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Subject:Response to Portion of NRC Request for Additional Information Letter No. 101 Related to ESBWR Design Certification Application, Regulatory Treatment of Non-Safety Systems (RTNSS) RAI Numbers 22.5-2 through 22.5-4, 22.5-6 and 22.5-15.

The purpose of this letter is to submit the GE-Hitachi Nuclear Energy Americas LLC (GEH) response to the U.S. Nuclear Regulatory Commission (NRC) Request for Additional Information (RAI) sent by NRC letter dated June 21, 2007 (Reference 1). The information in this letter supports the NRC review of the GEH application for final design approval and standard design certification of the Economic Simplified Boiling Water Reactor (ESBWR) standard plant design pursuant to 10 CFR Part 52. The responses to those questions are addressed in Enclosure 1 as RAI Numbers 22.5-2 through 22.5-4, 22.5-6 and 22.5-15.

Should you have any questions about the information provided here, please contact me. At 910-675-5057 or jim.kinsey@ge.com.

Sincerely,

Kathy Sedney for

James C. Kinsey
Project Manager, ESBWR Licensing

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NRO

Reference:

1. MFN 07-357, Letter from U.S. Nuclear Regulatory Commission to Robert E. Brown, *Request for Additional Information Letter No. 101 Related to ESBWR Design Certification Application,* June 21, 2007.

Enclosure:

1. Response to Portion of NRC Request for Additional Information Letter No. 101 Related to Regulatory Treatment of Non-Safety Systems (RTNSS) RAI Numbers 22.5-2 through 22.5-4, 22.5-6 and 22.5-15.

cc:	AE Cubbage	USNRC (with enclosure)
	GB Stramback	GEH/San Jose (with enclosure)
	RE Brown	GEH/Wilmington (with enclosure)

EDRF Section	0000-0072-0042 Rev 1	NRC RAI 22.5-4
	0000-0071-6013	NRC RAI 22.5-15
	0000-0072-03077	NRC RAI 22.5-2, 3 and 6

Enclosure 1

MFN 07-419

Response to Portion of NRC Request for

Additional Information Letter No. 101

Related to ESBWR Design Certification Application

Regulatory Treatment of Non-Safety Systems (RTNSS)

RAI Numbers 22.5-2 through 22.5-4, 22.5-6 and 22.5-15

NRC RAI 22.5-2

In MFN 07-066 (response to RAI 19.1.0-2), Enclosure 1, Table 3, the Turbine Component Cooling Water System (TCCWS) is identified as a RTNSS system to provide support for room cooling for Reactor Component Cooling Water System pumps. In Revision 3 of DCD Chapter 19, Table 19A-2, TCCWS is not identified as a RTNSS system. Please clarify that TCCWS is a RTNSS system or justify the position that TCCWS is not a RTNSS system.

GEH Response

TCCWS is not a RTNSS system. In MFN 07-066 (response to RAI 19.1.0-2), Enclosure 1, Table 3, TCCWS was identified as a RTNSS system; however, this classification was based on an assumption that TCCWS was required to cool the Turbine Building HVAC (TB HVAC) system. The assumption was made conservatively because the design details for TB HVAC had not yet been developed as of the issuance date of MFN 07-066 (January 30, 2007.) At the time of submittal of Revision 3 of DCD Chapter 19 (April 2007), the design details for TB HVAC were developed enough to determine that TB HVAC is cooled by the Chilled Water System. Therefore, DCD Tier 2 Chapter 19 Revision 3 was revised to state that the Chilled Water System is a RTNSS system and the TCCWS system is not a RTNSS system.

DCD Impact

There is no impact to Revision 4 of DCD Chapter 19.

NRC RAI 22.5-3

In MFN 07-066 (response to RAI 19.1.0-2), Enclosure 1, Table 1, the High Pressure Nitrogen Supply System (HPNSS) is identified as a safety system credited in the probabilistic risk assessment (PRA) sensitivity study. However, DCD Tier 2 Section 9.3.8, Revision 3, and Section 19A.6.1.2.1, Revision 3, identify HPNSS as a nonsafety-related system. Please clarify the safety/nonsafety designation of HPNSS and describe any RTNSS related functions and interfaces.

GEH Response

The High Pressure Nitrogen Supply System (HPNSS) is a nonsafety-related system. HPNSS provides nitrogen to the Safety/Relief Valve and Main Steam Isolation Valve accumulators to store the necessary gas volume and pressure to ensure that the safety-related functions can be performed. This function was originally modeled in the ESBWR PRA as an HPNSS basic event, and was set to "True" (that is, failed), in accordance with the focused PRA methodology. The function of charging the accumulators is not an active function and is not a post-accident function. Therefore, HPNSS does not provide a RTNSS function.

