GE Nuclear Energy

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May 11, 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 Outstanding Issues**

Dear Chet:

Enclosed are SSAR markups for DFSER Open Items 7.7.1.15-1 and 20.3-8, Confirmatory Item 7.2.1-2 and 7.6.1.3-1, and COL Action Item 7.7.1.15-1 which are a result of the GE/NRC May 10, 1993 conference call. In addition, there is a SSAR markup for a non-DFSER item pertaining to the conceptual design for out-of-scope communications.

Please provide a copy of this transmittal to Jim Stewart.

Sincerely,

Jack Fox
Advanced Reactor Programs

cc: Manny Patel (GE)
Bill Taft (GE)
Bernie Genetti (GE)
Nortman Fletcher (DOE)

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drywell monitoring are provided by the nuclear boiler system. A pressure rise above the normally indicated values will indicate a possible leak or loss of reactor coolant within the drywell. Pressure exceeding preset values will be alarmed in the main control room and required safety action will be automatically initiated.

(7) Reactor Vessel Head Flange Seal Monitoring

A single channel of pressure monitoring is provided for measurement and control room indication of pressure between the inner and outer reactor head flange seals. High pressure will indicate a leak in the inner O-ring seal. This high pressure is annunciated in the main control room (no isolation). A pressure tap for this measurement is provided by the nuclear boiler system. Leakage through both inner and outer seals will be detected by other drywell leak detection instrumentation. Any leakage through the inner seal can be directed to the drywell equipment drain sump.

(8) Reactor Recirculation Pump Motor Leakage Monitoring

Excess leakage from the RIP motor casing will be detected by the drywell floor drain sump monitors described in (1) above.

(9) Safety/Relief Valve Leakage Monitoring

SRV leakage is detected by temperature sensors located on each relief valve discharge line such as to detect any valve outlet port flow. Each of the temperature channels includes control room recording and alarm capabilities. The temperature sensors are mounted using thermowells in the discharge piping about half of a meter from the valve body to prevent false indication. The monitoring of this leakage is provided by the nuclear boiler system.

(10) Valve Stem Packing Leakage Monitoring

Large (two inch or larger) remote power-operated valves located in the drywell for the nuclear boiler, reactor water cleanup, reactor core isolation cooling, and residual heat removal systems are fitted with drain lines from the valve stems, from between the two sets of valve steam packing. Leakage through the inner packing is carried to the drywell equipment drain sump. Leakage during hydro-testing may be observed in drain line sight glasses installed in each drain line. Also, each drainline is equipped with temperature sensors for detecting leakage. A remote operated solenoid valve on each line may be closed to shut off the leakage flow through the first seal in order to take advantage of the second seal, and may be used during plant operation, in conjunction with the sump instrumentation, to identify the specific process valve which is leaking.

(11) Main Steamline High Flow Monitoring (for leaks downstream of flow elements)

High flow in each main steamline is monitored by four differential pressure transmitters that sense the pressure difference across a flow restrictor in the RPV main steam outlet nozzle. The pressure taps are part of the nuclear boiler system. Two sets of taps are provided, each set includes a nozzle tap and vessel tap. High flow rate in the main steamlines during plant operation could indicate a MSL break. High flow exceeding the preset value in any of the four main steamlines will result in trip of the MSIV isolation logic to close all the MSIVs and the MSL drain valves, and annunciate the high flow in the main control room. Each monitoring channel includes inputs to the process computer.

(12) Reactor Vessel Low Water Level Monitoring

The nuclear boiler system provides reactor water level monitoring for the LDS functions and for safety functions of other systems. Sixteen channels of monitoring (four in each division to provide trip signals at four different water levels, i.e., levels 3, 2, 1.5 and 1) are provided for the LDS functions, e.g., RHR, CUW, MSL and isolations of other portions of the plant. The safety related performance requirements of the level monitoring channels are a function of the nuclear boiler system.

