Response to

Request for Additional Information No. 9 Supplement 1, Revision 0

6/12/2008

U.S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 08.01 – Electric Power – Introduction
SRP Section 08.02 – Offsite Power System
Application Section: FSAR Chapter 8
EE Branch

Question 08.02-6:

EPR is designed to accept a 100% load rejection without a turbine trip and continue to supply plant loads without interruption. The initial test program (test #109) described in Chapter 14 (14.2.12.10.2) appears to be demonstrating that the unit main power system (i.e., main generator) can supply power to designated house loads. Confirm whether this test is the load rejection test from full power. In addition, the staff is concerned that the transient voltage spike during the above test could trip the onsite safety-related equipment including battery charges and UPS system. Include in EPR FSAR that the COL applicant should provide the transient load-flow analysis that simulates the above test and demonstrates that transient voltage spike causes no problem to plant safety system.

Response to Question 08.02-6:

Full load rejection capability is the ability of the main turbine and associated balance of plant supporting systems, and the reactor, to sustain a main generator load rejection from up to 100 percent power without a main turbine or reactor trip. Island mode operation is the capability of the main turbine-generator to stay online and maintain electrical power to plant auxiliary loads following a loss of the connection to the transmission system. The plant transitions to a stable state during island mode operation whereby the unit becomes self sustaining while separated from the transmission system.

U.S. EPR FSAR Tier 2, Section 14.2.12.10.2, initial test program (test #109) unit main power test demonstrates the capability of the main generator to supply plant auxiliary loads and transmit power to the transmission system during normal operation. This test does not initiate or test turbine-generator full load reject or island mode capabilities. No changes will be made to test #109 as a result of the response to this RAI.

U.S. EPR FSAR Tier 2, Section 14.2.12.21.4, initial test program (test #221) loss of offsite load initiates the turbine-generator removal from the grid by opening the main generator output breakers in the switchyard. Using this method of initiating this type of load rejection prevents the main generator from supplying power to plant auxiliary loads. In this test and condition, the plant auxiliary loads are supplied by offsite power through the switchyard. U.S. EPR FSAR Tier 2, Section 14.2.12.21.4, initial test program (test #221) Section 3.4 will be revised to delete, “Verify that the turbine-generator continues to provide house loads.”

U.S. EPR FSAR Tier 2, Section 14.2.12.21 will be revised to add Test #227 to test transition into island mode operation following a load rejection from full power. Performance of a transient load-flow analysis is included as a test prerequisite, in lieu of a COL information item, to demonstrate the electrical transient from the test will not challenge safety-related equipment function. The transient analysis will determine anticipated system transient voltage and frequency response and verify that the expected transient will not exceed electrical system component capabilities and protection setpoints and challenge safety systems. Including the analysis as a test prerequisite will verify the analysis has been performed with satisfactory results prior to test implementation.

FSAR Impact:

U.S. EPR FSAR Tier 2, Section 14.2.12.21.4 and Table 14.2-1will be revised as described in the response and as indicated in the enclosed markup.

U.S. EPR FSAR Tier 2, Section 14.2.12.21.7 will be added as described in the response and indicated on the enclosed markup.

U.S. EPR Final Safety Analysis Report Markups

2.1.1 Primary and secondary level controls (e.g., pressurizer, feedwater heaters, VCT, deaerator, SG).

2.1.2 Primary and secondary pressure controls (e.g., pressurizer, VCT, condensate).

2.1.3 Primary and secondary flow controls (e.g., CVCS letdown, feedwater).

2.1.4 Primary and secondary temperature controls (e.g., RCS T_{avg}).

2.1.5 Reactor reactivity controls (i.e., control rods, boration and dilution).

3.0 TEST METHOD

3.1 Plant power is reduced 10 percent from the original power level to a new power level over a one hour duration without operator intervention.

3.2 Plant power is stabilized at the new power level for two hours without operator intervention.

3.3 Plant power is increased ten percent from the reduced power level to the original power level over one and half hour duration without operator intervention.

