June 29, 1992

Docket No. 52-001

Mr. Patrick W. Marriott, Manager
Licensing & Consulting Services
GE Nuclear Energy
175 Curtner Avenue
San Jose, California 95125

Dear Mr. Marriott:

SUBJECT: CONFIRMATORY AND OPEN ITEMS IDENTIFIED IN THE FINAL SAFETY EVALUATION REPORT (FSER) FOR CHAPTER 12, "RADIATION PROTECTION," AND CHAPTER 14, "INITIAL PLANT TEST PROGRAMS"

The staff is developing the FSER for Chapters 12 and 14 of the GE Nuclear Energy (GE) Advanced Boiling Water Reactor (ABWR) Standard Safety Analysis Report (SSAR). We have identified 19 preliminary confirmatory items where the staff and GE have reached tentative agreement. We have also identified 5 preliminary open items where the staff and GE have not reached consensus. For each item, an amendment to the SSAR or revised inspections, tests, analyses and acceptance criteria, or additional information is required for complete closure.

Enclosed for your information is a summary of these confirmatory and open items.

Please contact me at (301) 504-1125 if you need additional information on these issues.

Sincerely,
Original Signed By:
Son Q. Ninh, Project Engineer
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Enclosure:
As stated

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12 RADIATION PROTECTION

The DSER identified two important areas where current operational BWR experience had not been adequately addressed in the ABWR design. These areas are the dose rates in the upper drywell during the transfer of irradiated (spent) fuel assemblies (SFA), and exposures resulting from a complete withdrawal of the traversing incore probe (TIP).

GE has provided a draft revision to the SSAR, dated March 26, 1992, that includes additional information concerning the radiation protection design features of the ABWR TIP system. These features include a shielded room for the TIP drive units with a separate shielded room for the parked TIP. Additional shielding is provided for the parked TIP probe and its drive cable to allow personnel to enter this room with the TIP out of the reactor. Also, the TIP drive units have an electro-mechanical switch that cuts power to the drive spooler to prevent the activated portions of the TIP from being completely withdrawn into the drive housings. These features are designed such that radiation exposures resulting form TIP operations, and related abnormal operational occurrences (AOOs), can be maintained ALARA. Therefore, they are acceptable to the staff.

This is a confirmatory item pending a verification that the SSAR is amended consistent with the March 26, 1992, submittal.

The potential for creating extremely high dose rates in the upper drywell from dropping a SFA onto the reactor vessel flange was also identified in the DSER as an area where current BWR experience was not adequately accounted for in the ABWR design. Individuals in the upper drywell during this AOO could receive potentially lethal radiation doses before they could evacuate the area. GE has acknowledged that current BWR designs are inadequate to ensure radiation protection during this AOO, and recommended the use of a shielded bridge arrangement (also known as a cattle chute) as a fix. GE issued two generic information letters on this subject in 1973 and 1980. Due to concerns over inadequate implementation of GE's recommended fix by operating BWRs, the NRC augmented its inspection program in 1987 to direct inspectors attention to

this area. Backfitting a shielded bridge onto existing BWR was accepted by the staff as a solution to this AOO. However, this solution only reduces the probability of high dose rates during this AOO, it does not completely eliminate the possibility. As discussed in Section 12.3.2 of this FSAR, GE has not provided an acceptable resolution for this concern. In response to the staff's question regarding how the ABWR design ensures protection of personnel in the drywell from the intense radiation resulting from a dropped SFA, GE provided details of a draft revision to the upper drywell shielding. The staff's review of this proposed modification indicates that the revised design would be inadequate to prevent personnel from receiving potentially lethal doses during this AOO.

As discussed in Section 12.3.2 below, this remains an open item.

12.2.3 Interfaces

Section 12.2.3 of the SSAR identifies two issues concerning compliance with 10 CFR Parts 20 and 50, and the determination of gamma shine from the turbine building, as plant interfaces. It is the staff's position that these issues are incorporated in the DAC discussed in Section 12.2.2 above. During a conference call following the February 27, 1992, meeting on plant interfaces, GE agreed to amend the SSAR and appropriately characterize these issues. This is a confirmatory issue pending a review of the amended SSAR.