Insert (12) aa

(13) RCIC Steamline Flow Monitoring (for leaks downstream of flow elements)

Insert (12) aa to page 5.2-22

For additional information on Reactor vessel water level instrumentation, see Subsection 7.7.1.1.
The impact of noncondensable gases on the accuracy of reactor vessel water level measurements shall be considered in the design of water level instrument piping.
The COL applicant will implement the water level instrument piping design changes determined by the BWR Owners' Group, as required in Subsection 5.2.6.3.

3.785 liters/min thus meeting Position C.2 requirements.

By monitoring (1) floor drain sump fillup and pumpout rate, (2) airborne particulates, and (3) air coolers condensate flow rate, Position C.3 is satisfied.

Monitoring of the reactor building cooling water heat exchanger coolant return lines for radiation due to leaks within the RHR, RIP and CUW and the fuel pool cooling system heat exchangers satisfies Position C.4. For system detail, see Subsection 7.6.1.2.

The floor drain sump monitoring, air particulates monitoring, and air cooler condensate monitoring are designed to detect leakage rates of 3.785 liters/min within one hour, thus meeting Position C.5 requirements.

The fission products monitoring subsystem is qualified for SSE. The containment floor drain sump monitor, air cooler, and condensate flow meter are qualified for OBE, thus meeting Position C.6 requirements.

Leak detection indicators and alarms are provided in the main control room. This satisfies Position C.7 requirements. Procedures and graphs will be provided by the COL applicant to plant operators for converting the various indicators to a common leakage equivalent, when necessary, thus satisfying the remainder of Position C.7 (See Subsection 5.2.6.1 for COL license information). The leakage detection system is equipped with provisions to permit testing for operability and calibration during the plant operation using the following methods:

(1) simulation of trip signal;

(2) comparing channel to channel of the same leak detection method (i.e., area temperature monitoring);

(3) operability checked by comparing one method versus another (i.e., sump fillup rate versus pumpout rate and particulate monitoring or air cooler condensate flow versus sump fillup rate); and

(4) continuous monitoring of floor drain sump level, and a source of water for calibration and testing is provided.

These satisfy Position C.8 requirements.

Limiting unidentified leakage to the 3.785 liters/min and identified to 95 liters/min satisfies Position C.9.

5.2.6 COL License Information

5.2.6.1 Conversion of Indications

Procedures and graphs will be provided by the COL applicant to operations for converting the various indicators into a common leakage equivalent (See Subsection 5.2.5.9). 4

5.2.6.2 Plant-Specific ISI/PSI

COL applicants will submit the complete plant- specific ISI/PSI program. Each applicant will submit or address the following:

(1) The PSI program should include reference to the edition and addenda of ASME Code Section XI that will be used for selecting of components for examinations, lists of the components subject to examination, a description of the components exempt from examination by the applicable code, and isometric drawings used for the examination.

(2) Submits plans for preservice examination of the reactor pressure vessel welds to address the degree of compliance with RG 1.150.

(3) Discusses the near-surface examination and resolution with regard to detecting service-induced flaws and the use of electronic gating as related to the volume of material near the surface that is not being examined. Discusses how the internal surfaces (e.g., inner radius of a pipe section and reactor vessel internals) will be examined.

(4) Submits an acceptable resolution of the information requested regarding the ISI/PSI program.

(5) Submits all relief requests, if needed, with a supporting technical justification.

→ 5.2.6.3 Reactor Vessel Water Level Instrumentation

The COL applicant will implement the Reactor vessel water level instrumentation design in accordance with the BWR Owners Group as described in Subsection 5.2.5.2.

The purpose of this is to permit venting of noncondensable gases from the sensing line during calibration procedures.

(5) Reactor Vessel Temperature

The reactor pressure vessel (RPV) coolant temperatures are determined by measuring saturation pressure (which gives saturation temperature), outlet flow temperature to the reactor water cleanup unit (RWCU), and bottom head drain temperature. Reactor vessel outside surface temperatures are measured at the head flange and bottom head locations. Temperatures needed for operation and for compliance with the technical specification operating limits are obtained from these measurements. During normal operation, either reactor steam saturation temperature and/or the inlet temperatures of the reactor coolant to the RWCU and the RPV bottom drain can be used to determine the vessel temperature.