Revision 3 of DCD Tier 2 Section 19 was corrected to reflect the fact that HPNSS does not meet RTNSS criteria.

DCD Impact

There is no impact on Revision 4 of DCD Tier 2 Section 19.

NRC RAI 22.5-4

Section 19A.8.4.9 and Table 19A-2, as well as MFN 07-066, Enclosure 1, Table 3, identify the diesel generators as RTNSS systems. The staff notes that each diesel generator is an independent system complete with support systems to include the fuel oil storage and transfer system, jacket cooling water system, starting air system, lubrication system, and combustion air intake and exhaust system. It is not clear that GE considers these supporting systems as RTNSS systems. Please address the following:

A. Identify the augmented design standards to be provided for these support systems to assure reliable performance in the event of hazards (i.e., seismic events, high winds, and flooding).

B. Revise Sections 9.5.4 through 9.5.8 to clearly specify availability controls for these support systems.

GEH Response

The ESBWR standby diesel generators are designated Regulatory Treatment for Nonsafety-Related Systems (RTNSS) because they are required to provide power for post-accident monitoring (RTNSS Criteria B2) and power for FAPCS and support systems (RTNSS Criteria C). The RTNSS designation is also applied to the standby diesel generator support systems required for the diesel generators to perform this function. These support systems include fuel oil storage and transfer system, jacket cooling water system, starting air system, lubrication system, and combustion air intake and exhaust system.

A. The augmented standards associated with each RTNSS function are provided in DCD Tier 2 Appendix 19A, Regulatory Treatment for Nonsafety-Related Systems (RTNSS).

   The requirements that must be met for the standby diesel generator and the standby diesel support systems include the following:

   The Diesel Generators must:

   1) Function following a seismic event or following a high wind event (e.g. Cat 5 hurricane) when analyzed using International Building Code (IBC) Seismic Use Group III criteria. This is to support operation of the safety related DCIS for post 72 hour monitoring.

   2) Be located above the flood elevation specified for the certified design.

   3) Have redundant trains of active components that are physically and electrically separated to provide power to run FAPCS in SPC or LPCI mode (non-seismic PRA sequences). For those systems integral to the diesel, redundancy requirements are satisfied by having a separate, independent diesel unit.

B. DCD Appendix 19A provides the level of oversight, availability controls and additional details for the standby diesel generator support systems. The proposed regulatory treatment of RTNSS systems is summarized in Table 19A-2. A mark-up of DCD Appendix 19A was transmitted via MFN 07-373. This markup describes the categorization of RTNSS SSCs and the augmented design requirements associated with those categories.

DCD Impact

The following subsections of DCD Chapter 9 Tier 2 Revision, 4, have been revised to identify the standby diesel generator support systems as RTNSS and reference DCD Appendix 19A for detailed requirements as shown in the attached markup.

9.5.4 Diesel Generator Fuel Oil Storage and Transfer System

9.5.5 Diesel Generator Jacket Cooling Water System

9.5.6 Diesel Generator Starting Air System

9.5.7 Diesel Generator Lubrication System

9.5.8 Diesel Generator Combustion Air Intake and Exhaust System

NRC RAI 22.5-6

Table 19A-2 identifies systems that are classified as RTNSS based upon the RTNSS criteria. The table lists no non-safety related structures that should be included as RTNSS based on Criterion B consideration. Confirm that the ESBWR design does not contain non-safety related structures, that either support or surround the RTNSS systems, whose failure may negatively affect the RTNSS system functions. If there are such structures, explain why they are not addressed within the table.

GEH Response

DCD Tier 2 Table 19A-2 lists the ESBWR systems that meet RTNSS criteria for regulatory oversight. The structures that house the systems and components that meet RTNSS criterion B1 or B2 are required to be meet specific seismic, wind, and flooding design standards. The augmented design requirements for structures containing Criterion B1 and B2 RTNSS systems were addressed in MFN 07-373, Section 19A.8.3. The systems and components that meet RTNSS criteria other than B1 and B2 are listed below, with a description of the design capability of their supporting structures. In each case, the minimum structural design rating is Category II.

