemistry and radiochemistry test
14.2.12.4.5	Turbine trip test
14.2.12.4.6	Unit load rejection test
14.2.12.4.7	Shutdown from outside the main control room test
14.2.12.4.8	Loss of offsite power test
14.2.12.4.9	Biological shield survey test
14.2.12.4.10	Steady-state core performance test
14.2.12.4.11	Intercomparison of plant protection system, core protection calculator, information processing system, and qualified information and alarm system inputs
14.2.12.4.12	Verification of core protection calculator power distribution related constants test
14.2.12.4.13	Feedwater and auxiliary feedwater system test
14.2.12.4.14	Core protection calculator verification
14.2.12.4.15	Main steam atmospheric dump and turbine bypass valve capacity test
14.2.12.4.16	In-core detector test
14.2.12.4.17	Core operating limit supervisory system verification
14.2.12.4.18	NSSS Integrity Monitoring System
14.2.12.4.19	Loss of one main feedwater pump
14.2.12.4.20	Penetration temperature survey test
14.2.12.4.21	HVAC capability test
14.2.12.4.22	Natural circulation test
14.2.12.4.23	Liquid waste management system test
14.2.12.4.24	Gaseous waste management system test
14.2.12.4.25	Pseudo-ejected CEA test
14.2.12.4.26	Pseudo-dropped CEA test

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14.2.12.4.27	Fatigue Monitoring System Test
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