GE Nuclear Energy

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

April 2, 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 7 DFSER Items**

Dear Chet:

Enclosed are SSAR markups that address Open Item 7.1.3.1-1, Confirmatory Item 7.5.2- and COL Action Items 7.3.1.11-1, 7.7.1.15-1 and 7.8-1.

Please provide a copy of this transmittal to Jim Stewart.

Sincerely,

Jack Fox

Jack Fox
Advanced Reactor Programs

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

060046

JF93-77



D050

ABWR CHAPTER 7 DFSER ISSUES
.DO ROADMAP7 .REPORT FORM ROADMAP7 TO PRINT

| DFSER ITEM NUMBER | DFSER BULLET STATEMENT | SSAR REFERENCE | GE RESPONSE |
|---|---|---|---|
| 7.1.3.1-1 OPEN | SSAR section 3.1 discusses each GDC generally and lists references to other SSAR sections for specific system application of the GDC. GDC 3, 26, 27, 30, 37, 42, 43, 55, and 56 are listed in the SSAR Chapter 3 as being included in Chapter 7. In the Chapter 7 GDC listings, however, these GDCs do not appear but should. In addition, GDC 2, 15, 38, are listed in SSAR Chapter 7, but there is no corresponding reference to Chapter 7 in the Chapter 3 discussions. These discrepancies need to be corrected in an amendment to the SSAR. This is Open Item 7.1.3.1-1 | Pages 3.1-3,-10,-30 | The ABWR meets all of the general design criteria. However, it was agreed with the staff (see the Licensing Review Basis (LRB) document for the ABWR), that criteria to be addressed specifically in Chapter 7 of the SSAR would be consistent with those identified in Chapter 7 of the SRP, plus any identified in the LRB. Accordingly, it was understood that GDC's not identified in Chapter 7 of the SRP would be addressed in other sections of the SSAR (i.e., Section 3.1 or other).<br><br>The cross references from the various GDCs in Section 3.1 to other chapters were not intended to imply the existence of a redundant assessment of each GDC, but rather a reference to additional technical information which supported the GDC commitment in Chapter 3. With this understanding, no SSAR change is required for GDCs 3, 26, 27, 30, 37, 42, 43, 55, and 56. However, specific references to Chapter 7 have been added in Section 3.1 for GDC's 2, 15, and 38 per the attached mark-up. |
| 7.3.1.11-1 COL | As described in the SSAR, the HVAC systems represent the traditional cooling designs provided for earlier BWR designs evaluated by the staff. These designs meet the requirements of GDC 3 and 21 (concerning system reliability and testability) for analog systems. However, some additional analysis may be required to determine whether the application of the ABWR computer-based technology requires additional cooling to limit hot spots resulting from higher current densities within the digital chip designs than those present in the previous transistor designs.<br><br>Additional controls and direct cooling may be required, and a design limit for the equipment designs | 7.3.3.1(Page 7.3-51) | The following information has been added to Section 7.3:<br><br>"7.3.3 COL License Information<br><br>7.3.3.1 Cooling Temperature Profiles for Class 1E Digital Equipment<br><br>The COL applicant shall include, as part of its pre-operational test procedure, cooling temperature profiles for racks containing Class 1E microprocessor-designed equipment. The profiles shall include data for HVAC configurations consistent with the various accident events which require Engineered Safety Features (ESF) systems." |

