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MFN 06-241

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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 34 Related to ESBWR Design Certification Application – Engineered Safety Features/Auxiliary Systems – RAI Numbers 6.3-3, 6.3-5 through 6.3-8, 6.3-10 through 6.3-25, 6.3-31, 6.3-33 through 6.3-37, and 9.3-24**

Enclosure 1 contains GE's response to the subject NRC RAIs transmitted via the Reference 1 letter.

If you have any questions about the information provided here, please let me know.

Sincerely,

Kathy Sedney for

David H. Hinds
Manager, ESBWR

D068

Reference:

1. MFN 06-198, Letter from U.S. Nuclear Regulatory Commission to David Hinds, *Request for Additional Information Letter No. 34 Related to ESBWR Design Certification Application,* June 22, 2006

Enclosure:

1. MFN 06-241 – Response to Portion of NRC Request for Additional Information Letter No. 34 Related to ESBWR Design Certification Application – Engineered Safety Features/Auxiliary Systems – RAI Numbers 6.3-3, 6.3-5 through 6.3-8, 6.3-10 through 6.3-25, 6.3-31, 6.3-33 through 6.3-37, and 9.3-24

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ENCLOSURE 1

MFN 06-241

Response to Portion of NRC Request for

Additional Information Letter No. 34

Related to ESBWR Design Certification Application

Engineered Safety Features/Auxiliary Systems

RAI Numbers 6.3-3, 6.3-5 through 6.3-8, 6.3-10 through 6.3-25,

6.3-31, 6.3-33 through 6.3-37, and 9.3-24

NRC RAI 6.3-3

Submit the P&ID for the GDCS.

GE Response

GDCS P&ID has been submitted. Please refer to MFN 06-107.

NRC RAI 6.3-5

A more detailed description is required to explain compliance with GDC 17. GDC 17 states: "An on-site electric power system and an off-site electric power system shall be provided to permit functioning of systems important to safety. The safety function of each system (assuming the other system is not functioning) shall be to provide sufficient capacity and capability ..." Confirm that the emergency core cooling systems (ECCS) have alternate sources of electric power as required by GDC 17, and must be able to withstand a single failure, with either of the power source. In the discussion about GDC-17, add a paragraph explaining the on-site or off-site power aspects related to ECCS. The discussion should include all ECCS including GDCS, standby liquid control system (SLCS), depressurization valves (DPVs) and automatic depressurization system (ADS).

GE Response

DC onsite power is used for ECCS. Requirements of GDC 17 are satisfied and are addressed in DCD Tier 2, Sections 8.1.5.2.4 and 8.3.1.2.1 and in Table 8.1-1. Section 8.1.5.2.4 will be revised to give further discussion on GDC 17. Table 8.1-1 will be updated to reflect that GDC 17 is addressed with DC on-site power.

The fourth paragraph in DCD Tier 2, Section 6.3 will be modified as follows.

"The top of ESBWR core remains covered during all anticipated operational occurrences (AOOs) and accident conditions. Therefore, the ESBWR ECCS meets the requirements of GDC 17 as it relates to the design of the ECCS having sufficient capacity and capability to ensure that specified acceptable fuel design limits and the design conditions of the reactor coolant pressure boundary are not exceeded during AOOs, and that the core is cooled during AOOs and accident conditions. Further discussion on GDC 17 is given in Sections 8.1.5.2.4 and 8.3.1.2.1.

Under DCD Tier 2, Section 8.1.5.2.4, General Design Criteria, GDC 17 bullet will be modified as follows.

- GDC 17, "Electric Power Systems" – Safety-related DC power sources are provided to support passive core cooling and containment integrity safety functions. No offsite or diesel-generator-derived AC power is required for 72 hours after an abnormal event.

GDC 17 row in Table 8.1-1 of DCD Tier 2 will be modified as follows.

