GE Nuclear Energy

General Electric Company
175 Curtner Avenue, San Jose, CA 95125

May 28, 1993

Docket No. STN 52-001

Chet Poslusny, Senior Project Manager
Standardization Project Directorate
Associate Directorate for Advanced Reactors
and License Renewal
Office of the Nuclear Reactor Regulation

Subject: Submittal Supporting Accelerated ABWR Review Schedule - **Chapter 8 Modifications**

Dear Chet:

Enclosed are SSAR markups to Chapter 8 material that resulted from the GE/NRC conference call on May 27, 1993. The following items are addressed:

Confirmatory Items 8.s3.3.10-1, 8.3.8.6-1, and 8.3.8.7-1

Please send copies of this transmittal to John Knox and Dale Thatcher.

Sincerely,

Jeffrey C. Baechler for JNF

Jack Fox
Advanced Reactor Programs

cc: Bob Strong (GE)
Norman Fletcher (DOE)

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(see 8.3.4.15). The ABWR therefore exceeds the requirements of the policy issue.

(5) Other Criteria

(a) IEEE 741 - "Standard Criteria for the Protection of Class 1E Power Systems and Equipment in Nuclear Power Generating Stations"

The ABWR fully meets the requirements of this standard

8.3.2 DC Power Systems

8.3.2.1 Description

8.3.2.1.1 General Systems

A DC power system is provided for switchgear control, control power, instrumentation, critical motors and emergency lighting in control rooms, switchgear rooms and fuel handling areas. Four independent Class 1E 125 Vdc divisions, three independent non-Class 1E 125 Vdc load groups and one non-Class 1E 250 Vdc computer and motor power supply are provided. See Figures 8.3-4 for the single lines.

Each battery is separately housed in a ventilated room apart from its charger and distribution panels. Each battery feeds a dc distribution switchgear panel which in turn feeds local distribution panels and dc motor control centers. An emergency eye wash is supplied in each battery room.

All batteries are sized so that required loads will not exceed warranted capacity at end-of-installed-life with 100 percent design demand.

The capacity of each of the four redundant Class 1E battery chargers is based on the largest combined demands of the various continuous steady-state loads, plus charging capacity to restore the battery from the design minimum charge state to the fully charged state within 12 hours (per technical specifications), regardless of the status of the plant during which these demands occur, ~~(see 8.3.4.35)~~. Insert "AC"

(84) 83.8.6-1 Conf

8.3.2.1.1.1 Class 1E 125 Vdc System

The 125 Vdc system provides a reliable control and switching power source for the Class 1E systems.

Each 125 Vdc battery is provided with a charger, and a standby charger shared by two divisions, each of which is capable of recharging its battery from a discharged state to a fully charged state while handling the normal, steady-state dc load.

Batteries are sized for the dc load in accordance with IEEE Standard 485.

The batteries are installed in accordance with industry recommended practice as defined in IEEE 484, and meet the recommendations of Section 5 of IEEE 946 (see 8.3.4.32).

In accordance with this standards, each of the four Class 1E 125-volt batteries:

1) is capable of starting and operating its required steady state and transient loads,

MARK-UP TEXT INSERTS

INSERT AB (NRC request to close item 8.3.3.14-1 per 5-24-93 phone call)

There are three automatic switching modes for the CVCF power supplies, any of which may be initiated manually. First, the frequency of the output of the inverter is normally synchronized with the input ac power. If the frequency of the input power goes out of range, the power supply switches over to internal synchronization to restore the frequency of its output. Switching back to external synchronization is automatic and occurs if the frequency of the ac power has been restored and maintained for approximately 60 seconds.

The second switching mode is from ac to dc for the power source. If the voltage of the input ac power is less than 88% of the rated voltage, the input is switched to the dc power supply. The input is switched back to the ac power after a confirmation period of approximately 60 seconds.

The third switching mode is between the inverter and the voltage regulating transformer, which receives power from the same bus as the primary source. If any of the conditions listed below occur, the power supply is switched to the voltage regulating transformer.