ABWR CHAPTER 7 DFSER ISSUES
.DO ROADMAP7 .REPORT FORM ROADMAP7 TO PRINT

| DFSER ITEM NUMBER | DFSER BULLET STATEMENT | SSAR REFERENCE | GE RESPONSE |
|---|---|---|---|
| | consistent with the life expectancies is required to complete the design documentation. As discussed in Chapter 9 of this report, the ITAAC will verify that the chillers are appropriately sized for the heat loads of the room. In addition, the I&C equipment will be qualified for its particular environment, as described in Section 7.2 of this report. The environmental qualification of the equipment is also described in the generic equipment qualification ITAAC in Chapter 3.1 of the DCM. The staff expects that the COL applicant will include as part of its test procedure, cooling temperature profiles for the racks with the HVAC configurations possible for various accident events requiring ESF. This is COL Action Item 7.3.1.11-1. | | |
| 7.5.2-1 CONF | Among the manual action variables required for reactor shutdown from outside the control room, SSAR Table 7.5-7 lists drywell pressure. However, the parameters listed in SSAR Section 7.4 for display of the remote shutdown panel do not include this parameter. GE has stated that this parameter is not required for shutdown using the RSS without a design-basis event, and it should, therefore, not be listed in the table. This is Confirmatory item 7.5.2-1. | Tab.7.5-7, Amend.23 | The Amendment 23 version of Table 7.5-7 has deleted the drywell pressure variable. |
| 7.7.1.15-1 COL | There is a provision in the SSAR for a separate telephone communication system using portable, sound-powered telephones to be designed also will be provided. This is the responsibility of the COL Applicant and is COL Action Item 7.7.1.15-1. This system provides communication between boards in the main control room, between the main control room and field stations, and between field stations during fuel transfer, testing, inspections, calibrations, | 9.5.13.17, 9.5.2.2.2 | The following COL Action Item has been added:<br><br>"9.5.13.17 Sound-Powered Telephone Units<br><br>The COL Applicant shall provide the sound-powered telephone units to be used in conjunction with the system described in 9.5.2.2.2." |

ABWR CHAPTER 7 DFSER ISSUES
.DO ROADMAP7 .REPORT FORM ROADMAP7 TO PRINT

| DFSER ITEM NUMBER | DFSER BULLET STATEMENT | SSAR REFERENCE | GE RESPONSE |
|---|---|---|---|
| | and maintenance. | | |
| 7.8-1 COL | In RAI Q420.014, the staff requested that GE address the effects of station blackout on the HVAC system required to maintain functional electronics. GE responded that this will be addressed as an interface requirement for the performance of a heat-rise analysis for the stations blackout (assuming no HVAC) scenario using the environmental temperatures for the specific plant location. The staff has determined that this will be the responsibility of the COL applicant and is now COL Action Item 7.8-1. This will be acceptable subject to the resolution of the above COL Action Item 7.8.1. | APPENDIX 1C | The SSAR has indicated that the ABWR can cope with station blackout without the need for the Combustion Turbine Generator (CTG). However, due to recent developments involving SECY 90-016, GE now takes credit for the CTG as an alternate ac (AAC) power source, as defined in Section 3.3.5 of Regulatory Guide 1.155. Furthermore, the CTG and its associated distribution system are designed such that the CTG can be available to power a Class 1E bus within 10 minutes. With these capabilities, a coping study is not required per Regulatory Guide 1.155. However, the 4-8 hour coping study previously submitted in 19E.2.1.2.2 confirms there should be no heat-up concerns within the 10-minute startup time for the CTG.<br><br>A detailed assessment of Regulatory Guide 1.155, with the CTG used as an AAC, will be provided in Appendix 1C. |

| | | |
|---|---|---|
| (5) | 3.5 | Missile Protection |
| (6) | 3.7 | Seismic Design |
| (7) | 3.8 | Design of Seismic Category I Structures |
| (8) | 3.9 | Mechanical Systems and Components |
| (9) | 3.10 | Seismic Qualifications of Seismic Category I Instrumentation and Electrical Equipment |
| (10) | 3.11 | Environmental Qualification of Safety-Related Mechanical and Electrical Equipment |
| add → (11) | 7.1 | Table 7.1-2 |

#### 3.1.2.1.3 Criterion 3 - Fire Protection

##### 3.1.2.1.3.1 Criterion 3 Statement

Structures, systems, and components important to safety shall be designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions. Noncombustible and heat-resistant materials shall be used whenever practical throughout the unit, particularly in locations such as the containment and control room. Fire detection and fighting systems of appropriate capacity and capability shall be provided and designed to minimize the adverse effects of fires on structures, systems, and components important to safety. Fire fighting systems shall be designed to assure that their rupture or inadvertent operation does not significantly impair the safety capability of these structures, systems, and components.

##### 3.1.2.1.3.2 Evaluation Against Criterion 3

Fires in the plant are prevented or mitigated by the use of non-combustible and heat-resistant materials such as metal cabinets, metal wireways, high melting point insulation, and flame-resistant markers for identification wherever practicable.