System or Function	RTNSS Criterion	Structures	Seismic Category
Alternate Rod Insert	A	Reactor Building	I (II in stair towers and elevator shafts)
BiMAC	C	Containment	I
Diverse Protection System	C	Reactor Building, Control Building	I (II in stair towers and elevator shafts)
Drywell Hatches	C	Reactor Building	I (II in stair towers and elevator shafts)
FAPCS	C	Fuel Building, Reactor Building	I (II in Fuel Bldg HVAC penthouse, stair towers and elevator shafts)
Fuel Bldg HVAC	C	Fuel Building	HVAC Components – I and II; Building - I (II in HVAC penthouse, stair towers and elevator shafts)
Feedwater Runback	A	Reactor Building, Control Building	I (II in stair towers and elevator shafts)
SLCS Actuation	A	Reactor Building, Control Building	I (II in stair towers and elevator shafts)

DCD Impact

There is no impact on the DCD.

NRC RAI 22.5-15

Section 19A.2.1, ATWS Assessment, states that most of SLCS [Standby Liquid Control System] is safety-related and therefore has sufficient regulatory oversight. Please clarify the portions of the SLCS that are non-safety related, and the regulatory oversight (i.e., treatment) specified for those components. Discuss the basis for the determination that regulatory oversight of the SLCS is sufficient with portions of the SLCS categorized as non-safety related.

GEH Response

The Standby Liquid Control (SLC) system, which is discussed in DCD Tier 2 Subsection 9.3.5, is safety-related and therefore has regulatory oversight. The statement reading, "Most of SLCS is safety-related and therefore has sufficient regulatory oversight" has been removed from DCD Tier 2 Subsection 19A.2.1.

SLC does have nonsafety-related portions. These portions include the subsystem for nitrogen charging of the accumulators, and the subsystem for boron mixing and makeup of the accumulators. These systems are not required for SLC to perform its safety-related function. They are used to maintain SLC readiness. The functions of these systems are monitored in Technical Specifications and are not required to be RTNSS.

DCD Impact

DCD Tier 2, Subsection 19A.2.1 will be revised in Revision 4. The content of the revision was transmitted to the NRC Staff as Attachment 1 of MFN 07-073, dated July 15, 2007) as a markup of DCD Appendix 19A.

ATTACHMENT 1

NRC RAI 22.5-4
DCD Section Markups

9.5.4 Diesel Generator Fuel Oil Storage and Transfer System

9.5.5 Diesel Generator Jacket Cooling Water System

9.5.6 Diesel Generator Starting Air System

9.5.7 Diesel Generator Lubrication System

9.5.8 Diesel Generator Combustion Air Intake and Exhaust System

9.5.4 Diesel Generator Fuel Oil Storage and Transfer System

9.5.4.1 Design Bases

Safety (10 CFR 50.2) Design Bases

The diesel generator fuel oil storage and transfer system is not safety-related and has no safety-related design basis.

The diesel generator fuel oil storage and transfer system has Regulatory Treatment of Non-Safety Systems (RTNSS) functions as a supporting system to provide power. Performance of RTNSS functions is assured by applying ~~requirements for redundant trains, physical and electrical separation of trains, seismic requirements, and ability to withstand Category 5 hurricane missiles and flood protection. Appendix 19A provides the level of oversight and additional requirements to meet the RTNSS functions.~~ the augmented design standards described in DCD Section 19A.8.3.

The diesel generator fuel oil storage and transfer system piping and components supporting the RTNSS functions meet the requirements for Category B2 RTNSS as described in Section 19A.8.3.~~of the International Building Code (IBC) Seismic Use Group III.~~

Power Generation Design Bases

Each DG is supplied by a separate fuel oil system. The diesel generator systems are standby power supply systems. The fuel oil and transfer systems for the diesel generators design bases are as follows:

- Provide day tank of sufficient capacity to supply fuel oil to the DG for a minimum of 8 hours of operation at full load;
- Provide a long-term fuel oil storage capacity (fuel oil storage tank) sufficient to support continuous Diesel operation for a minimum of 7 days without refueling. The use of the Diesel Generators for peaking service will not challenge the 7 day fuel oil supply reserves for diesel generator operation relative to plant investment protection or RTNSS functions;
- Ensure adequate separation between the two Diesel Generators Systems including their auxiliary and fuel oil supplies so that failure in one DG does not incapacitate the other diesel-generator;
- Provide protection against contamination of the ground or ground water through failure of tanks [EA1]or buried piping;
- The diesel engine is designed to be compatible with the use of low and ultra-low sulfur diesel fuel;
- Diesel Fuel tanks will be designed in accordance with State and Federal regulations for required berm holding requirements; and[ndrr2]
- The Diesel Fuel tanks will provide fuel to the Auxiliary Boiler system and Fire Protection System.