(a) Output voltage out of rating by more than plus or minus 10 per cent

(b) Output frequency out of rating by more than plus or minus 3 per cent

(c) High temperature inside of panel

(d) Loss of control power supply

(e) Commutation failure

(f) Over-current of smoothing condenser

(g) Loss of control power for gate circuit

(h) Incoming MCCB trip

(i) Cooling fan trip

INSERT AC (NRC request to close item 8.3.8.6-1 per 5-27-93 phone call)

The battery chargers are designed to prevent the ac power supply from becoming a load on the battery. They also have provisions to isolate transients from the ac system from affecting the dc system; and conversely, provisions to isolate transients from the dc system from affecting the ac system. The battery charger system is sized in accordance with the guidelines of IEEE 946. The design of the dc system includes the capability to periodically verify the required capacity for each of the battery charger power supplies (see 8.3.4.35). (24)

Insert "AC"

the remaining ac power divisions. The plant design and circuit layout from these dc systems provide physical separation of the equipment, cabling and instrumentation essential to plant safety.

Each division of the system is located in an area separated physically from other divisions. All the components of Class 1E 125 Vdc systems are housed in Seismic Category I structures.

8.3.2.1.3.1 125 Vdc Systems Configuration

Figure 8.3-4 shows the overall 125 Vdc system provided for Class 1E Divisions I, II, III and IV. One divisional battery charger is used to supply each divisional dc distribution panel bus and its associated battery. The divisional battery charger is normally fed from its divisional 480V MCC bus, with no automatic interconnection or transfer between buses. Also, there are no manual interconnections between dc divisions except those involving the standby battery chargers, as described below.

Each Class 1E 125 Vdc battery is provided with a charger, and a standby charger shared by two divisions, each of which is capable of recharging its battery from a discharged state to a fully charged state while handling the normal, steady-state dc load. Cross connection between two divisions through a standby charger is prevented by at least two interlocked breakers, kept normally open, in series in each potential cross-connect path. (See Figure 8.3-4 and Subsection 8.3.4.18.)

The maximum equalizing charge voltage for Class 1E batteries is 140 Vdc. The dc system minimum discharge voltage at the end of the discharge period is 1.75 Vdc per cell (105 volts for the battery). The operating voltage range of Class 1E dc loads is 100 to 140V.

~~As a general requirement,~~ The batteries have sufficient stored energy to operate connected Class 1E loads continuously for at least two hours without recharging. The Division I battery, which controls the RCIC system, is sufficient for eight hours during station blackout. During ~~this~~ the station blackout event ~~scenario~~, the load reductions ~~on Divisions II, III, and IV~~ also extend the times these batteries are available (See Subsection 19E.2.1.2.2). Each distribution circuit is capable of transmitting sufficient energy to start and operate all required loads in that circuit. (51)

Insert R (85)

8.3.8.7-1 conf

A load capacity analysis has been performed based on IEEE 485-1978, and submitted on the docket for estimated Class 1E dc battery loads as of September, 1989. A final analysis will be performed when specific battery parameters are known (see 8.3.4.6).

An initial composite test of onsite ac and dc power systems is called for as a prerequisite to initial fuel loading. This test will verify that each battery capacity is sufficient to satisfy a safety load demand profile under the conditions of a LOCA and loss of preferred power.

Thereafter, periodic capacity tests may be conducted in accordance with IEEE Std 450. These tests will ensure that the battery has the capacity to continue to meet safety load demands.

Insert "R" (85)

MARK-UP TEXT INSERTS

A capacity and voltage drop analysis will be performed in accordance with IEEE 141 to assure that power sources and distribution equipment will be capable of transmitting sufficient energy to start and operate all required loads for all plant conditions.

~~INSERT S (87 CONF)~~

~~(7) The bus tie arrangment, and the capacity and capability of the CTG, is designed such that the time to place the CTG on line to feed any one train of shutdown loads (i.e., includes manual connection to any one Class 1E bus) shall be within 10 minutes.~~

~~INSERT T (87 CONF - RG 1.155, Sect. 3.3.5 assessment)~~

~~The reliability of the CTG should meet or exceed 95 percent as determined in accordance with NSAC-108 or equivalent methodology.~~

~~INSERT U (87 CONF - RG 1.155, Sect. 3.3.5 assessment)~~

~~6. Electric Power Research Institute, "Reliability of Emergency Diesel Generators at U.S. Nuclear Power Plants," NSAC-108, September 1986.~~

~~INSERT V (66 CONF)~~

~~Light fixtures in safety areas are seismically supported, and are designed with appropriate grids or diffusers, such that broken material will be contained and will not become a hazard to personnel or safety equipment during or following a seismic event.~~

~~INSERT W (Needed to backup ITAAC)**~~

~~Displays provided in the Main Control Room (MCR) consist of (but are not necessarily limited to) the following: Main Generator output voltage, amperes, watts, VARS (or power factor), frequency, and synchronization; also, distribution system medium voltage (M/C) switchgear voltages, feeder and load amperes, and circuit breaker positions.~~

~~Manual controls are provided in the MCR for the Main Generator output circuit breaker, the medium voltage (M/C) switchgear feeder circuit breakers, and load circuit breakers to power centers or motor control centers.~~

ABWR is designed in accordance with all criteria. Any exceptions or clarifications are so noted.