Table 8.1-1
On-Site Power System SRP Criteria Applicability Matrix

Applicable Criteria	IEEE Standard	Notes	Off-site Power System	AC (On-site) Power System	DC (On-site) Power System
GDC 17			~~X~~	~~X~~	X

NRC RAI 6.3-6

Confirm that the GDCS, isolation condenser system (ICS), SLCS and ADS are physically, mechanically and electrically are separated. Address potential impact of fire and flood.

GE Response

GDCS, ICS, SLCS, and ADS are physically, mechanically, and electrically separated. Although the ICS and depressurization valves (DPV) of the ADS are attached to the same stub tube from the reactor vessel, they have their own inlet, and the stub tube does not contain a component that would adversely affect the DPV or ICS.

The impact of fire within containment is not credible, since containment is inerted during normal operation. Fire outside containment is addressed in Section 12 of NEDO-33201 Revision 1, submitted with MFN 06-171.

LOCA scenarios inside containment require ECCS components to function while either submerged in water or exposed to saturated steam conditions. ECCS is designed to withstand the effects of flooding. The associated controls with each system are located or protected so the effects of flooding do not adversely affect their function. All ECCS components are qualified to withstand the harsh environments that exist during a postulated LOCA. Flooding outside containment is addressed in Section 13 of NEDO-33201 Revision 1, submitted with MFN 06-171.

NRC RAI 6.3-7

Identify components shared between the ECCS and other systems (e.g. pools, coolant make up systems, etc.) that satisfy engineered safeguard feature design requirements and confirm that the ECCS function is not diminished as a result of sharing these components. For example, two of the four GDCS lines share one of the GDCS Pools. There may be other systems which share supporting systems.

GE Response

See table below for components being shared by ECCS systems and other systems, and their impact on ECCS functions.

ECCS System	Shared Component	Impact on ECCS Function
GDCS	Pipes from FAPCS used to provide make-up water and cleaning as needed for GDCS pools	Pipes dip into the GDCS pools from the top. Function of GDCS is not diminished.
	Pipes from PCCS discharge condensate into GDCS pools	Pipes dip into the GDCS pools from the top. Function of GDCS is not diminished.
	GDCS pool B/C has two GDCS injection lines	The loss of these injection lines does diminish the capacity of the other line, but GDCS as whole maintains the core covered during a LOCA – see DCD Tier 2 Section 6.3.1.1.1
ADS/ICS	ADS system has eight DPVs. Four of the DPVs are attached to four stub tubes that are attached to the reactor vessel which also have ICS supply inlets attached	Even though ICS steam supply line and inlet to DPV come off of the same stub tube at the RPV, there is no component located in this stub tube that would affect either or both ICS and DPV. From the tee at the stub tube, the ICS and DPV each have their own inlet.
SLCS	Does not share any components with any other system	

NRC RAI 6.3-8

DCD Tier 2, Section 6.3.1.1.2, Reliability Requirements

(a) Since GDCS and SLCS are being used as ECCS for the first time, a failure mode and effects analysis of the ECCS should be submitted for staff review.
(b) Identify the functional consequence of each possible single failure including the effects of any single failure or operator error that can cause any valve to move to a position that could adversely affect safety.
(c) Discuss the reliability requirements for the biased open check valve, squib actuated injection valve and the DPV.
(d) We understand that magnetically linking to a DC-torque motor is a unique design. Is there any test performed to verify that this design will perform as designed?
(e) We understand that squib actuated motor operated valves are used in the standby liquid control system for operating reactors. Describe the operating experience with the squib actuated valves, and its applicability to the squib valves that are used in the ESBWR design (GDCS, DPVs, and SLCS). Address design differences between ESBWR squib valves and operating reactor squib valves.

GE Response

(a) Both systems, GDCS and SLCS, are simple in design and consideration of failure modes and effects are evident in each of their system descriptions and functions. They do not contain pumps and have highly reliable squib valves for actuation. The SLCS has been designed with two branch lines with each containing two squib valves in parallel. The existing SLCS equipment that performs the ECCS function was already classified as safety related, Seismic Category I. For GDCS, design basis accidents have been analyzed with a GDCS line break in conjunction with a single failure of an injection line.