3.4 The plant behavior is monitored to establish that the control systems maintain the NSSS within operating limits.

4.0 DATA REQUIRED

4.1 Plant condition prior to transient.

4.2 The following acceptance criteria parameters are monitored prior to and throughout the transient:

4.2.1 Pressurizer parameters (i.e., pressure and level).

4.2.2 RCS temperatures (i.e., T_{cold}, T_{hot} and T_{avg}).

4.2.3 SG parameters (i.e., flow, pressure, temperature and level).

4.2.4 RCS parameters (i.e., flow, pressure, temperature and pressurizer level).

4.2.5 RCCA position.

4.2.6 RCS boron concentration.

4.3 Additional key plant parameters shall be monitored for base line data.

5.0 ACCEPTANCE CRITERIA

5.1 The plant responds as described in Section 10.2.

14.2.12.21.4 Loss of Offsite Load (Test #221)

1.0 OBJECTIVE

1.1 To demonstrate that the plant responds and is controlled as designed following a loss of offsite load.

1.2 This procedure shall be performed at the following plateau:

1.2.1 ≥98 percent reactor power in accordance with RG 1.68.

2.0 PREREQUISITES

2.1 The following systems are in automatic operation:

2.1.1 Primary and secondary level controls (e.g., pressurizer, feedwater heaters, VCT, deaerator, SG).

2.1.2 Primary and secondary pressure controls (e.g., pressurizer, VCT, condensate).

2.1.3 Primary and secondary flow controls (e.g., CVCS letdown, feedwater).

2.1.4 Primary and secondary temperature controls (e.g., RCS T_{avg}).

2.1.5 RCSL control of RCCAs.

3.0 TEST METHOD

3.1 The turbine-generator is removed from the grid by opening the output breaker.

3.2 Verify that RCPs continue to operate with power supplied from the offsite grid.

3.3 Verify that a partial rod trip occurs but the reactor remains critical.

3.4 ~~Verify that the turbine-generator continues to provide house loads.~~

3.5 The plant behavior is monitored to establish that the control systems maintain the NSSS within operating limits.

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4.0 DATA REQUIRED

4.1 Plant condition prior to trip.

4.2 The following acceptance criteria parameters are monitored prior to and throughout the transient:

4.2.1 Pressurizer parameters (i.e., pressure and level).

4.2.2 RCS temperatures (i.e., T_{cold}, T_{hot} and T_{avg}).

4.2.3 SG parameters (i.e., flow, pressure, temperature and level).

4.2.4 RCS parameters (i.e., flow, pressure, temperature and pressurizer level).

4.2.5 RCCA position as a function of time.

4.3 Additional key plant parameters shall be monitored for base line data.

4.3.1 Turbine speed and generator frequency.

4.3.2 Generator voltage.

4.3.3 Generator excitation.

5.0 ACCEPTANCE CRITERIA

5.1 ~~The plant responds as described in Section 15.2.1~~RCSL and turbine controls remain within analyzed limits and reactor power is stabilized at the lower power for at least 30 minutes following the test initiation without unanticipated operator action.

5.2 RCCAs are restored to proper sequence and overlap with Tech Spec LCO limits.

14.2.12.21.5 Actual Rod Drop Times (Test #222)

1.0 OBJECTIVE

1.1 To determine the actual RCCA drop times from actual reactor trips.

1.2 This procedure shall be performed at the following plateau:

1.2.1 ≥98 percent reactor power in accordance with RG 1.68.

2.0 PREREQUISITES

2.1 Determine reactor trip times for reactor trips since fuel load.

3.0 TEST METHOD

3.1 Collect rod drop times for each reactor trip.

4.0 DATA REQUIRED

4.1 Rod drop times for each reactor trip.

5.0 ACCEPTANCE CRITERIA

5.1 Verify that actual rod drop data meets Technical Specification requirements and there are no adverse data trends.

14.2.12.21.6 Cooling Tower Acceptance (Test #223)

A COL applicant that references the U.S. EPR design certification will provide site-specific information for the cooling tower. The following is a typical COLA test; if a site specific test will be used the COL applicant will provide the test.