(6) Reactor Vessel Water Level

Figure 7.7-1 shows the water level range and the vessel penetration for each water level range. The instruments that sense the water level are strictly differential pressure devices calibrated for a specific vessel pressure (and corresponding liquid temperature) conditions. INSERT 7.7.1.1(6) The following is a description of each water level range shown on Figure 7.7-1.

(a) Shutdown Water Level Range

This range is used to monitor the reactor water level during the shutdown condition when the reactor system is flooded for maintenance and head removal. The water level measurement design is the condensate reference chamber leg type. The temperature and pressure condition that is used for the calibration is 0 kg/cm^3g and 48.9° C water in the vessel. The two vessel instrument penetrations elevations used for this water level measurement are located at the top of the RPV head and the instrument tap just below the bottom of the dryer skirt.

(b) Narrow Water Level Range

This range uses the RPV taps at the elevation near the top of the steam outlet nozzle and the taps at an elevation near the bottom of the dryer skirt. The zero of the instrument is at the top of the active fuel and the instruments are calibrated to be accurate at the normal operating point. The water level measurement design is the condensate reference chamber type and uses differential pressure devices as its primary elements. The feedwater control system uses this range for its water level control and indication inputs. For more information on the feedwater control system, see Subsection 7.7.1.4.

(c) Wide Water Level Range

This range uses the RPV safety-related taps at the elevation near the top of the steam outlet nozzle and the taps at an elevation below the top of the active fuel. The zero of the instrument is the top of the active fuel and the instruments are calibrated to be accurate at the normal power operating point. The water level measurement design is the condensate reference type and uses differential pressure devices as its primary elements.

(d) Fuel Zone Water Level Range

This range uses the RPV taps at the elevation near the top of the steam outlet nozzle and the taps below the top of the active fuel (above the pump deck). The zero of the instrument is the top of the active fuel and the instruments are calibrated to be accurate at 0 kg/cm^3g and saturated condition. The water level measurement design is the condensate reference type and uses differential pressure devices as its primary element.

(e) Reactor Well Water Level Range

This range uses the RPV tap below the top of the active fuel. The zero of

INSERT 7.7.1.1(6)
For consideration of non condensable gases in instrument lines, see Subsection 5.2.5.2.1(12)

(10) Operational Considerations

The LPRM is a monitoring system with no special operating considerations.

7.6.1.1.2.2 Average Power Range Monitor Subsystem - Instrumentation and Controls

(1) General Description

The APRMs are safety-related systems. There are four divisions of DMC-based APRM channels located in the control room. Each channel receives 52 LPRM signals as inputs, and averages such inputs to provide a core average neutron flux that corresponds to the core average power. One APRM channel is associated with each trip system of the reactor protection system (RPS). However, trip signal from each APRM division also goes to all other RPS divisions, with proper signal isolation.

(2) Power Sources

APRM channels are powered as listed below:

<u>Channels</u>

A	120 VAC UPS Bus A (Division I)
B	120 VAC UPS Bus B (Division II)
C	120 VAC UPS Bus C (Division III)
D	120 VAC UPS Bus D (Division IV)

The trip units and LPRM channels associated with each APRM channel receive power from the same power supply as the APRM channel.

(3) Signal Conditioning

APRM channel electronic equipment averages the output signals from a selected set of LPRMs. The averaging circuit automatically corrects for the number of unbypassed LPRM amplifiers providing input signals.

Assignment of LPRMs to the APRM channels is shown in Figure 7.6-1. The LPRM detector in the bottom position of a detector assembly is designated Position A. Detectors above A are designated B and C, and the uppermost detector is designated D.

Reactor core flow signals derived from core plate pressure drop signals are used in the APRM to provide the flow biasing for the APRM rod block and thermal power trip setpoint functions. There is also the Core Flow Rapid Coastdown Trip logic in the APRM unit which utilizes the core flow and thermal power information. The core flow signal is also used to provide the flow biasing for the MRBM rod block setpoint functions.

