

Enclosure 3

Docket No. PROJ 0782

Response to RAI Regarding KHNP's Response to the U.S. NRC
Inspection Report No. 99901453/2014-201

January 2015

Violation 99901453/2014-201-01(a)

The NRC requests that KHNP provide the evaluation for the impact of flow channel gap on the validity of testing in response to the NOV, under the inspection report number and project number, when that portion of the evaluation has been completed. The information should be descriptive enough for the NRC staff to determine if KHNP considered the extent of condition, and for the NRC staff to determine the adequacy of the corrective actions that KHNP has initiated.

Response

The impact of flow channel gap on the validity of testing is described in Appendix A of the APR1400-K-A-NR-14001, "In-vessel Downstream Effect Tests for the APR1400." (see Enclosure 4)

The change of flow channel gap from the as-fabricated value to the design value gives a rise in pressure drop of less than []^{TS}. Thus, the results on the in-vessel effect tests conducted in September 2014 are valid because there is a margin of []^{TS} under the limiting condition of hot-leg break.

Violation 99901453/2014-201-01(b)

The NRC requests that KHNP provide the evaluation for the impact of debris settling on the validity of testing in response to the NOV, under the inspection report number and project number, when that portion of the evaluation has been completed. The information should be descriptive enough for the NRC staff to determine if KHNP considered the extent of condition, and for the NRC staff to determine the adequacy of the corrective actions that KHNP has initiated.

Response

The impact of debris settling on the validity of testing that was conducted is described in Appendix B of the APR1400-K-A-NR-14001, "In-vessel Downstream Effect Tests for the APR1400." (see Enclosure 4)

The maximum pressure drop under the cold-leg break tests without debris settling is below []^{TS} and it meets the available head limit ([]^{TS}) with a margin of approximately []^{TS}. Therefore, the test results that were conducted with some debris settling are valid with a margin of approximately []^{TS} under the cold-leg break condition.

Violation 99901453/2014-201-02(a)

The NRC requests that KHNP provide the evaluation of the impact on the test validity of using test parameters from the preliminary version of the procedure, which were different than the approved version of the test procedure. The

information should be descriptive enough for the NRC staff to determine if KHNP considered the extent of condition, and for the NRC staff to determine the adequacy of the corrective actions that KHNP has initiated.

Response

The test procedure DC-DG-11-02 Revision 4, which was used in the inspection period, made two changes to Revision 3 as follows:

- a. Revision 4 changed the flow rate from “16.6 lpm” to an unspecified flow rate, “[blank] lpm” (a flow rate which is dependent on test conditions)
- b. Revision 4 implemented a change at Step 6.2, changing the elapsed time from “10 minutes” to the time required for “one loop volume turnover” when stepwise flow change is conducted.

The preliminary procedure of Revision 4 had a typo and an unnecessary Step which is supposed to conduct at the end of the test. The approved procedure of Revision 4 corrected a typo and deleted the unnecessary Step.

Even though the test started using the preliminary procedure of Revision 4 at a planed flow rate, the approved procedure was used before starting the changed test Step 6.2. Therefore, the test results were not affected by any of the changes made between the preliminary and the approved version of the test procedure, because the approved procedure was in use prior to reaching that portion of the procedure impacted by the changes.

Violation 99901453/2014-201-02(c)

The NRC requests that KHNP provide an evaluation of how the 2% dP change required by the acceptance criteria for cold leg break tests is achieved if the uncertainty of the dP change readings is greater than the 2% dP change. The information should be descriptive enough for the NRC staff to determine if KHNP considered the extent of condition, and for the NRC staff to determine the adequacy of the corrective actions that KHNP has initiated.

Response

The acceptance criteria for steady state pressure drops are two steps: first, the absolute value of the variation over the last 30 minute time interval is less than the uncertainty value ($[\quad]^{TS}$) of the pressure gauge, and second, the variation rate over the last 30 minute time interval is less than 2%.

These acceptance criteria are described in the test procedure, and the steady state pressure drops are confirmed at each test step. If the absolute value of the variation is less than the uncertainty, the variation rate is not accounted, because it is believed that there is no meaningful change in the pressure drops.

The required accuracy of the pressure gauge was set to the available head limit of

TS

Thus, the uncertainty ([]^{TS}) of the pressure gauge meets the required accuracy ([]^{TS}) for all the test conditions including the cold-leg break. When the uncertainty of the dP change readings is greater than the 2% dP change, the above acceptance criteria were followed also, because the uncertainty of the pressure gauge is less than the required accuracy.

Violation 99901453/2014-201-03

The NRC inspection team noted that the flow meter supplier's documentation stated that the flow measurements were not accurate in the low range used for the cold leg break tests. The NRC requests that KHNP provide more detail information as to how it was determined that the flow meter would provide accurate and repeatable information, when being used in a range the flow meter supplier's documentation indicated that it would not be accurate. The information should be descriptive enough for the NRC staff to determine if KHNP considered the extent of condition, and for the NRC staff to determine the adequacy of the corrective actions that KHNP has initiated.

Response

The accuracy and measurement range of flow meter used in the tests are described in Appendix C of the APR1400-K-A-NR-14001, "In-vessel Downstream Effect Tests for the APR1400." (see Enclosure 4)

The recalibrated certificate of the flow meter provides the deviations between the standard flow rate and the measured flow rate at a lower flow range used for the cold-leg break tests. The deviations meet the requirement according to the supplier, and the repeatability of the measurement is maintained.

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Therefore, the flow meter meets the required accuracy in the flow range used for the cold-leg break tests.

Violation 99901453/2014-201-04(b)

The NRC requests that KHNP provide the evaluation for the impact of bubbles impinging on the bottom nozzle on the validity of testing in response to the NOV, under the inspection report number and project number, when that portion of the

evaluation has been completed. The information should be descriptive enough for the NRC staff to determine if KHNP considered the extent of condition, and for the NRC staff to determine the adequacy of the corrective actions that KHNP has initiated.

Response

The impact of bubbles impinging on the bottom nozzle of the fuel assembly is described in Appendix D of the APR1400-K-A-NR-14001, "In-vessel Downstream Effect Tests for the APR1400." (see Enclosure 4)

Air bubbles in the test loop could have a negative effect on the pressure drops by the debris bed. However, the air bubbles disappeared at the initial step of the tests, when there was no debris bed, the effect of air bubbles on the test results is negligible.

Violation 99901453/2014-201-04(c)

During the inspection the NRC staff noted that KHNP did not define test anomalies in their procedures and did not have a separate procedure or process for test anomalies. Provide further detail as to how KHNP will be able to adequately implement this note. The information should be descriptive enough for the NRC staff to determine if KHNP considered the extent of condition, and for the NRC staff to determine the adequacy of the corrective actions that KHNP has initiated.

Response

KHNP established a procedure DC-DG-11-01, "Test Control," which provides requirements for the control of testing including test procedure and test report. It describes how deviations and anomalies should be addressed during a test to assure an acceptable test as follows:

- a. The guidelines on action to do with any deviations shall be provided.
- b. The project manager shall handle inadequate items in accordance with relevant procedures.
- c. The action taken with any deviations shall be included in the test report.

When the test anomalies are found or recorded in the test log, actions are taken according to the procedure QA-15-01-DC, "Control of Non-Conformance Report (NCR)," and, if necessary, it is entered into KHNP's Corrective Action Program (CAP).