
REVISED 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.: 175-8034
SRP Section: 05.04.12 – Reactor Coolant System High Point Vents
Application Section: 5.4.12
Date of RAI Issue: 08/20/2015

Question No. 05.04.12-1

10 CFR 50.46a, “Acceptance Criteria for Reactor Coolant System Venting Systems,” describes the criteria for acceptable high point vent systems. 10 CFR 50.34(f)(2)(vi) requires, in part, that high point vent operation does not lead to an unacceptable increase in LOCA probability or an unacceptable challenge to containment integrity. Furthermore, in Standard Review Plan (SRP) Section 5.4.12, Acceptance Criterion 1 states that the reactor coolant vent design must ensure that use of these vents during and following an accident does not aggravate the challenge to containment or the course of the accident.

DCD Tier 2, Section 5.4.12 states that the reactor coolant gas vent system (RCGVS) is designed to provide a “safety-grade” means of remotely venting noncondensable gases and steam. It only discusses flow paths to the in-containment refueling water storage tank (IRWST) except for Subsection 5.4.12.2.3, “Design Features for Minimization of Contamination,” which mentions a vent path to the nonsafety-related reactor drain tank (RDT). The only other Tier 2 information the staff could locate regarding RCGVS discharge to the RDT is in Subsection 9.3.4.2.8.3, “Chemical and Volume Control System Tanks,” which states that the RDT is designed to receive discharge from the RCGVS for a limited period. No details are provided on that “limited period.”

However, Section 2.4.5 of DCD Tier 1 does state that the safety function vent path is to the IRWST, while for the non-safety function during plant startup and shutdown, the vent path can be to the RDT or IRWST. Because DCD Tier 2 does not provide such a description, please clarify in DCD Tier 2, Section 5.4.12 when the paths to the IRWST and RDT are used, and distinguish between the safety-related and non-safety-related functions. This is necessary to ensure that the Tier 2 material regarding the high point vent system satisfies 10 CFR 50.46a and 10 CFR 50.34(f)(2)(vi).

Response - (Rev. 1)

In DCD Tier 2, Subsection 5.4.12 will be revised to clarify when the paths to the IRSWT and RDT are used and provide the non-safety function description.

Impact on DCD

In DCD Tier 2, Subsection 5.4.12 will be revised as indicated in the Attachment.

Impact on PRA

There is no impact on the PRA.

Impact on Technical Specifications

There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports

There is no impact on any Technical, Topical, or Environmental Report.

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5.4.12 Reactor Coolant System High Point Vents

The reactor coolant gas vent system (RCGVS) is used to discharge noncondensable gases and steam from the high point of the RCS for venting or pressure control during post-accident conditions.

Deleted

5.4.12.1 Design Bases

~~the RCGVS effluent from the pressurizer or the reactor vessel closure head is transported to the reactor drain tank (RDT) or the in-containment refueling water storage tank (IRWST) for the non-safety gas vent operation during plant startup and shutdown.~~

The RCGVS is designed to provide a safety-grade means of remotely venting noncondensable gases from the reactor vessel closure head and the pressurizer steam space during post-accident conditions. The RCGVS is also designed to provide a safety-grade means of remotely and selectively removing steam from the pressurizer steam space and/or the reactor vessel for RCS pressure control purposes in the event that pressurizer main spray and auxiliary spray are unavailable during non-LOCA design basis events. ~~In addition, the RCGVS is used for the noncondensable gases vent path during plant startup to fill the RCS.~~

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The reactor vessel closure head vent portion of the RCGVS is designed to provide sufficient venting capacity to vent a steam bubble formed in the reactor vessel closure head during a natural circulation cooldown analysis, assuming a single failure. Reactor vessel closure head vent flow isolation is possible, assuming a single failure.

The pressurizer vent portion of the RCGVS is designed to provide sufficient venting capacity to reduce pressurizer pressure consistent with plant cooldown requirements, assuming a single failure. Pressurizer vent flow isolation is possible, assuming a single failure.

The RCGVS equipment and piping from the reactor vessel closure head vent up to and including the second vent valve, and from the pressurizer up to and including second vent valve are designed as seismic Category I, Class 1E and designed, fabricated, erected, tested and maintained to high quality standards in accordance with ASME Section III, Class 1 requirements.