(1) General Design Criteria (GDC):

(a) Criteria: GDCs 2, 4, 17, and 18.

(b) Conformance: The dc power system is in compliance with these GDCs. The GDCs are generically addressed in Subsection 3.1.2.

(2) Regulatory Guides (RGs):

(a) RG 1.6 - Independence Between Redundant Standby (Onsite) Power Sources and Between Their Distribution Systems

8.3.3.10-1 Cont. (71)

(b) RG 1.32 - Criteria for Safety-Related Electric Power Systems for Nuclear Power Plants

Fuses cannot be periodically tested to verified setpoints, and are exempt from such requirements per Section 4.1.7 of IEEE 741.

Insert I here

(c) RG 1.47 - Bypassed and Inoperable Status Indication for Nuclear Power Plant Safety Systems

(d) RG 1.63 - Electric Penetration Assemblies in Containment Structures for Light-Water-Cooled Nuclear Power Plants

(e) RG 1.75 - Physical Independence of Electric Systems

The DC emergency standby lighting system circuits up to the lighting fixtures are Class 1E associated and are routed in seismic Category I raceways. However, the lighting fixtures themselves are not seismically qualified, but are seismically supported. This is acceptable to the Class 1E power supply because of over-current protective device coordination. The cables and circuits from the power source to the lighting fixtures are Class 1E associated. The bulbs cannot be seismically qualified. This is why the circuits are Class 1E associated. The bulbs can only fail open and therefore do not represent a hazard to the Class 1E power sources.

Besides the emergency lighting circuits, any other associated circuits added beyond the certified design must be specifically identified and justified. Associated circuits are defined in Section 5.5.1 of IEEE 384-1981, with the clarification for Items (3) and (4) that non-Class 1E circuits being in an enclosed raceway without the required physical separation or barriers between the enclosed raceway and the Class 1E or associated cables makes the circuits (related to the non-Class 1E cable in the enclosed raceway) associated circuits.

(f) RG 1.106 - Thermal Overload Protection for Electric Motors on Motor-Operated Valves

Safety functions which are required to go to completion for safety have their thermal overload protection devices in force during normal

MARK-UP TEXT INSERTS

INSERT E (35 CONF)

(5) Other Criteria

(a) IEEE 741 - "Standard Criteria for the Protection of Class 1E Power Systems and Equipment in Nuclear Power Generating Stations"

The ABWR fully meets the requirements of this standard.

INSERT F (35 CONF)

(5) Other Criteria

(a) IEEE 946 - "Recommended Practice for the Design of Safety-Related DC Auxiliary Power Systems for Nuclear Power Generating Stations"

The ABWR fully meets the requirements of this standard.

INSERT G (65 CONF)

This equipment is designed and qualified to survive the combined effects of temperature, humidity, radiation, and other conditions related with a LOCA or other design-basis event environment at the end of their qualified and/or design life.

INSERT H (43 CONF)

These overload bypasses meet the requirements of IEEE 603, and are capable of being periodically tested (see 8.3.4.24).

INSERT I (71 CONF)

Section 5.2 of IEEE 308 is addressed for the ABWR as follows:

Those portions of the Class 1E power system that are required to support safety systems in the performance of their safety functions meet the requirements of IEEE 603. In addition, those other normal components, equipment, and systems (that is, overload devices, protective relaying, etc) within the Class 1E power system that have no direct safety function and are only provided to increase the availability or reliability of the Class1E power system meet those requirements of IEEE 603 which assure that those components, equipment, and systems do not degrade the Class 1E power system below an acceptable level. However, such elements are not required to meet criteria as defined in IEEE 603 for: operating bypass, maintenance bypass, and bypass indication." (71)

INSERT J (72 OPEN/CONF)

Insert I