9.5.5 Diesel Generator Jacket Cooling Water System

9.5.5.1 Design Bases

Safety (10 CFR 50.2) Design Bases

The DG jacket cooling water system is not safety-related and has no safety design basis.

The diesel generator jacket cooling water system has Regulatory Treatment of Non-Safety Systems (RTNSS) functions as a supporting system to provide power. Performance of RTNSS functions is assured by applying requirements for Category B2 RTNSS as described in Section 19A.8.3.

~~redundant trains, physical and electrical separation of trains, seismic requirements, and ability to withstand Category 5 hurricane missiles and flood protection. Appendix 19A provides the level of oversight and additional requirements to meet the RTNSS functions.~~

Power Generation Design Bases

A separate jacket cooling water system supplies each DG.

The DG jacket cooling water system is self-contained and sized to meet the full load cooling demands of the diesel-generator.

9.5.5.2 System Description

Summary Description

The diesel generator manufacturer shall specify the design of the DG jacket water system. A simplified diagram of a typical DG jacket cooling water system is shown in Figure 9.5-10.

The DG systems are standby power supply systems. The DG jacket cooling water system is a self-contained, closed-loop system that circulates cooling water through the diesel engine, to maintain system operating temperature. The jacket cooling water, which picks up heat from the operating engine is cooled as it circulates through the jacket water heat exchanger. The system incorporates a keep-warm system to maintain the diesel in a pre-warmed state while in the standby mode to support required engine start times.

Detailed System Description

Each DG unit is supplied with a complete closed-loop cooling system mounted integrally with the engine-generator package. Included in each cooling package are a jacket water heater and keep warm pump, temperature regulating valve, lube oil cooler, jacket water pumps, a manifold, a head tank and a jacket water heat exchanger. The JW heat exchanger rejects engine heat to the Reactor Component Cooling Water System (RCCWS). RCCWS water supply is from the same train as that of the DG served. In addition to the engine (jacket and head), the jacket water cools the turbocharger, the governor, the engine air coolers, the exhaust manifold and the lube oil cooler. However, depending upon the engine manufacturer, the above components may vary slightly.

The installed electric heater is designed to keep the engine jacket water at a manufacturer recommended standby temperature.

9.5.6 Diesel Generator Starting Air System

9.5.6.1 Design Bases

Safety (10 CFR 50.2) Design Bases

The DG starting air auxiliary system is not safety-related and has no safety design basis.

The diesel generator starting air system has Regulatory Treatment of Non-Safety Systems (RTNSS) functions as a supporting system to provide power. Performance of RTNSS functions is assured by applying requirements for Category B2 RTNSS as described in Section 19A.8.3.

~~redundant trains, physical and electrical separation of trains, seismic requirements, and ability to withstand Category 5 hurricane missiles and flood protection. Appendix 19A provides the level of oversight and additional requirements to meet the RTNSS functions.~~

Power Generation Design Bases

Each DG is supplied by a separate starting air system. The DG systems are standby power supply systems. The DG starting air system meets the following design bases:

- Provides a supply of compressed air for starting the generator diesel engines without external power; and
- Starting Air Receivers have sufficient air storage capacity for three consecutive starts of the engine and perform the starting function so that the DG meets the readiness criteria defined in Subsection 8.3.1- Onsite AC Power Systems.

9.5.6.2 System Description

Summary Description

Each system includes two air compressors, air receiver(s), and redundant air admission valves. When standby DG electric power is required, the air admission valves are opened to initiate engine cranking.

The diesel generator manufacturer provides the DG air starting system design. A simplified diagram of a typical DG air starting system is provided in Figure 9.5-11

Detailed System Description

Each of the two standby DGs is provided with its own starting air system, consisting of two redundant 100% capacity air compressors, air receiver, a 100% capacity air dryer, associated piping, and valves. Two redundant starting air valves, one in each engine starting air manifold, are provided for each engine. Failure of one valve does not affect the ability of the other valve to start the engine.

The air compressors are motor driven. Each compressor is equipped with appropriate moisture removal equipment. The air receiver(s) are sized so each air starting system has sufficient capacity for cranking its engine for three automatic starts without recharging. Each air receiver

is provided with an automatic drain trap at the receiver bottom to remove any water accumulated in the tank.

9.5.7 Diesel Generator Lubrication System

9.5.7.1 Design Bases

Safety (10 CFR 50.2) Design Bases

The DG lubrication system is not safety-related and has no safety design basis.

