Enclosure 1

MFN 08-652, Supplement 1

Response to Portion of NRC Request for

Additional Information Letter No. 278

Related to ESBWR Design Certification Application

DCD Tier 2, Section 3.9

Mechanical Systems and Components

RAI Numbers 3.9-201 S01

For historical purposes, the original text of RAI 3.9-201 and the GEH response are included. The attachments (if any) are not included from the original response to avoid confusion.

NRC RAI 3.9-201

NRC Summary:

Provisions for non-condensible gas in GDCS

NRC Full Text:

The collection of gas in the GDCS can cause binding or restriction of necessary injection flow, especially with only gravity head. In addition, gas might be released from the reactor coolant water as a result of depressurization following a LOCA and will coalesce at high points in the injection path. Discuss the provisions for high point vents in the GDCS lines, and address the need for Technical Specification surveillance requirements for monthly venting of the GDCS lines.

GEH Response

Gravity Driven Cooling System (GDCS) injection lines run from GDCS pools to Reactor Pressure Vessel (RPV) inlet nozzles, where the GDCS pool outlets are at higher elevation than the RPV inlet nozzles. DCD Tier 2, Figure 6.3-1 illustrates this relationship. There are four trains of injection lines for the GDCS. DCD Tier 2, Table 6.3-2 contains the minimum elevation change between the GDCS pool surface and the RPV nozzles that assure the pool outlet is higher than the RPV nozzles.

Each train of GDCS 8-inch injection line with an isolation valve, which begins from GDCS pool outlet, is routed down first making a 4-inch branch for deluge line and then two 6-inch branches for injection lines. Each 6-inch GDCS injection branch line pipe route makes a U-shape bottom loop at the lowest elevation before rising up to tie into the RPV nozzle. There is no elevated piping loop above GDCS outlet and RPV inlet nozzle levels.

The bottom section of each 6-inch pipe loop is at the lowest elevation with reference to GDCS pool outlet elevation and RPV nozzle inlet elevation. The bottom loop design prevents collection of non-condensable gases at the bottom of the injection line pipe.

A squib valve is located at the bottom of each U-shape pipe loop. There is an open check valve upstream of the squib valve and an open block valve downstream of squib valve. During normal operation the injection line squib valve stays closed and pipe legs on both sides of squib valve are filled with water. The water solid pipe leg from squib valve to RPV inlet nozzle prevents non-condensable gases entering into the pipe.

The GDCS injection line section from squib valve to GDCS pool is self-venting back to the pool, which is at the highest elevation of the system. Each GDCS pool is sufficiently vented to the drywell gas space.

There are two 1-inch test lines on each 6-inch injection pipe, one on each side of squib valve. Each test line has two isolation valves. It stays closed during normal operation. Test lines stay filled with liquid up to isolation valves. Test lines are for test/black flush during refueling outages.

High points between the pool outlets and the RPV inlet nozzles will not exist and ITAAC Item 24 in DCD Tier 1, Table 2.4.2-3 provides this assurance. Therefore, Technical Specification surveillance is not required for venting.

DCD Impact

No DCD changes will be made in response to this RAI.

NRC RAI 3.9-201 S01

Summary: GDCS venting gases

RAI Text:

In RAI 3.9-201, the NRC staff requested that GEH address the need for high point venting of gases that could collect in the GDCS lines, and might cause binding or restriction of necessary injection flow. In its response to this RAI (MFN 08-652), GEH stated that there are no high points in the GDCS piping where gases can collect, the GDCS piping is self-venting, and the presence of a water-filled loop seal in the piping prevents entry of gases. However, GEH did not address the possible volume of gas that might come out of solution when the water depressurizes. Gases that come out of solution will need to vent to either the GDCS pool or to the reactor vessel, during which time the GDCS may be required to inject flow. The NRC staff requests that GEH discuss the potential effects on GDCS injection flow from gases in the system and their consideration as part of the design process.

GEH Response

Gases created in the GDCS injection lines during depressurization will not cause any significant degradation in GDCS flow. As discussed in the response to RAI 21.6-112 (MFN 08-692, dated 9/17/08), any steam in the GDCS line will be condensed and any noncondensable gases will be swept out into the reactor pressure vessel. This is due to the large hydrostatic head that drives the GDCS flow and the steam condensing capacity of the GDCS flow.

The loop seal design of the GDCS, which prevents the collection of gases during normal operation, further assures that a cold leg upstream of the squib valve will exist to provide steam condensing capacity along with the GDCS pools. ITAAC Item 24 added to DCD Revision 5 Tier 1, Table 2.4.2-3 assures that the as-built piping installation for GDCS conforms to a design that allows venting of noncondensable gases to the GDCS pools and to the RPV to prevent collection in the GDCS injection pipes.

DCD Impact

No DCD changes will be made in response to this RAI.