1.0 OBJECTIVE

1.1 To verify the cooling tower is capable of rejecting the design heat load.

2.0 PREREQUISITES

2.1 Construction activities are complete.

2.0 PREREQUISITES

2.1 Construction activities are complete.

2.2 Circulating water system flow balance has been performed.

2.3 Permanently installed instrumentation is functional and calibrated.

2.4 Test instrumentation is calibrated and available.

2.5 Plant output is at approximately full-power.

3.0 TEST METHOD

3.1 Perform a measurement of the cooling tower performance using Cooling Tower Institute (CTI) standards.

4.0 DATA REQUIRED

4.1 Cooling water temperature and flows.

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5.0 ACCEPTANCE CRITERIA

5.1 The cooling tower performance meets manufacturers design as described in Section 10.4.5.1.

14.2.12.21.7 Loss of Offsite Power with Plant Auxiliary Loads Supplied in Island Mode (Test #227)

1.0 OBJECTIVE

1.1 To demonstrate that the plant responds and is controlled as designed following a loss of offsite grid.

1.2 This procedure shall be performed at the following plateau:

1.2.1 ≥98 percent reactor power in accordance with RG 1.68.

2.0 PREREQUISITES

2.1 A transient load flow analysis has been performed that demonstrates the electrical transient (voltage and frequency) from the test will not exceed safety-related equipment capabilities and protection system setpoints.

2.2 The following systems are in automatic operation:

2.2.1 Primary and secondary level controls (e.g., pressurizer, feedwater heaters, VCT, deaerator, SG).

2.2.2 Primary and secondary pressure controls (e.g., pressurizer, VCT, condensate).

2.2.3 Primary and secondary flow controls (e.g., CVCS letdown, feedwater).

2.2.4 Primary and secondary temperature controls (e.g., RCS T_{avg}).

2.2.5 RCSL control of RCCAs.

3.0 TEST METHOD

3.1 Offsite power is removed from the plant by tripping transmission line breakers in the switchyard.

3.2 Verify that RCPs continue to operate with power supplied from the main generator.

3.3 Verify that a partial rod trip occurs but the reactor remains critical.

3.4 Verify that the turbine-generator continues to provide auxiliary loads.

3.5 The plant behavior is monitored to establish that the control systems maintain the NSSS within operating limits.

4.0 DATA REQUIRED

4.1 Plant condition prior to trip.

4.2 The following acceptance criteria parameters are monitored prior to and throughout the transient:

4.2.1 Electrical distribution system voltage and frequency.

4.2.2 Pressurizer parameters (i.e., pressure and level).

4.2.3 RCS temperatures (i.e., T_{cold}, T_{hot}, and T_{avg}).

4.2.4 SG parameters (i.e., flow, pressure, temperature, and level).

4.2.5 RCS parameters (i.e., flow, pressure, temperature, and pressurizer level).

4.2.6 RCCA position as a function of time.

4.3 Additional key plant parameters shall be monitored for baseline data.

4.3.1 Turbine speed and generator frequency.

4.3.2 Generator voltage.

4.3.3 Generator excitation.

5.0 ACCEPTANCE CRITERIA

5.1 RCSL and turbine controls remain within analyzed limits and reactor power is stabilized at the lower power for at least 30 minutes following the test initiation without unanticipated operator action.

5.2 Electrical distribution system voltage and frequency measurements can be correlated with the transient load flow analysis.

14.2.13 References

1. ASME Boiler and Pressure Vessel Code, Section III, “Rules for Construction of Nuclear Facility Components,” Class 1, 2, and 3 Components, The American Society of Mechanical Engineers, 2004 (No Addenda).

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Table 14.2-1—List of Initial Tests for the U.S. EPR
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Test #	Test Name	FSAR or COLA Test	Applicable Section of RG 1.68, Revision 3	Other RG
227	Loss of Offsite Power with Plant Auxiliary Loads Supplied in Island Mode	FSAR	Appendix A, 5