The DSER identified several deficiencies related to the Chapter 12 figures 12.3-1 through 12.3-73 that depict plant radiation zones (during normal operations, normal shutdown and accident conditions) and area radiation monitor locations. GE has amended the SSAR to provide more legible figures for the reactor, control and radwaste buildings. These updated figures also indicate the normal controlled and uncontrolled access routes to the plant as well as the access/egress routes to plant vital areas under accident conditions. On April 13,1992, and May 1, 1992, GE provided draft revised copies of the reactor and turbine building figures. The revised figures resolved the

inconsistencies between the turbine building figures noted in the DSER. This is a confirmatory item pending a review of a corresponding amendment to the SSAR.

An open item identified in the DSER is the adequacy of the shielding in the upper drywell. The biological shield surrounding the reactor vessel (depicted in Figures 12.3-23 and 24) does not cover a significant portion of the top of the reactor vessel. As noted in Section 12.1, a fuel handling mishap resulting in dropping a SFA across the reactor flange is a significant radiological hazard in BWRs. In addition to the radiological hazard presented by this AOO, it appears that raising an irradiated fuel bundle in proximity of the vessel wall could result in significant radiation dose rates in the upper drywell. On July 29, 1991, GE provided details of a proposed design change to the shielding in the upper drywell. This design change would raise the biological shield, to within four inches of the upper drywell ceiling. The staff's evaluation of this proposal indicated that the revised design would provide sufficient shielding during the normal withdrawal of SFAs from the reactor. However, a dropped SFA resting across the reactor flange would still produce significant radiation streaming into the upper drywell. Personnel in the upper drywell during this AOO could still receive lethal radiation doses before they could escape. The staff concludes that the ABWR design as described in the SSER , and as revised by the July 29, 1991, memorandum, is inadequate to ensure radiation protection during this event, and is not acceptable. During a management meeting held on March 25-26, 1992, in San Jose, GE committed to revise the upper drywell shielding to resolve this issue.

This remains an open item pending a review of the revised design.

The DSER also identified an open item concerning the shielding of the TIP system. As discussed in 12.1.2 above, TIP drive and storage are located in separate shielded rooms. However, the conduit which guides the TIP from the reactor to its storage, is virtually unshielded. This conduit shares the primary containment penetration with the lower drywell personnel access. Personnel located at the lower drywell access hatch, or in the access tunnel,

would be exposed to the unshielded activated TIP and drive cable as they are retracted from the reactor core. On March 26, 1992, GE provided a draft SSAR amendment that discusses the radiation design features associated with the TIP system. This amendment notes that the lower drywell access is located in a separate shielded room that can be locked to prevent access to these areas while the TIP is being withdrawn from the core. In addition, flashing alarms at the door to this room and at the lower drywell access hatch are provided to warn personnel when power is applied to the TIP drives. Also, the TIP system operates such that TIP withdraw is in the high speed mode which will minimize the transit time of the activated components through the unshielded portions of the system. These features ensure that the personnel radiation exposures resulting from the operation of the TIP system can be maintained ALARA, and are acceptable to the staff. This is a confirmatory item pending a review of the SSAR amendment consistent with the March 26, 1992, memorandum.

12.3.5.3 Radiation Design Features

In addition to the radiation protection features addressed in the DAC above, Chapter 12 of the SSAR describes several features that are incorporated into the ABWR design to ensure that radiation doses to operators and the public are within the limits of 10 CFR Part 20 and are ALARA. These features include the limited use of cobalt bearing components in the reactor water systems; the use of titanium main condenser tubing; remote back-flushing capability on all filter-demineralisers; the use of seamless piping, butt-welds,and straight through valves where practicable, to eliminate crud traps; the use of an electro-mechanical switch on the TIP drive and the TIP warning alarm at the lower drywell access;and the fittings on the RWCU, RHR, and RIP heat exchangers to facilitate decontamination. GE has not completed its submittal of the ABWR Tier 1 design description and ITAAC. Therefore, the staff has not verified that these features are included in this Tier 1 documentation. This is an open item pending a satisfactory review of the completed ABWR Tier 1 documentation.

14 INITIAL PLANT TEST PROGRAMS

14.2.7 Conformance of Test Program With Regulatory Guides

Section 14.2.7 states that the NRC Regulatory Guides (RGs) that were used in the development of the initial test program are listed in Section 14.2.7 and the applicable tests comply with these RGs. The applicable revisions to these RGs are listed in Table 1.8-20.