INSERT 7.6.1.1.2.2

CNFM 7.2.1-2

(4) Trip Function

APRM system trips are summarized in Table 7.6-2. The APRM scram trip function is discussed in Section 7.2. The APRM rod block trip function is discussed in Subsection 7.7.1.2. The APRM channels also provide trip signals indicating when an APRM channel is upscale, downscale, bypassed, or inoperative.

(5) Bypasses and Interlocks

One APRM channel may be bypassed at any time. The trip logic will in essence become two-out- of-three instead of two-out-of-four.

(6) Redundancy

Four independent channels of the APRM monitor neutron flux. Any two of the four APRM channels which indicate an abnormal condition will initiate a reactor scram via the RPS two out of four logic. The redundancy criteria are met so that in the event of a single failure under permissible APRM bypass conditions, a scram signal can be generated in the RPS as required.

(7) Testability

APRM channels are calibrated using data from previous full-power runs and are tested by procedures in the instruction manual. Each APRM channel can be tested individually for the operability of the APRM scram and rod-blocking functions by introducing test signals. A self-

Insert 7.6.1.1.2.2.

"The APRM signal conditioning unit also includes an algorithm that provides detection of core oscillation resulted from core in-stability. This algorithm uses LPRM signals as input, and is based on a specific detection methodology that relates the fuel thermal response in the fuel assembly to the LPRM signals. It includes a specific method of combining the designated LPRM signals in order to detect localized core power oscillation. The algorithm monitors core power oscillation responses and provides a trip signal if a growing oscillation with sufficient magnitude is detected. The COL applicant will implement the oscillation monitoring logic function in the APRM in accordance with the conclusion of the BWR Owners' Group as required in Subsection 7.6.3."

(3) Regulatory Guides (RGs):

In accordance with the Standard Review Plan for Section 7.6, and with Table 7.1-2, the following RGs are addressed for CAMS:

(a) RG 1.22 - *Periodic Testing of Protection System Actuation Functions*

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

(c) RG 1.53 - *Application of the Single-Failure Criterion to Nuclear Power Protection Systems*

(d) RG 1.75 - *Physical Independence of Electric Systems*

(e) RG 1.97 - *Instrumentation for Light-Water-Cooled Nuclear Power Plants to Assess Plant and Environs Conditions During and Following an Accident*

(f) RG 1.105 - *Instrument Setpoints for Safety-Related Systems*

(g) RG 1.118 - *Periodic Testing of Electric Power and Protection Systems*

Regulatory Guide 1.22 is not applicable to the CAMS because the CAMS does not actuate or provide controls to any protective system. The CAMS is in conformance with all other RGs listed, assuming the same interpretations and clarifications identified in Subsections 7.3.2.1.2 and 7.1.2.10. A generic assessment of Regulatory Guide 1.97 is provided in Section 7.5.

(4) Branch Technical Positions (BTPs):

In accordance with the Standard Review Plan for Section 7.6, and with Table 7.1-2, only BTPs 21 and 22 are addressed for CAMS as follows:

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

(b) BTP ICSB 22 - *Guidance for Application of Regulatory Guide 1.22:* CAMS performs no actuation functions. Therefore, this BTP is not applicable to CAMS.

(5) TMI Action Plan Requirements (TMI):

In accordance with the Standard Review Plan for Section 7.6, and with Table 7.1-2, the following TMI action plan requirements are addressed for the CAMS:

(a) TMI II.F.1 - *Accident Monitoring Instrumentation Positions*

(b) TMI II.F.3 - *Monitoring Accident Conditions (RG 1.97)*

The CAMS provides safety-related instrumentation for use during and after LOCA events and is in compliance with RG 1.97. These TMIs are addressed generically in Appendix 1A. An assessment of Regulatory Guide 1.97 is also presented in Section 7.5.