Cabling is suitably rated and cable tray loading is designed to avoid objectionable internal heat buildup. Cable trays are suitably separated to avoid the loss of redundant channels of protective cabling if a fire occurs. The arrangement of equipment in reactor protection channels provides physical separation to limit the effects of a fire.

Combustible supplies, such as logs, records, manuals, etc, are limited in such areas as the control room to amounts required for current operation thus limiting the effect of a fire or explosion.

The plant fire protection system includes the following provisions:

(1) automatic fire detection equipment in those areas where fire danger is greatest, and

(2) extinguishing services which include automatic actuation with manual override as well as manually-operated fire extinguishers.

The design of the fire protection system meets the requirements of Criterion 3. For further discussion, see the following sections:

| Chapter/ Section | Title |
|---|---|
| (1) 3.8.2.6 | Materials, Quality Control and Special Construction Techniques |
| (2) 7 | Instrumentation and Control Systems |
| (3) 8 | Electric Power |
| (4) 9.5 | Fire Protection System |
| (5) Appendix 9A | Fire Hazard Analysis |
| (6) 13 | Conduct of Operations |

#### 3.1.2.1.4 Criterion 4 - Environmental and Missiles Design Bases

##### 3.1.2.1.4.1 Criterion 4 Statement

Structures, systems, and components important to safety shall be designed to accommodate the effects of and to be compatible with the environmental conditions associated with normal

| | Chapter/ Section | Title |
|---|---|---|
| (1) | 1.2.1 | Principal Design Criteria |
| (2) | 3 | Design of Structure, Components, Equipment, and Systems |
| (3) | 5.2.2 | Overpressurization Protection |
| (4) | 5.2.5 | Reactor Coolant Pressure Boundary and Core Cooling Systems Leakage Detection |
| (5) | 5.3 | Reactor Vessel |
| (6) | 5.4.1 | Reactor Recirculation System |
| (7) | 7.3 | Engineered Safety Feature Systems Instrumentation and Control |
| (7) (8) | 15 | Accident Analyses |

### 3.1.2.2.7 Criterion 16 - Containment Design

#### 3.1.2.2.7.1 Criterion 16 Statement

Reactor containment and associated systems shall be provided to establish an essentially leaktight barrier against the uncontrolled release of radioactivity to the environment and to assure that the containment design conditions important to safety are not exceeded for as long as postulated accident conditions require.

#### 3.1.2.2.7.2 Evaluation Against Criterion 16

The primary containment system consists of the following major structures and components:

(1) A leaktight primary containment vessel (PCV) enclosing the reactor pressure vessel, the reactor coolant pressure boundary, and other branch connections of the reactor primary coolant system. The PCV is a cylindrical steel-lined reinforced concrete structure with a removable steel head and has upper and lower drywell zones, diaphragm floor (D/F) and annular suppression chamber (or wetwell zone) under upper drywell separated by the D/F.

(2) A suppression pool containing a large amount of water used to rapidly condense steam from a reactor vessel blowdown or from a break in a major pipe.

(3) Associated containment penetrations and isolation devices.

The drywell and wetwell zones condense the steam and contain fission product releases from the postulated design bases accident (i.e., the double ended rupture of the largest pipe in the primary coolant system). The leaktight primary containment vessel prevents the release of fission products to the environment.

The secondary containment boundary of the reactor building, which completely encloses and integrates structurally the PCV, provides additional radiation shielding to protect operating personnel and the public and also protects the PCV from weather and external missiles.

Temperature and pressure in the PCV are limited following an accident by using the RHR system to condense steam in the containment atmosphere and to cool the suppression pool water.

The design of the containment systems meets the requirements of Criterion 16.

For further discussion, see the following sections.

| | Chapter/ Section | Title |
|---|---|---|
| (1) | 1.2 | General Plant Description |
| (2) | 3.8.2 | Steel Containment |
| (3) | 6.2 | Containment Systems |
| (4) | 15 | Accident Analyses |

### 3.1.2.2.8 Criterion 17 - Electric Power Systems

#### 3.1.2.2.8.1 Criterion 17 Statement

An onsite electric power system and an offsite electric power system shall be provided to permit functioning of structures, systems, and components important to safety. The safety function for each system (assuming the other system is not functioning) shall be to provide sufficient capacity and capability to assure that:

#### 3.1.2.4.9.1 Criterion 38 Statement

A system to remove heat from the reactor containment shall be provided. The system safety function shall be to reduce rapidly, consistent with the functioning of other associated systems, the containment pressure and temperature following any LOCA and maintain them at acceptable low levels.