Based on its review of Section 14.2.7 of the SSAR for the DSER, the staff determined that GE needed to add additional references to Rgs. In its letter of May 20, 1991, GE agreed to amend the ABWR SSAR to include the following items:

(a) Include RG 1.95, "Protection of Nuclear Power Plant Control Room Operators Against an Accidental Chlorine Release," in accordance with SRP Section 14.2.

(b) Include RG 1.139, "Guidance for Residual Heat Removal," in accordance with SRP Section 14.2.

(c) Document the applicable revision number of each RG listed in Section 14.2.7 or reference Table 1.8-20 of the SSAR. Amend the SSAR so that Section 14.2.7 will reference Table 1.8-20 for the applicable revision numbers of the listed RG.

(d) Correct the reference to RG 1.68.3, "Preoperational Testing of Instrument and Control Air Systems," contained in Table 1.8-20 of the SSAR or Section 14.2.7, as appropriate, to Revision 0, issue date of April 1982.

The staff verified that GE made the required changes (a), (b), and (c) to Amendment 18 of the SSAR. The required change (d) above was made by markup submitted on March 11, 1992. The staff finds this item acceptable subject to incorporation of item (d) into a future SSAR revision. This is a confirmatory item.

The staff will evaluate the acceptability of this section when the confirmatory material listed above is incorporated into a future SSAR revision.

Staff Evaluation of Previous Open Items

Based on the staff's review of Section 14.2.11 for the DSER, the staff has determined that this section of the SSAR should be modified to include the following:

(a) A figure that illustrates the power-flow operating map.

GE indicated that SSAR Figure 4.4-1 illustrates the power flow operating map, however, the staff stated in the DSER that this figure does not provide sufficient detail regarding test condition identification to determine that each startup test is conducted at appropriate power-flow conditions in accordance with RG 1.68, Appendix A.5.

The staff determined GE subsequently submitted a power-flow operating map Figure 14.2-1 that provides an appropriate indication of test conditions and a table of startup tests Table 14.2-1. The staff finds this item acceptable subject to incorporation into a future SSAR revision. This is a confirmatory item.

(b) A table that lists the startup tests and states at which test condition(s) each test is to be conducted.

During the staff's review of Section 14.2.11 for the DSER, the SSAR did not contain the table identified in (b) above.

The staff determined that Table 14.2-1, lists the startup tests and states at which test condition(s) each test is to be conducted. With the power-flow operating map Figure 14.2-1 provides the requested information in accordance with RG 1.68, Appendix A.5. The staff finds this item acceptable subject to incorporation into a future SSAR revision. This is a confirmatory item.

The staff determined that the level of detail in the test abstracts is insufficient to determine conformance with RG 1.68, Position C.2. The individual test abstracts in Subsections 14.2.12.1.1, 14.2.12.1.7, 14.2.12.1.11, 14.2.12.1.12, 14.2.12.1.13, 14.2.12.1.18, 14.2.12.1.21, 14.2.12.1.22, 14.2.12.1.43, 14.2.12.1.45.1, 14.2.12.1.45.2, 14.2.12.1.45.3, 14.2.12.1.45.4, 14.2.12.1.53, 14.2.12.1.59, 14.2.12.1.67, 14.2.12.1.68, and 14.2.12.1.69 do not specify basic systems required to be available, interface systems, or criteria required as prerequisite or initial conditions for the preoperational tests. GE should address specific prerequisites in these individual test abstracts. This item remains open.

(b) The use of the word "should" in most, if not all test abstracts, is not a commitment by GE to perform certain tasks. It should, therefore, be reevaluated and revised accordingly (i.e., "will," "must").

The staff verified that GE incorporated the word change from "should" to either "will" or "shall" into most test abstracts. The staff finds this item acceptable subject to incorporation into a future SSAR revision. This is a confirmatory item.

GE has indicated that Chapter 14 of the SSAR was written primarily to document the appropriate testing commitments contained in RG 1.68. GE indicated that precise acceptance criteria would be provided as part of the ITAAC effort.

The staff determined that GE has not provided this information in ITAAC or in the SSAR Chapter 14. This item remains open.