(b) ECCS systems are designed such that single failures do not impact overall performance of achieving their goals. Redundancy and independence are designed into each ECCS, which take into account single failures. All potential single failures are no more severe than those identified in Table 6.3-6. Each failure in Table 6.3-6 was evaluated. The functional consequence of a failure of a DPV or SRV to actuate is a delay in GDCS injection because of a reduction in the depressurization rate. The functional consequence of a failure of a GDCS injection valve to actuate is a reduction in the GDCS reflooding rate. Evaluation of these failures during a LOCA shows that there is adequate ECCS capacity. For further description, please see DCD Tier 2 Section 6.3.3.

(c) Component reliability data is provided in Section 5 of NEDO-33201 Revision 1, which has been previously supplied to the NRC in letter MFN 06-171.

(d) This feature does not perform a safety function and its ability to exercise the valve will be verified during surveillance testing. The development of magnetically linking a

DC torque motor will be accomplished as part of the valve procurement. Full testing will be required prior to shipment of the valve.

(e) In SLCS of operating plants, explosive charges are used to provide the driving force to actuate squib valves. The main differences between current operating squib valves in SLCS and ESBWR GDCS squibs and DPV squibs are size and nipple shear cap capture. Operating SLCS squib valves are 1.5 inches in diameter and the nipple shear cap is held down by the piston to prevent obstruction of flow. ESBWR DPVs are 12 inches in diameter and the nipple shear cap is hinged at the bottom (RPV pressure will be higher than drywell pressure and nipple shear cap will swing out of the flow stream once it is sheared off and rotate to a horizontal position because of gravity and upstream pressure and be retained by the hinge pin). ESBWR GDCS squib valves are 6 inches in diameter and the nipple shear cap is captured in a slightly v-shaped groove, which holds it in place. ESBWR SLCS squib valves will be of the same design used in operating BWR plants except they will have a larger valve body (the ESBWR SLCS injection line is three inches vs. 1.5 inches for the operating plants).

Clarification Note:
In reference to item (e) in the RAI text, the first sentence calls out "squib actuated motor operated valves…" Please note that there is no motor operation in squib actuated valves.

NRC RAI 6.3-10

DCD Tier 2, Section 6.3.2.1

(a) It is stated that "[t]he starting signal for the ECCS comes from independent and redundant sensors of low reactor water level." Please address the drywell high pressure sensors and a delay timer, in this section of the DCD.
(b) Can the GDCS timer be over-ridden?
(c) It is recommended that the following statement be revised from "[b]ecause ECCS flow is gravity driven, NPSH is not a concern" to "[b]ecause GDCS flow is gravity driven, NPSH is not a concern." The SLCS is not gravity driven, therefore the entire ECCS is not gravity driven.

GE Response

(a) The first paragraph in DCD Tier 2, Section 6.3.2.1 will be modified as follows.

"The starting signal for the ECCS comes from independent and redundant sensors ~~of low reactor water level~~as per Table 6.3-1, item B.1. The ECCS is actuated automatically and requires no operator action during the first 72 hours following the accident."

(b) The GDCS timer cannot be over-ridden.

(c) The last paragraph in DCD Tier 2, Section 6.3.2.1 will be modified as follows.

"Because ~~ECCS~~GDCS flow is gravity driven, NPSH is not a concern."

NRC RAI 6.3-11

DCD Tier 2, Section 6.3.2.7, GDCS
State the bounds within which principal GDCS parameters must be maintained in the interest of constant standby readiness, e.g. minimum coolant reserve in the GDCS pool, maximum number of inoperable valves in injection lines, equalizing and deluge lines, maximum allowable time period for which a component can be out of service.

GE Response

Section 3.5 in Chapter 16 of DCD Tier 2 states what equipment is allowed to be out of service and duration that it can be out of service. Standby readiness of the GDCS pool levels is a minimum height of 6.5 meters.

<u>NRC RAI 6.3-12</u>

DCD Tier 2, Section 6.3.2.7.2, Detailed System Description
On Page 6.3-8 it is stated that "[e]lectrical and mechanical separation between the divisions is complete." Since there are only three GDCS pools for four GDCS systems, mechanical separation between the divisions is not "complete". Revise and state the exception.