Suitable redundancy in components and features and suitable interconnections, leak detection, isolation, and containment capabilities shall be provided to assure that, for onsite electric power system operation (assuming offsite power is not available) and for offsite electric power system operation (assuming onsite power is not available), the system safety function can be accomplished, assuming a single failure.

#### 3.1.2.4.9.2 Evaluation Against Criterion 38

The containment heat removal function is accomplished by the suppression pool cooling mode of the RHR. Following a LOCA, suppression pool cooling mode limits the temperature within the wetwell by recirculating the suppression pool water and removing heat via the RHR system heat exchangers. Any or all redundant RHR system heat exchangers can be manually activated. This subsystem is initiated manually following indiction of high suppression pool temperature. If a LOCA signal is present, the RHR will function in the core cooling (LPFL) mode.

Following a LOCA, wetwell and drywell spray mode of the RHR condenses steam within the drywell and wetwell zones of the containment by spraying suppression pool water cooled through the heat exchangers. Wetwell/drywell spray is started manually. The drywell spray mode is initiated by operator action post-LOCA in the presence of high drywell pressure. The wetwell spray mode can be manually initiated in the control room, unless an overriding LOCA signal for the LPFL is present. The wetwell spray mode does not depend on the operation of the suppression pool cooling mode.

The redundancy and capability of the offsite and onsite electrical power systems for the RHR system is presented in the evaluation against Criterion 34.

For further discussion, see the following sections:

| | Chapter/ Section | Title |
|---|---|---|
| (1) | 5.4.7 | Residual Heat Removal System |
| (2) | 6.2.2 | Containment Heat Removal Systems |
| (3) | 8.3.1 | AC Power Systems |
| (4) | 9.2 | Water Systems |
| (5) | 15 | Accident Analyses |

### 3.1.2.4.10 Criterion 39 - Inspection of Containment Heat Removal System

#### 3.1.2.4.10.1 Criterion 39 Statement

The containment heat removal system shall be designed to permit appropriate periodic inspection of important components, such as the torus, sumps, spray nozzles, and piping, to assure the integrity and capability of the system.

#### 3.1.2.4.10.2 Evaluation Against Criterion 39

Provisions are made to facilitate periodic inspections of active components and other important equipment of the containment heat removal systems. During plant operations, the pumps, valves, piping, instrumentation, wiring, and other components outside the containment can be visually inspected at any time and will be inspected periodically. Such components inside the containment will be tested and inspected during periodic outages. The testing frequencies of most components will be correlated with the component inspection.

The suppression pool is designed to permit appropriate periodic inspection. Space is provided outside the containment for inspection and maintenance.

The containment heat removal system is designed to permit periodic inspection of major components. This design meets the requirements of Criterion 39.

For further discussion, see the following sections:

(a) BTP ICSB 21 - *Guidance for Application for Regulatory Guide 1.47:* The ABWR design is a single unit. Therefore, item B-2 of the BTP is not applicable.

Otherwise, the HPIN are in full compliance with this BTP.

(b) BTP ICSB 22 - *Guidance for Application of Regulatory Guide 1.22:* All actuated equipment within the HPIN can be fully tested during reactor operation.

(5) TMI Action Plan Requirements (TMI):

In accordance with the Standard Review Plan for Section 7.3, and with Table 7.1-2, there are no TMI action plan requirements applicable to the HPIN.

**7.3.2.11 Additional Design Considerations Analyses**

**7.3.2.11.1 General Plant Safety Analysis**

The examination of the ESF systems at the plant safety analyses level is presented in Chapter 15.

**7.3.2.11.2 Loss of Plant Instrument Air System**

Loss of plant instrument air will not negate the ESF systems safety functions (Chapter 15).

**7.3.2.11.3 Loss of Cooling Water to Vital Equipment**

Loss of cooling water to ECCS, containment and reactor vessel isolation systems and other systems described in this section, when subject to single active component failure (SACF) or single operator error (SOE) will not result in the loss of sufficient ESF systems to negate their safety function (Chapter 15).