(d) Section 14.2.12.2 states that failure to satisfy some acceptance criteria (e.g., those related to values of process variables important to plant design) will result in the plant being placed in a suitable hold position until resolution is obtained, while failure to satisfy other acceptance criteria (e.g., expectations relating to system performance) may only result in the need for further data analysis.

The distinction between these types of acceptance criteria is unclear. GE

should clearly address in Section 14.2.12.2 the various types of acceptance criteria and the resultant actions for each type if unsatisfactory test results are obtained.

GE has stated in Section 14.2.12.2, "Specific actions for dealing with criteria failures and other testing exceptions or anomalies will be described in the startup administrative manual."

This response is not acceptable. Thirty-three of thirty-five individual test abstracts in Section 14.2.12.2 do not specify the required actions or precautions for dealing with criteria failures and other testing exceptions or anomalies. GE has not modified Section 14.2.12.2 or the individual test abstracts to address the subject acceptance criteria or actions. This item remains open.

The staff verified that GE revised Section 14.2.13 to state that the RG 1.68 Position C.1 criteria will be used to make the determination of any testing that is currently specified for systems that are not essential for demonstrating conformance with the aforementioned criteria. The staff finds this item acceptable subject to incorporation into a future SSAR revision. This is a confirmatory item.

14.2.12.3 Conformance of the ABWR with RG 1.68 Revision 2

The staff's review of the preoperational and startup test phase descriptions disclosed that the operability of several of the systems and components listed in RG 1.68 may not be adequately demonstrated by the tests described in the SSAR.

Staff Evaluation of Previous Open Items

The staff determined that GE should either expand the test descriptions to address the following items, insert cross-references in Section 14.2.12 if complete test descriptions for the following items are provided elsewhere in the ABWR SSAR, or modify Section 14.2.7 or Table 1.8-20 of the SSAR, as

appropriate, to provide technical justification for any exception to RG 1.68, Rev. 2. Thus the following items should be reflected in a subsequent amendment to the SSAR. (Note: Each item is numbered in accordance with RG 1.68 Revision 2).

1.a.(2)(d) Supports and restraints for discharge piping of SRVs

GE stated in its response dated May 20, 1991, that a statement has been added to Section 14.2.12.1.1 indicating that testing of SRV discharge piping supports and restraints is specifically covered by that testing described in SSAR Section 14.2.12.1.51.

The staff verified that cross-references SSAR Sections 3.9.2.1 and 5.4.14.4 were incorporated into Section 14.2.12.1.51. These references were evaluated in Chapters 3 and 5 respectively. The staff finds this item acceptable subject to incorporation into a future SSAR revision. This is a confirmatory item.

4(k) Steam driven plant auxiliaries and power conversion equipment.

The staff verified that Section 14.2.12.2 was revised to add Subsection 14.2.12.2.39 which addresses testing of steam and power conversion systems. The staff finds this item acceptable subject to incorporation into a future SSAR revision. This is a confirmatory item.

5(n) Reactor coolant system loose parts monitoring system.

The staff verified that Section 14.2.12.2 was revised to add Subsection 14.2.12.2.36 which addresses loose parts monitoring system baseline data collection. The staff finds this item acceptable subject to incorporation into a future SSAR revision. This is a confirmatory item.

5(w) Demonstration that concrete temperatures surrounding hot penetrations do not exceed design limits with the minimum design capability of cooling system components available.

The staff verified that Section 14.2.12.2 was revised to add Subsection 14.2.12.2.37 which addresses concrete penetration temperature surveys. The staff finds this item acceptable subject to incorporation into a future SSAR revision. This is a confirmatory item.

5(c)(c) Demonstration that gaseous and liquid radioactive waste processing, storage, and release systems operate in accordance with design.

The staff verified that Section 14.2.12.2 was revised to add Subsection 14.2.12.2.38 which addresses radioactive waste system testing. The staff finds this item acceptable subject to incorporation into a future SSAR revision. This is a confirmatory item.

14.2.12.4 TMI Items

Staff Evaluation of Previous Open Items

Section 1A.2.4 of the SSAR states that testing described in Chapter 14 is consistent with the BWR Owner's Group response to Item I.G.1 of NUREG-0737 as documented in a letter dated February 4, 1981, from D. B. Waters to D. G. Eisenhut. The staff determined Section 14.2.12 test abstracts that describe testing outlined in Appendix E of this letter should be identified or modified accordingly.