7.6.3 COL Licensing Information

7.6.3.1 APRM Oscillation Monitoring Logic

The COL applicant will implement the APRM ocillation monitoring logic function in accordance with the BWR Owners Group as described in Subsection 7.6.1.1.2.2.

testing feature similar to that described for SSLC is also provided

(8) Environmental Considerations

All APRM equipment is operated in the environments described in Section 3.11. The APRM is capable of functioning during and after the design basis events in which continued APRM operation is required (see Sections 3.10 and 3.11).

7.6.1.1.3 Reactor Operator Information

The man-machine interface of the neutron monitoring system provides for the information and controls described in this subsection. The lists provided in Table 7.6-3 consist of major signal information which is also documented in the system IED (Figure 7.6-1) and the system IBD (Figure 7.6-2).

7.6.1.2 Process Radiation Monitoring System - Instrumentation and Controls

A number of radiation monitoring functions are provided on process lines, HVAC ducts, and vents that may serve as discharge routes for radioactive materials. These include the following:

(1) Main steam line tunnel area

(2) Reactor building ventilation exhaust (including fuel handling area)

(3) Control building air intake supply

(4) Drywell sumps liquid discharge

(5) Radwaste liquid discharge

(6) Off-gas discharge (Pre-treated and Post-treated)

(7) Gland steam condenser off-gas discharge

(8) Plant stack discharge

(9) Turbine building vent exhaust

(10) Standby gas treatment ventilation exhaust

(11) Radwaste building ventilation exhaust

The process radiation subsystems are shown in the system design IED (Figure 7.6-5). Subsystems (1) through (4) are classified nuclear safety-related while subsystems (5) through (11) are classified as nonsafety-related. System descriptions and requirements are discribed in detail in Section 11.5

7.6.1.3 High Pressure/Low Pressure Systems Interlock Protection Functions

(1) Function Identification

The low pressure modes of the RHR which connect to the reactor coolant pressure boundary and the instrumentation which protects them from overpressurization are discussed in this section. Such high pressure/low pressure interfaces with the reactor vessel are exclusive to the RHR system for the ABWR. The RHR P&ID may be found on Figure 5.4-10. The RHR IBD may be found on Figure 7.3-4.

(2) Power Sources

The power for the interlocks is provided from the essential power supplies used for the RHR system and its various modes of operation.

(3) Equipment Design

Refer to Table 7.6-3 for a list of high pressure/low pressure interfaces and the rationale for valve interlock equipment.

(4) Circuit Description

At least two valves are provided in series in each of these lines. The RHR shutdown cooling supply valves (E11-FO12 and E11-FO13) have independent sets of interlocks to prevent the valves from being opened when the primary system pressure is above the subsystem design pressure or when reactor water level is below Level 3. These valves also receive a signal to close when reactor pressure is above system pressure, or reactor water level is below Level 3. An additional interlock is RHR equipment

area ambient temperature (not shown on Table 7.6-3).

The RHR shutdown cooling/LPFL injection valve E11-FO47 is interlocked to prevent valve opening whenever the reactor pressure is above the subsystem design pressure, and automatically closes whenever the reactor

F005

pressure exceeds the subsystem design pressure. This valve must operate for long-term cooling, and has a remote testable check valve, E11-FO48 (F006), downstream. The check valve position can be confirmed at any time.

(5) Logic and Sequencing

The logic for the pressure and level sensor inputs is two-out-of-four high pressure or low level signals for valve closure. The additional RHR equipment area temperature signals for the shutdown suction valves consist of a single input channel for each valve.

(6) Bypasses and Interlocks

There are no additional bypasses or interlocks in the high pressure/low pressure interlocks themselves.

(7) Redundancy and Diversity

Each process line has two valves in series which are redundant in assuring the interlock. Each shutdown cooling supply and return valve has independent and diverse interlocks to prevent the valves from being opened under the following conditions (see Subsection 7.4.2.3.2 (4a)):

(a) reactor pressure is above the RHR system design pressure;

(b) reactor water level is below Level 3; or

(c) RHR equipment area ambient temperature is above setpoint.