The diesel generator lubrication system has Regulatory Treatment of Non-Safety Systems (RTNSS) functions as a supporting system to provide power. Performance of RTNSS functions is assured by applying requirements for Category B2 RTNSS as described in Section 19A.8.3.

~~redundant trains, physical and electrical separation of trains, seismic requirements, and ability to withstand Category 5 hurricane missiles and flood protection. Appendix 19A provides the level of oversight and additional requirements to meet the RTNSS functions.~~

Power Generation Design Bases

Each DG is supplied by a separate lubrication system. The DG lubrication system supplies clean filtered oil to the engine bearings at controlled pressure and temperature.

9.5.7.2 System Description

Summary Description

The DG includes a self-contained lubrication system including lube oil sump tank, circulating pump, filtering elements, and a cooler. The system filters the lubricating oil and delivers it at controlled pressure and temperature to the engine and generator bearing surfaces. Built-in lube oil storage capacity ensures adequate lubrication of wearing surfaces and cooling as necessary. An electric heater and a keep-warm circulating pump continuously circulate warm oil to maintain the engine in standby readiness. This keep-warm system is not required for the engine to perform its function.

The diesel generator manufacturer supplies the lubrication system as part of the engine design. A simplified diagram of a typical DG lubrication system is provided in Figure 9.5-12.

Detailed System Description

Each of the two DG lubrication systems consists of an oil sump in the engine frame, an engine-driven positive displacement pump, a cooler, a main header, strainer, and filters. The main engine-driven lube oil pump takes oil from the lube oil sump tank, passes it through the lube oil cooler and lube oil filter, through a strainer, through the main header, through the lube oil loads and back to the lube oil sump tank. The lubrication system (LO) system also supplies oil to the combustion air turbochargers . Pressure-regulating valves maintain constant oil pressure to the main header by bypassing excess oil back to the lube oil sump tank. The system is manufacturer designed to provide engine lubrication of moving surfaces and to remove engine heat.

Each lube oil cooler is built to TEMA Class C or Industry Standards as per the engine manufacturer. Cooling water for the coolers -is from the DG jacket cooling water system.

The DG sets have lube oil heating systems to keep the oil warm during standby. An electric lube oil heater heats the oil, which is then circulated through the engine oil circuit by a motor-driven keep-warm circulating pump. The keep-warm system circulates oil through a filter to ensure

9.5.8 Diesel Generator Combustion Air Intake and Exhaust System

9.5.8.1 Design Bases

Safety (10 CFR 50.2) Design Bases

The DG combustion air intake and exhaust system is not safety-related and has no safety design basis.

The diesel generator air intake and exhaust system has Regulatory Treatment of Non-Safety Systems (RTNSS) functions as a supporting system to provide power. Performance of RTNSS functions is assured by applying requirements for Category B2 RTNSS as described in Section 19A.8.3.

~~redundant trains, physical and electrical separation of trains, seismic requirements, and ability to withstand Category 5 hurricane missiles and flood protection. Appendix 19A provides the level of oversight and additional requirements to meet the RTNSS functions.~~

Power Generation Design Bases

Each DG is supplied by a separate air intake and exhaust system.

The DG systems supply standby electric power. The DG combustion air intake and exhaust system is designed to meet the following design bases:

- Provide a supply of combustion air for operating the diesel engines;
- Prevent ingress to the diesel engines of contaminating substances that could degrade the diesel engine performance;
- Provide a diesel engine exhaust system capable of exhausting the products of combustion to the atmosphere; and
- Federal, State and Local Air Quality Emission Standards.

9.5.8.2 System Description

Summary Description

Each DG is provided with a separate intake and exhaust system. The combustion air intake and exhaust system supplies filtered air for engine fuel combustion. The system also exhausts engine combustion products out of the DG enclosure to the atmosphere. It includes intake and exhaust silencers to ensure quiet engine operation.

The diesel generator manufacturer supplies the DG air intake and exhaust system as part of their engine design. A simplified diagram of a typical -DG air intake and exhaust system is provided in Figure 9.5-9 .

Detailed System Description

Each engine takes combustion air from its own cubical in the DG room. Air enters the cubical through the outside wall and is filtered before entering the air intake plenum (which may be integral to the turbocharger). Combustion air is drawn from the intake plenum through an air intake silencer (which may be integral to the turbocharger) and then is drawn into the engine

turbocharger(s) which discharges through an intercooler into the diesel engine combustion air manifold.