<u>GE Response</u>

GDCS injection line divisions B and C are both connected to GDCS pool B/C by sharing the pool wall and coolant inventory; pool B/C does not contain a component within it that directly connects divisions B and C. The same condition exists for the GDCS equalizing lines where all four divisions draw coolant from the suppression pool.

The following change to the first paragraph in DCD Tier 2, Section 6.3.2.7.2, under heading "Detailed Design Description" will be made.

"'The GDCS is composed of four divisions designated as Divisions A, B, C, and D. Electrical separation and mechanical train separation between the divisions is complete. The mechanical trains A and D draw water from independent pools designated as A and D and trains B and C draw water from a common pool designated as B/C~~The GDCS is composed of four divisions. Electrical and mechanical separation between the divisions is complete~~. Physical separation is ensured between divisions by locating each ~~division~~ train in a different area of the reactor ~~building~~containment. A single division of the GDCS consists of three independent subsystems: a short-term cooling (injection) system, a long-term cooling (equalizing) system, and a deluge line. The short-term and long-term systems provide cooling water under force of gravity to replace RPV water inventory lost during a LOCA and subsequent decay heat boil-off. The deluge line connects the GDCS pool to the lower drywell."

NRC RAI 6.3-13

DCD Tier 2, Section 6.3.2.7.2, Detailed System Description
On page 6.3-8, it is stated that "[t]he nozzle throat length is long enough to ensure that the homogenous flow model can be used in the LOCA analyses." Since the throat length is an important assumption in the LOCA analyses, throat length should be included in the ITAAC.

GE Response

The TRACG critical flow model accounts for break conditions (subcooled, two-phase, steam), and upstream and downstream pressures. Break geometry can be treated with the use of discharge coefficients. The TRACG model is empirically based but accounts for all relevant parameters and has been shown to be accurate by extensive comparisons to data. The nozzle throat length is not an assumption but is just one of the inputs in the LOCA analyses.

The nozzle throat length is determined by component design.

The fifth paragraph in Section 6.3.2.7.2 under heading "Detailed System Description" will be revised by deleting reference to the homogeneous flow model.

"The RPV injection line nozzles and the equalizing line nozzles all contain integral flow limiters with a venturi shape for pressure recovery. The minimum throat diameter of the nozzles in the short-term system is 76.2 mm (3 in) and the minimum throat diameter of the nozzles in the long-term system is 50.8 mm (2 in.). ~~The nozzle throat length is long enough to ensure that the homogeneous flow model can be used in LOCA analyses.~~ Each injection line and equalizing line contains a locked open, manually-operated maintenance valve located near the vessel nozzle and another such valve located near the water source."

NRC RAI 6.3-14

The operation of several timers is crucial to the actuation of various parts of the ECCS in the ESBWR. The ADS and the GDCS, including injection from the GDCS pool and the suppression pool, depend on elapsed time signals to accomplish their functions. Confirm that common mode failure in the hardware or software can not disable all the timers.

GE Response

Timers used for ADS and GDCS satisfy Branch Technical Position (BTP) HICB-19 (1997) referenced in NUREG 0800 SRP 7-A, which addresses NRC concerns with common cause failures in software-based reactor protection system (RPS) and engineered safety features (ESF) systems. Further discussions are provided in DCD Tier 2, Section 7.8.2, Common Mode Failure Defenses within Safety System Design.

<u>NRC RAI 6.3-15</u>

Squib valves and biased open check valves should also be included with the safety relief valves (SRVs) and the DPVs which will be tested during plant initial power ascension.

<u>GE Response</u>

The second and third paragraph in DCD Tier 2, Section 6.3.4.1 will be modified as follows.

"~~The SRVs and DPVs~~All ECCS safety related valves are ~~all~~ tested during plant initial power ascension per Regulatory Guide 1.68, Appendix A,~~.~~ except that the mechanical components of the ECCS squib type valves will be fully tested by the manufacturer prior to delivery to the site.