(8) Actuated Devices

The motor-operated valves and N_2-operated check valve (E11-FO48 (F006)) are the actuated devices.

(9) Separation

Separation is maintained in the instrumentation portion of the high pressure/low pressure interlocks by assigning the signals for the electrically controlled valves to ESF separation divisions. The pressure and level sensors are supplied from the nuclear boiler system and are shared with other systems. There is one sensor from each of the four divisions, whose signal is passed through optical isolators and then the two-out-of-four voting logic (in combination with the signals from the other three divisions). The resultant signal is used to actuate each valve. Each division has its own isolation and two-out-of-four voting logic hardware. (See sheet 2 of RHR IBD, Figure 7.3-4.)

(10) Testability

Since the high pressure/low pressure interlock valves are specifically designed to close under all conditions for normal reactor pressure, they cannot be tested during reactor operation. However, the sensors and logic can be tested during reactor operation in the same manner that the LPFL sensors and logic are tested. Refer to Subsection 7.3.1.1.4, 3(g) for a discussion of typical LPFL testing.

(11) Environmental Considerations

The instrumentation and controls for the high pressure/low pressure interlocks are qualified as Class 1E equipment. The sensors are mounted on local instrument panels and the control circuitry is housed in control panels in the control room.

(12) Operational Considerations

The high pressure/low pressure interlocks are strictly automatic. There is no manual bypass capability. If the operator initiates the RHR system, the interlocks will prevent RHR system exposure to high reactor pressure.

(13) Reactor Operator Information

The status of each valve providing the high pressure/low pressure boundary is indicated in the control room. The state of the sensors is also indicated in the control room.

TABLE 7.6-3

HIGH PRESSURE/LOW PRESSURE SYSTEM INTERLOCK INTERFACES

Interlocked Process Line	Type	Valve	Parameter Sensed	Purpose
RHR Shutdown Cooling Supply	MO MO	E11-~~FO12~~ F010 E11-~~FO13~~ F011	Reactor pressure, low level	Prevents valve opening until reactor pressure is low and level is above Level 3.*
RHR Shutdown Cooling/LPFL Injection	Check MO	E11-~~FO48~~ F006 E11-~~FO47~~ F005	N/A Reactor pressure	N/A Prevents valve opening until reactor pressure is low.**

* Recloses valve if pressure is high, or level drops below Level 3.

** Recloses valve if pressure is high.

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 and emergency condition such as operation from RSS consists of local communication stations containing terminal jacks and boxes and a ~~system~~ main ~~communication board~~ patch panel with storage for patch cords. The patch panel is located outside the MCR. The portable sound-powered telephones themselves are out of the ABWR Standard Plant scope.

The system provides communication capability between ~~boards in~~ the main control room, ~~between the main control room~~ RSS 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~~ main patch panel.

Terminal jacks are attached to the ~~control~~ communication station at control ~~boards~~ panels and to local panels and racks where communication links are frequently required for testing, calibration, maintenance and for operation from RSS.

The portions of the flooder pipe that extend from the steel liner in the lower drywell meet the requirements of ASME Class 2 piping components.

An ANSI B16.5 stainless steel weld-neck flange (or equivalent) is used at the interface between the flooder pipe and the fusible plug valve. The flooder pipe is made of the same material as the blowdown vent pipe or of a stainless steel material that is compatible for welding to the blowdown vent pipe.

The fusible plug is required to open fully when the outer metal temperature of the valve reaches 260°C during a severe accident and to pass a minimum of 10.5 l/sec with 375 mm of water above the valve inlet.

A plastic cover on the valve outlet seals the valve from the intrusion of moisture that could cause corrosion of the fusible metal material. The plastic cover has a melting point below 130°C and greater than 70°C and is required to melt completely or offer minimal resistance to valve opening when the opening temperature is reached.

9.5.12.4 Testing and Inspection Requirements

The ability of the LDF to mitigate severe accidents by passing sufficient water to cover and quench the postulated corium in the drywell is confirmed by PRA analysis (Appendix 19D).