GE stated in its response dated May 20, 1991, that testing outlined in Appendix E of the referenced document is specified in the following test abstracts: 14.2.12.1.1(3)(a), 14.2.12.1.9(3)(j) and 14.2.12.1.44(3)(a).

The staff verified that GE revised the test abstracts 14.2.12.1.1(3)(a), 14.2.12.1.9(3)(j) and 14.2.12.1.44(3)(a) to include a reference to Section 1A.2.4 and revised 1A.2.4 to discuss the requirements of Item I.G.1 of NUREG-0737 Appendix E applicable to the initial test program. The staff finds this item acceptable subject to incorporation into a future SSAR revision. This is a confirmatory item.

14.2.12.5 Conformance with Other RGs

Staff Evaluation of Previous Open Item

The staff determined that Subsection 14.2.12.1.19, "Reactor Water Cleanup System Preoperational Test," Section 14.2.12.1.54, "Condensate Cleanup System Preoperational Test," and Section 14.2.12.2.21, "Reactor Water Cleanup System Performance," should address the concerns of RG 1.56, "Maintenance of Water Purity in Boiling Water Reactors."

GE stated in its response dated May 20, 1991, that RG 1.56 deals mainly with design related issues, specifically the equipment and instrumentation needed to assure proper BWR reactor water chemistry. Subsections 14.2.12.1.19, 14.2.12.1.54 and 14.2.12.2.21 describe preoperational and power ascension testing that is adequate to demonstrate proper performance of the reactor water clean-up system and the condensate filter/demineralizer system in assuring that acceptable reactor water chemistry is maintained. Subsection 14.2.12.1.22 describes the preoperational testing intended to demonstrate the proper functioning of the instrumentation required by RG 1.56. Likewise, Subsection 14.2.12.2.1 verifies that a proper reactor water chemistry monitoring program is in place.

The staff verified that Subsections 14.2.12.1.22 and 14.2.12.2.1 were revised to more specifically address functioning of conductivity meters, which are a major focus of RG 1.56. The staff finds this item acceptable subject to incorporation into a future SSAR revision. This is a confirmatory item.

The staff determined that Subsection 14.2.12.2.14, "Feedwater Control," should address the following items in accordance with RG 1.68.1, "Preoperational and Initial Startup Testing of Feedwater and Condensate Systems for Boiling Water Reactor Power Plants:"

(a) Modify the test description to provide for demonstration of the operability of the feedwater system at low reactor power (less than or equal to 15 percent reactor power) (R.G.1.68.1.C.2.a).

GE stated in its response dated May 20, 1991, such testing is already specified in the current description.

The staff verified that the test matrix identified Feedwater System Performance and Feedwater Control System Adjustment/Confirmation tests to be performed at the Nuclear Heat-Up and Low Power testing plateaus. The staff finds this item acceptable subject to incorporation into a future SSAR revision. This is a confirmatory item.

(a) RHR system isolation (RG 1.139.C.2).

GE stated in its response dated May 20, 1991, that the applicable demonstrations were intended to be a part of the testing described in Subsection 14.2.12.1.8(3)(i).

The staff verified that the testing description in Subsection 14.2.12.1.8 was revised to specifically address testing of features designed to assure isolation of low pressure portions of the RHR system from RCS at high pressure. The staff finds this item acceptable subject to incorporation into a future SSAR revision. This is a confirmatory item.

(b) RHR system pressure relief (R.G.1.139.C.3).

GE stated in its response dated May 20, 1991, that the design of the RHR system includes the relief capability and capacity required by the above referenced position, in accordance with the applicable ASME code. GE has indicated that the verification of the proper setting of relief valves is a vendor bench test required per the same ASME code, and thus no specific additional preoperational test is needed.

The staff verified that Subsection 14.2.12.1.8 was revised to allow for verification of proper setpoint of system relief valves per ASME code requirements (including those intended to meet the requirements of RG 1.139 using the results of vendor tests and the appropriate documentation of such). The staff finds this item acceptable subject to incorporation into a future SSAR revision. This is a confirmatory item.