~~An ADS l~~Logic system functional test and simulated automatic operation of all ~~ADS~~ logic channels are to be performed at least once per plant operating interval between reactor refuelings. Instrumentation channels are demonstrated operable by the performance of a channel functional test and a trip unit calibration at least once per month and a transmitter calibration at least once per operating interval."

NRC RAI 6.3-16

DCD 6.3.5 Instrumentation Requirements, Page 6.3-24
It is recommended that "[t]he GDCS is automatically initiated on low reactor water level" be changed to "[t]he GDCS is automatically initiated on low reactor water level plus high drywell pressure."

GE Response

The level needed to initiate only on reactor water level must be lower than the level needed with high drywell pressure or delay timer. See Table 6.3-1 for values associated with the different levels and initiating signals. A reference to Table 6.3-1 will be added to the last paragraph of DCD Tier 2, Section 6.3.5.

"~~The GDCS is automatically initiated on low reactor water level. The ADS is automatically actuated by sensed variables for reactor vessel low water level. The GDCS flow into the RPV begins when reactor pressure decreases below the GDCS pool pressure plus its gravity head.~~The ECCS initiating signals are shown in Table 6.3-1."

NRC RAI 6.3-17

Table 6.3-2
Specify the total GDCS pool volume, in addition to the minimum inventory indicated.

GE Response

The total GDCS pool volumes at low water level, the change in elevation from reactor injection nozzles to the pool surfaces, and the total drainable volume will be specified in Table 6.3-2, DCD Tier 2. See table below.

Table 6.3-2

GDCS Design Basis Parameters

Parameter	Value
Number of separate/independent GDCS divisions	4
Per division, number of (short-term core cooling injection) lines from its GDCS pool	1
Per division, number of injection line RPV nozzles	2
Per division, number of equalizing line RPV nozzles	1
Total inventory (for 3 GDCS pools) at GDCS pool low water level	1830 m^3 (64626 ft^3)
Minimum total drainable inventory (for 3 GDCS pools) at GDCS pool low water level of 6.5 meters	~~1760~~ 1746 m^3 (61659~~62,150~~ ft^3)
Minimum elevation of GDCS pool surfaces above the RPV nozzles, at GDCS pool low water level	13.5~~13.3~~ m (44.3~~43.6~~ ft)
Minimum long-term core cooling flow delivered by the GDCS equalizing lines for a minimum ΔP of 9.12 kPa (1.32 psid) across the equalizing lines	22.7 m^3/s (100 gpm)
Minimum flow through the deluge lines required to flood the lower drywell region	70 kg/sec (1541 m/sec)*
Minimum available suppression pool water inventory 1 meter above TAF with 1.0 m of equalizing line driving head	799~~334~~m^3 (28216~~11,800~~ ft^3)
Minimum GDCS equalizing line driving head	1.0 m (3.3 ft)

* Core melt scenario instead of ECCS performance evaluation scenarios.

NRC RAI 6.3-18

The following important parameters given in DCD Tier 2, Table 6.3-2 should be incorporated into the ITAAC in DCD Tier 1, Table 2.4.2-1:
(a) Minimum total drainable inventory (for 3 GDCS pools): 1760 cubic meters
(b) Minimum long term core cooling flow delivered by the GDCS equalizing lines for a delta P of 1.32 psid across the equalizing lines: 100 gpm
(c) Minimum flow through the deluge lines required to flood the lower drywell region: 70 kg/sec
(d) Minimum available suppression pool water inventory: 1 meter above top of active fuel (TAF), 334 cubic meters
(e) Minimum GDCS equalizing line driving head: 3.3 feet

GE Response

The level of detail requested is beyond the intent of what is needed to assure the system will perform as required. There are ongoing discussions with the industry and the NRC as to the content that is required in Tier 1. When such requirements are settled upon, each system in Tier 1 may go through a thorough review to satisfy the agreed upon requirements.

