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Subject: **Response to Portion of NRC Request for Additional Information Letter No. 81 Related to ESBWR Design Certification Application, Safety-Related Sensor Locations, RAI 14.3-99, Supplement 1**

Enclosure 1 contains GEH's response to Supplement 1 to the original NRC RAI transmitted via the Reference 1 letter.

If you have any questions or require additional information regarding the information provided here, please contact me.

Sincerely,

Kathy Sedney for

James C. Kinsey
Project Manager, ESBWR Licensing

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NRO

Reference:

1. MFN 06-462, Letter from U.S. Nuclear Regulatory Commission to David Hinds, *Request for Additional Information Letter No. 81 Related to ESBWR Design Certification Application,* November 14, 2006

Enclosure:

1. MFN 07-003, Supplement 1, Response to a Portion of NRC Request for Additional Information Letter No. 81, Related to ESBWR Design Certification Application, Safety-Related Sensor Locations, RAI Number 14.3-99 S01

cc:

AE Cubbage	USNRC (with enclosures)
DH Hinds	GEH (with enclosures)
RE Brown	GEH (w/o enclosures)
eDRF	0000-0069-7670

ENCLOSURE 1

MFN 07-003, Supplement 1

Response to a Portion of NRC Request for,

Additional Information Letter No. 81,

Related to ESBWR Design Certification Application,

Safety-Related Sensor Locations

RAI Number 14.3-99 S01

NRC RAI 14.3-99

Section 2.16.8 Turbine Building: No ITAACs have been specified for the structure as safety related portion of the Main Steam resides in the Turbine building. Please provide the ITAACs for the building structure protecting the Main Steam System.

Response to RAI 14.3-99

The Main Steam system transitions from safety-related (Safety Class 2) to non-safety related (N) at the seismic interface restraint in the Reactor Building as indicated in Tier 2, Revision 2, Chapter 3, Table 3.2-1 (B21 and N11) and Table 3.2-2. As such, the portion of the Main Steam system residing in the Turbine Building is nonsafety-related. There are, however, safety-related sensors mounted near or on the turbine stop valves, turbine control valves, turbine bypass valves, and vacuum sensors near the condenser that interface with the reactor protection system.

Additional design description (DD) and an ITAAC will be added to Tier 1, Subsection 2.16.8 per the attached proposed change.

NRC RAI 14.3-99 S01

In response to RAI 14.3-99 (MFN-06-520, dated December 22, 2006), the applicant stated that the safety-related sensors are mounted on or near nonsafety-related piping and structures. Since the failure of nonsafety-related structures, systems and components could impact safety-related sensors, the staff requests to demonstrate how they will protect the safety-related components, i.e., sensors that are mounted on nonsafety-related systems including how the system is to be protected?

Response to RAI 14.3-99 S01

Safety-related sensors are mounted on or near nonsafety-related piping and structures in the Turbine Building. The Turbine Building included in the ESBWR standard plant design is nonsafety-related. The (Turbine Building) structure is designed to prevent a failure of the structure that would impair the ability of nearby safety-related SSCs, including safety-related sensors, from performing their function. This subject was addressed in the original response to this RAI. This supplemental response addresses the failure of nonsafety-related piping and systems in the Turbine Building that have the potential to adversely impact the safety-related function(s) of safety-related sensors. This potential adverse effect is mitigated by the fail-safe design of the sensors and their respective control systems to provide safety system protection.

The following is a list of safety-related sensors located in, or potentially located in, the Turbine Building:

- Condenser Pressure transmitters (RPS),
- Turbine Bypass Valve limit switches (RPS),
- Main Stop Valve limit switches (RPS),
- Undervoltage Sensor on the power generation bus (RPS),
- Turbine Control Valve (fast closure) hydraulic pressure transmitters (RPS),
- Main Steam Line turbine inlet pressure transmitters (LD&IS), and
- Main Steam Line leak detection in the Turbine Building (LD&IS),

The sensors in the above list that are included in the safety-related Reactor Protection System (RPS) are identified with the acronym "RPS" in parentheses at the end of the respective sensor description. The sensors in the above list that are included in the safety-related Leak Detection and Isolation System (LD&IS) are identified with the Acronym "LD&IS" at the end of the respective sensor description. The RPS and LD&IS systems are addressed separately in this evaluation.

Reactor Protection System

RPS equipment is designed to provide a reliable means of automatically or manually initiating a reactor scram. RPS equipment is designed to fail into a trip-initiating state on loss of power, loss or disconnection of any input signal, or loss of any internal or external device-to-device connection signal (see DCD Tier 2 Subsection 7.2.1.2.4). In addition, the RPS is designed to provide reliable single-failure-proof capability to automatically or

manually initiate a reactor scram while maintaining protection against spurious scrams resulting from single failures. This is accomplished through the combination of fail-safe equipment design, four redundant channels for trip decision logic, and the redundant two-out-of-four trip systems output scram logic. Based on the above discussion, safety-related functions of the RPS system sensors are protected by the system's fail-safe design in the event of a failure of proximal nonsafety-related systems.

Leak Detection and Isolation System

Two of the sensors in the list above are included in the safety-related Leak Detection and Isolation System. The system's primary function is to detect and isolate the source of a leak from the reactor coolant pressure boundary to prevent radioactive releases to the environment. LD&IS design utilizes various measurements and redundant instrument channels to detect and monitor reactor coolant leakage in and external to the containment. The logic for this isolation utilizes a two-out-of-four coincidence voting logic technique to initiate the isolation functions. This design provides reliable safety functions while minimizing inadvertent isolation events.

This system is designed similar to the RPS in that the system architecture includes four redundant divisional channels that are a fail-safe design (see Tier 2 Subsection 7.3.3.3). LD&IS isolation logic is in an energized state under normal conditions. Isolation functions are initiated in the de-energized state. Thus, isolation functions associated with the LD&IS system are initiated in the affected channels on the loss of an input signal from a connected sensor. Accordingly, the failure of nonsafety-related systems or components, that can potentially damage LD&IS sensors, will not prevent the LD&IS from performing the safety related function of initiating a reactor scram.

Conclusion

The safety-related sensors in the Turbine Building are included in either the Reactor Protection System or the Leak Detection and Isolation System. The safety-related Reactor Protection and Leak Detection and Isolation System sensors in the Turbine Building are protected from the failure of nonsafety-related systems by the fail-safe design and architecture of the respective systems. Inadvertent reactor scrams and isolation events are also minimized by the design and implementation of these systems.

Sensors that monitor reactor neutron flux and reactor vessel pressure are provided in the safety-related Reactor Building. These sensors perform a safety-related function of initiating a reactor scram whenever monitored process variables exceed or fall below their specified trip setpoints. Additional diversity and defense-in-depth is provided by these sensors. Anticipated Operational Occurrences and other infrequent events that normally utilize safety-related sensors in the Turbine Building (listed above) to initiate a scram are backed-up by the above sensors in the Reactor Building.

The fail-safe nature of the RPS and LD&IS systems, as described above, allows safety-related sensors to be mounted on or near nonsafety-related systems in the turbine building without the need for physical protection or barriers.

DCD Impact:

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