Each active RCGV valve is designed to be powered from the normal or the emergency power source. Power connections are through two independent power divisions so that in

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The RCGVS effluent from the pressurizer or the reactor vessel closure head is transported to the in-containment refueling water storage tank (IRWST) through the RCGVS sparger for the safety vent function. The IRWST provides a water reservoir to condense the steam effluent and collect the RCS discharge. The RCGVS effluent from the pressurizer or the reactor vessel closure head is transported to the reactor drain tank (RDT) or the IRWST for the non-safety gas vent operation during plant startup and shutdown.

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the event of an accident, in conjunction with a loss of normal power and a single failure of one emergency DC power division, a vent path from the pressurizer and the reactor vessel head can be established. The RCGV valves are remotely operated from the main control room and remote shutdown room.

Vent areas provide for mixing of the containment air. Swing panels at the top of the IRWST allow circulation of air for adequate mixing of any combustible gases with the containment atmosphere.

Venting does not adversely affect the performance of safety-related SSCs and does not aggravate the challenge to containment or the course of an accident.

The RCGVS is designed in accordance with the quality assurance acceptance criteria provided in Chapter 17.

The RCGVS satisfies applicable requirements and industry standards, including ASME Code classifications; 10 CFR 50.34(f)(2)(vi); 10 CFR 50.44; 10 CFR 50.46; 10 CFR 50.46a; 10 CFR 50.49; 10 CFR 50.55a; GDC 1, 14, 17, 19, 30, 34, and 36; and safety classifications and environmental qualifications.

5.4.12.2 System Design IRWST and the RDT.

RCGVS provides a means of venting noncondensable gases and steam from the pressurizer and the reactor vessel closure head to the ~~in-containment refueling water storage tank (IRWST)~~. The functions are as follows:

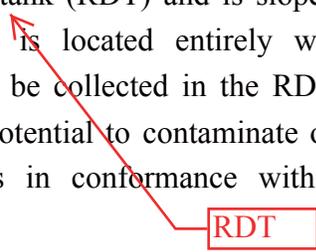
- a. RCGVS provides a safety-grade means of venting noncondensable gases and steam from the pressurizer and the reactor vessel closure head during post-accident conditions for non-LOCA design basis events.
- b. Safety-grade means to depressurize the RCS in the event that pressurizer main spray and auxiliary spray systems are unavailable.

c. RCGVS provides a non-safety gas vent operation from the pressurizer or the reactor vessel closure head during plant startup and shutdown.

APR1400 DCD TIER 2**5.4.12.2.3 Design Features for Minimization of Contamination**

The RCGVS is designed with features that meet the requirements of 10 CFR 20.1406 and NRC RG 4.21. The basic principles of NRC RG 4.21, and the methods of control suggested in the regulations, are delineated in four design objectives and two operational objectives, as described in Subsection 12.4.2.

The reactor coolant gas vent system consists of piping and valves that are located inside the containment. The RCGVS vents noncondensable gases from the pressurizer and the reactor vessel upper head and depressurizes the RCS in the event that the pressurizer main spray or auxiliary spray systems are unavailable during plant cool down. The piping directs the vented gases to the IRWST or the ~~reactor drain tank (RDT)~~ and is sloped to facilitate the drainage of condensation. As the system is located entirely within containment, any leakage from the system components will be collected in the RDT or IRWST inside containment. Hence, the RCGVS has low potential to contaminate other areas of the plant or the environment. This design is in conformance with the requirements of NRC RG 4.21.

**Prevention/Minimization of Unintended Contamination**

The RCGVS is designed to vent non-condensable gases from the pressurizer and the reactor vessel upper head and depressurizes the reactor coolant system in the event that the pressurizer main spray or auxiliary spray systems are unavailable during plant cooldown. The piping directs the vented gases to the IRWST or the RDT and is sloped to facilitate the drainage of condensation, thus minimizing leakage and unintended contamination of the facility and the environment.

Adequate and Early Leak Detection

The RCGVS is designed not to be used during normal operation, and the piping is designed to slope downward to drain to the RDT and the IRWST. The potential for leakage is very low and a leak detection system is not required.