NRC RAI 6.3-19

DCD Tier 1, Table 2.4.2-1, ITAAC Item # 2
The calculated flow resistance between each GDCS pool line and the reactor vessel need to be specified in the acceptance criteria for item # 2. (8 injection lines, 4 equalizing lines and 12 deluge lines between each GDCS pool and the reactor vessel, the suppression pool and the drywell floor).
Include the tests for the deluge line flow to the drywell floor.

GE Response

See response to RAI 6.3-18.

NRC RAI 6.3-20

DCD Tier 1, Table 2.4.2-1, ITAAC item # 2 describes the open reactor vessel flow test, but the flow rate required for the test in not specified in the acceptance criteria. Please specify the required flow rate.

GE Response

See response to RAI 6.3-18.

NRC RAI 6.3-21

DCD Tier 1, Table 2.4.2-1, ITAAC item # 3, 4 and 5 specify the parameters such as flow coefficient and minimum flow to be tested, but there is no value specified in the acceptance criteria. Please specify values for the acceptance criteria.

GE Response

See response to RAI 6.3-18.

NRC RAI 6.3-22

DCD Tier 1, Table 2.4.2-1, ITAAC item # 6, add reactor pressure vessel (RPV) Level 0.5 and the lower drywell high temperature 1000 degrees F in the acceptance criteria.

GE Response

See response to RAI 6.3-18.

NRC RAI 6.3-23

Add the following items to DCD Tier 1, ITAAC Table 2.4-2:
Inspection of the elevation of all the GDCS pools and suppression pool will be conducted.
The elevation of the bottom inside pool surface is higher than the direct vessel injection nozzle centerline by the specified value.

GE Response

See response to RAI 6.3-18.

NRC RAI 6.3-24

DCD Tier 1, Section 2.4.2 ECCS - GDCS, Design Description
(a) Specify the location of the system
(b) Add equipment to be qualified for harsh environment

GE Response

See response to RAI 6.3-18.

NRC RAI 6.3-25

Add the following to DCD Tier 1, ITAAC Table 2.4.2-1:
(a) Divisional power supplies
(b) Physical Separation

GE Response

See response to RAI 6.3-18.

<u>NRC RAI 6.3-31</u>

The SRP Section 6.3, Revision 2, April 1984, states that "The ECCS design is reviewed to confirm that there are provisions for maintenance of the long-term coolant recirculation and decay heat removal systems, e.g; pump or valve overhaul, in the post LOCA environment (including consideration of radioactivity)."
Confirm that the above item is not applicable for the ESBWR design.

<u>GE Response</u>

Decay heat removal post LOCA for the ESBWR is provided by the Passive Containment Cooling System (PCCS), which does not utilize pumps or valves. DCD Tier 2, Section 6.2.2 provides a description of PCCS.

NRC RAI 6.3-33

Add a paragraph describing the interaction between GDCS and passive containment cooling system (PCCS), and address the following:

(a) What are the normal water levels in the pools? What will the GDCS pool level be after the LOCA? Is there a limit to the GDCS pool drainage during a LOCA?

(b) When an equilibrium is reached between the reactor decay heat and the condensate flow rate from the PCC, what will the level be in the GDCS pools?

GE Response

(a) The normal water level in the GDCS pools is 6.6 m from the pool bottom, which is at an elevation of 17.5 m from the RPV 0.0. The GDCS pools could drain down to the elevation at the suction of the GDCS drain lines, which is 0.3 m from the pool bottom.

The post-LOCA GDCS pool level depends on the type of pipe break and the break elevation. For bottom drain line break or GDCS drain line break where the break elevation is below the GDCS pool bottom, most of the initial water inventory will drain into the RPV and the post-LOCA GDCS pool level is at the elevation of the drain line suction. For main steam line break or feedwater line break where the break elevation is above the GDCS pool bottom, the post-LOCA level in the GDCS pools reaches an equilibrium with the RPV downcomer level, which is at the elevation of the break location in the RPV.

(b) When an equilibrium is reached between the reactor decay heat and the condensate flow rate from the PCC, the level in the GDCS pools will also approach the post-LOCA elevation. The post-LOCA GDCS pool level depends on the type of pipe break and the break elevation as discussed in (a).