No testing of the LDF system will be required during normal operation. During refueling outages, the following surveillance would be required:

(1) During each refueling outage, verify that there is no leakage from the fusible plug valve flange or outlet when the suppression pool is at its maximum level.

(2) Once every four refueling outages, lower suppression pool water level or plug the flooder pipe inlet and replace two fusible plug valves. Test the valves that were removed to confirm their function. This practice follows the precedent set for in-service testing of standby liquid control system (SLCS) explosive valves in earlier boiling water reactors.

9.5.12.5 Instrumentation Requirements

The LDF operates automatically in a passive manner during a severe accident scenario that involves a core melt and vessel failure. No operator action is required; therefore, no instrumentation is placed upon the system. An inadvertent opening or leak would be detected by the lower drywell leak detection system and the suppression pool water level instrumentation which would result in plant shutdown.

During severe accidents, operation of the LDF is confirmed by other instrument readings in the containment. These instruments include those which would record the drywell temperature reduction and the lowering of suppression pool water level.

9.5.13 COL License Information

9.5.13.1 Contamination of the DG Combustion Air Intake

The COL applicant will take measures to restrict contaminating substances from the plant site which may be available to the diesel generator air intakes. (See Subsection 9.5.8.1).

9.5.13.2 Use of Communication System in Emergencies

Procedures for use of the communication system emergencies shall be provided by the COL applicant. (See Subsection 9.5.2.4).

9.5.13.3 Maintenance and Testing Procedure for Communication Equipment

Maintenance and testing procedures for the plant communication shall be provided by the COL applicant. (See Subsection 9.5.2.5)

9.5.13.4 Use of Portable Hand Light in Emergency

The portable sealed beam battery powered hand light (used by the fire brigade and other personnel during an emergency to achieve a plant shutdown) is out of ABWR standard design scope. The COL applicant's design will comply with the BTP CMEB 9.5-1, position C.5.g(1) and (2). The COL applicant will supplement this subsection accordingly as applicable.

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.

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

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

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(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 Subsection 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 conjuction with the system described in Subsection 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.

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.

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.

9.5.2 Communication Systems

The ABWR Standard Plant design provides a telephonic communication system consisting of a power actuated paging facility and a separate network of cables and jacks to facilitate use of sound-powered telephones for maintenance and repair.

See Subsection 9.5.13.11 for COL applicant information pertaining to criteria for the design of plant security system.

9.5.2.1 Design Bases

9.5.2.1.1 Power-Actuated Paging System

The paging system is designed to provide facilities for mutual communication and simultaneous broadcasting in the related buildings of the plant.

9.5.2.1.2 Sound-Powered Telephone System

The design basis for the sound powered telephone system is to provide communication primarily for fuel transfer, testing, calibration, and maintenance.

9.5.2.2 Description

9.5.2.2.1 Paging Facilities

This system provides communication means such as ringing, mutual telephonic communication and simultaneous broadcasting in various select buildings and areas including outdoor locations of a nuclear power plant unit. The system also permits merging with and separation from other units of the nuclear power station. The system is primarily used for intraplant communications and a fixed-type (as opposed to wireless communication) emergency communication during plant operations, testing, calibration, start-up and limited emergencies.

The paging facilities system is a non-safety system and, therefore, does not have seismic mounting requirements. Mounting of system components is not on or above seismic class equipment, and is in accordance with sound design engineering practices.

The paging facilities consist of handsets, speakers, branch boxes, main distribution boards, a control board, amplifiers, amplifier boards, 48V battery, battery chargers, dc distribution board, cables wiring materials, junction boxes and jacks. The system is a 3 channel, 3 system split type design with a separate set of amplifiers and a distribution board for each branch. A general outline of the system is shown in Figure 9.5-2.