**7.3.2.12 Periodic Testing of ESF Instrumentation**

Protection system in-service testability is discussed in Subsection 7.1.2.1.6.

7.3.3 COL License Information

7.3.3.1 Cooling Temperature Profiles for Class 1E Digital Equipment

The COL applicant shall include, as part of its pre-operational test procedure, cooling temperature profiles for racks containing Class 1E microprocessor-designed equipment. The profiles shall include data for HVAC configurations consistent with the various accident events which require Engineered Safety Features (ESF) systems.

add

Due to its importance to plant operation and safety the paging equipment will have an exclusive DC power supply with a dedicated battery. The battery has capacity for 10 hours of operation following the loss of AC power. The charger is sized to recharge the battery form a fully discharged condition in 10 hours while supplying the normal DC loads.

A handset is located at the same relative position on each floor, at a conspicuous location in the patrol route, at uniform intervals in corridors and large rooms, close to panels where possible and at a location least affected by radioactivity within one area.

Paging equipment for outdoor facilities is designed to automatically limit the sound volume at night to a level manually set from the operator's desk. The manual volume settings can be 10, 20, 30 or 40 dB.

The paging equipment produces an emergency signal (siren sound) upon actuation of an emergency signal pushbutton.

Box-type speakers are installed in small rooms where reverberations make hearing difficult.

Speakers and handsets are installed at the best practical distance from noise sources. However, in rooms where noise level increases during equipment operation, (such as feed water pump room ,diesel generator room etc.), handsets are enclosed within a sound-proof booth.

The speakers are of two different types as described below. Their sound to noise (S/N) ratio is approximately 3 to 6 dB.

S: Output sound pressure of speaker.

N: Noise level at a place where the speaker is installed.

(1) Horn shaped (Trumpet shaped): Output of 5 to 15W

(2) Cone shaped (box Type): Output of 3W

(3) Junction Box

Junction boxes installed outdoors are made of stainless plate in accordance with the outdoor specifications. Junction boxes installed within building are constructed to prevent water damage from above.

The interconnecting cables consist of a standard pair of conductors with cross-linked polyethylene insulation, a static electricity shield and an overall sheath of flame and heat resistant PVC (colored yellow).

The circuits from the main paging equipment to each junction box are wired by separate routes. Wiring is routed in existing cable trays for control cables. Containment penetrations X-102 A and B are used for communication cables which are routed to the communication circuits within containment.

**9.5.2.2.2 Sound-Powered Telephone System for Plant Maintenance and Repair**

A separate telephone communication system using portable sound-powered telephone units will be provided.

The communication facilities for use during plant maintenance consists of local terminal jacks and boxes and a system main communication board with storage for patch cords. The portable sound-powered telephones themselves are out of the ABWR Standard Plant scope, (see 9.5.13.17).

The system provides communication capability between boards in the main control room, between the main control room and field stations, or from field stations, or from field station to field station during testing and periodic inspection of the plant.

An outline of the system is shown in Figure 9.5-2.

The communication between stations of the maintenance communication facility is by means of portable telephone units and patch cords at the maintenance communication system board.

Terminal jacks are attached to the central control boards and to local panels and racks where communication links are frequently required.

**9.5.13.16 NUREG/CR-0660 Diesel Generator Reliability Recommendations**

Programs shall be developed to address NUREG/CR-0660 recommendations regarding training, preventive maintenance, and root-cause analysis of component and system failures.

9.5.13.17 Sound-Powered Telephone Units

The COL Applicant shall provide the sound-powered telephone units to be used in conjunction with the system described in 9.5.2.2.2.

### 9.5.14 References

1. Stello, Victor, Jr., *Design Requirements Related To The Evolutionary Advanced Light Water Reactors (ALWRS)*, Policy Issue, SECY-89-013, The Commissioners, United States Nuclear Regulatory Commission, January 19, 1989.

2. Cote, Authur E., *NFPA Fire Protection Handbook*, National Fire Protection Association, Sixteenth Edition.

3. *Design of Smoke Control Systems for Buildings*, American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc., September 1983.

4. *Recommended Practice for Smoke Control Systems*, NFPA 92A, National Fire Protection Association, 1988.

5. Life Safety Code, NFPA 101, National Fire Protection Association.