DCD Section 6.3 will be revised in the next update to include the above discussions.

NRC RAI 6.3-34

If the same batch pyrotechnic booster charge is used for all the squib valves in the GDCS injection and equalizing lines, there is a potential for common mode failure. We understand that a different batch is used for squib valves in the deluge lines. For diversity and defense in depth, different batches of booster charges may be needed. This may be COL action item.

GE Response

The GDCS injection and equalizing squib valves will be required to use different booster batches in order to minimize common mode failure.

The following change in paragraph three, under heading "Squib Valves," Section 6.3.2.7.2 will be made.

"Valve actuation initiates upon the actuation of either of two squib valve initiators, a pyrotechnic booster charge is ignited, and hot gasses are produced. To minimize the probability of common mode failure, the injection line squib valve pyrotechnic booster charge will be from a different batch than from the batch used in equalizing line squib valves. When these gasses reach a designed pressure, a tension bolt holding a piston breaks allowing the piston to travel downward until it impacts the ram and nipple shear caps. Once the piston impacts the ram and nipple shear caps, the nipples are sheared. The ram and shear caps are then driven forward and are locked in place at the end of stroke by an interference fit with the nipple retainer. This lock ensures that the nipples cannot block the flow stream and provides a simple means of refurbishment by simply unthreading the plug. A switch located on the bottom of the valve provides a method of indication to the control room of an actuated valve. The shear nipple sections are designed to produce clean shear planes."

NRC RAI 6.3-35

On drawing 105E4038 (GDCS P&ID), Note 6, use of the term "GDCS Gravity line" is not consistent with Chapter 6 of the design control document (DCD) that refers to "GDCS injection line." Which terminology is correct?

GE Response

The terminology within the P&ID is self-consistent. GDCS gravity line and GDCS injection line are interchangeable terms. Note 6 is placed on the injection line on the P&ID.

NRC RAI 6.3-36

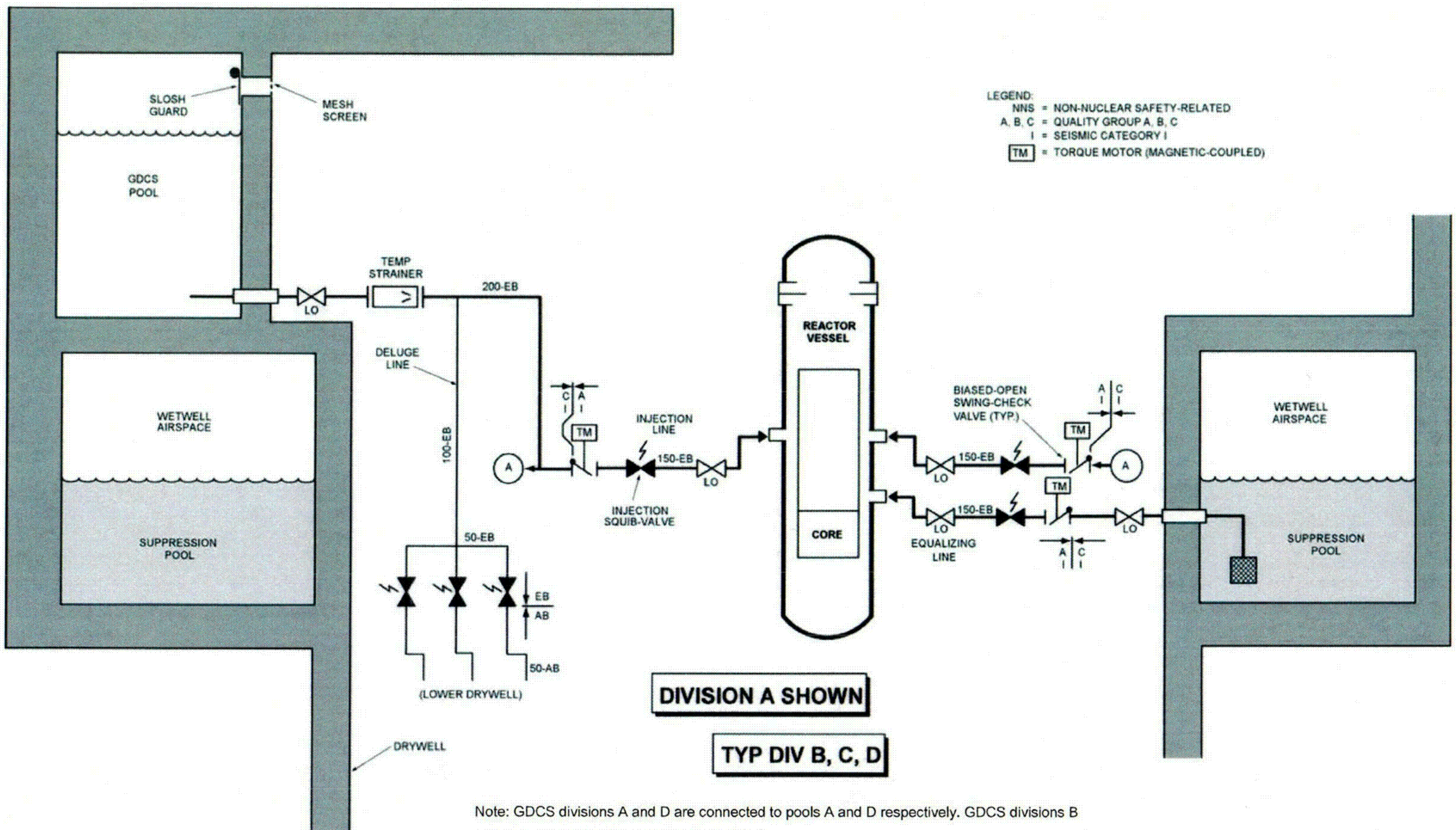
DCD Tier 1, Figure 2.4.2-1 and DCD Tier 2, Figure 6.3-1 are not in agreement with the GDCS P&ID. The DCD figures state that Division A, shown, is typical of Divisions B, C, and D. This is not precise since one of the GDCS pools shares two injection lines. Please clarify the DCD figures.

The staff proposes to add the following note to these DCD figures: "Two of the three pools (A and D) contain one RPV injection line. The third GDCS pool (B/C) contains two independent RPV injection connections."

GE Response

The GDCS Figure 2.4.2-1 in DCD Tier 1 and Figure 6.3-1 in DCD Tier 2 will be modified with the following note, see attached figure.

"GDCS divisions A and D are connected to pools A and D respectively. GDCS divisions B and C are connected to a common pool (B/C)."



Note: GDCS divisions A and D are connected to pools A and D respectively. GDCS divisions B and C are connected to a common pool (B/C).

NRC RAI 6.3-37

Regarding Note 12 of Drawing 105E4038 (GDCS P&ID) what is the purpose of the additional interconnecting lines between the GDCS pools?

GE Response

The interconnecting lines provide a path for water clean-up and make-up if necessary by the Fuel and Auxiliary Pool Cooling System (FAPCS). The FAPCS draws water from pools A and D and returns water to pool B/C. Water cascades from pool B/C into pools A and D.

NRC RAI 9.3-24

The control system that engages the SLCS differs from conventional designs of boiling water reactors. A depressurization valve (DPV) opening signal is also used to initiate the SLCS.
This logic is in place to increase core coverage in the event of a loss of coolant accident (LOCA). If both SLCS trains are activated, a total of approximately 5000 gallons of borated water would be injected into the core. Discuss the resulting increase in level that this volume of water would provide in the vessel annulus and above the core.

GE Response

The total water volume injected into the RPV by the SLCS is about 15.6 m^3. For a vessel inside diameter of 7.1 m, this total water volume will cover a height of 0.4 m. This is the estimated increase of the collapsed water level in the downcomer and chimney regions. The resulting increase in collapsed level will be less than 0.4 m, because some of the injected SLCS water will be carried out of the RPV by the rapid depressurization due to DPV opening.

No change to the DCD is needed.