Handsets and speakers are installed in places which are important for plant operation and necessary for personnel safety, and where communication is frequent including the rooms described below:

(1) Main Control Room

(2) Electrical Equipment room

(3) Fuel replacement area

(4) Turbine operation area

(5) Periphery of control rods hydraulic units

(6) Feedwater Pump Room

(7) Elevators

(8) Exteriors of plant buildings

Each handset station can be used to communicate with any other handset station or the central station of an another unit at the same nuclear station.

One circuit of the handset station is connected to a telephone line, thereby, permitting a simultaneous broadcasting from a security telephone unit. In addition to the basic paging function the equipment can be used for an automatic surveillance of main amplifier output, alarm indication in the event of failure of main equipment and manual switching to spare amplifier as necessary.

The system is operated from a 48V battery source with a normal and a spare battery chargers. The chargers are fed from 3ø, 440VAC station power supply and a separate 1ø, 120VAC power source is used for panel lights and receptacles.

The cable for the ~~maintenance~~ sound-powered communication facility is unshielded with a flame and heat resistance PVC sheath and cross-linked polyethylene insulation. The cables are routed in existing control voltage level cable trays where available. ~~The wiring used for this system is color coded and the color of the sheath is black.~~

9.5.2.3 System Operation

The telephonic communication systems are designed to assist the plant personnel during preoperational, start-up, testing, maintenance and ~~limited~~ emergency conditions. The system provides easily accessible means of communications between various intraplant locations and simultaneous broadcasting in those locations.

The various equipment involved in system operation is designed to function in the environment where it is located. The power supply for the paging system is derived from the dedicated batteries, thus providing a reliable source of power and the communication system for up to 10 hours in the event of a loss of plant power supply. The sound-powered telephone system does not require any electrical power source to operate the system.

9.5.2.4 Safety Evaluation

The communication system has no safety-related function as discussed in Section 3.2. However, see Subsection 9.5.13.2 for COL license information pertaining to use of the system in emergencies.

9.5.2.5 Inspection and testing Requirements

The communication systems are conventional and have a history of successful operation. Routine use of parts of the system during normal operation ensures availability. Measurements or tests required to guard against long-term deterioration shall be performed on a periodic basis. See Subsection 9.5.13.3 for COL license information pertaining to communication equipment maintenance and testing procedures.

9.5.2.6 Portable and Fixed Emergency Communication Systems

~~The portable radio communication system, and the fixed emergency communication system~~

See replacement Subsections 9.5.2.6.1 thru 9.5.2.6.5.

~~(independent of the normal plant communication system) are out of ABWR standard plant design scope. The COL applicants design shall comply with the BTP CMEB 9.5-1, position C.5.g(3) and (4). The COL applicant will supplement this subsection accordingly as applicable. See Subsection 9.5.13.14 for COL license information.~~

See replacement Subsections 9.5.2.6.1 thru 9.5.2.6.5.

(The following is a replacement for current SSAR Section 9.5.2.6)

9.5.2.6 Portable And Fixed Emergency Communication Systems

9.5.2.6.1 Design Basis (Interface Requirement)

The design basis for the portable and fixed emergency voice communication systems is to provide communication facilities for normal and emergency plant operations and for plant security.

9.5.2.6.2 System Description (Conceptual Only)

A fixed emergency communication system shall provide reliable communications between operating areas in the plant and to off-site locations. The system shall be independent of the other communication systems and shall include, but not be limited to commercial telephone, emergency alarms, and/or private branch exchange (PBX) system. The system shall be compatible with the plant paging facilities (see Subsection 9.5.2.2.1) such that it will permit a simultaneous broadcasting from a security telephone unit.

A portable communications system such as hand-held portable radio or equivalent shall be furnished independent of other communications systems, and be available for use by plant operations and security personnel during plant normal and emergency conditions.

Design of fixed emergency communication and portable communication systems shall comply with BTP CMEB 9.5.1, position C.5.g(3) and (4).

9.5.2.6.3 System Operation (Interface Requirements)

The system operation is the same as listed in Subsection 9.5.2.3 except for the discussion on the power supply requirements. The power supply requirements for these systems shall be specified by the COL Applicant.

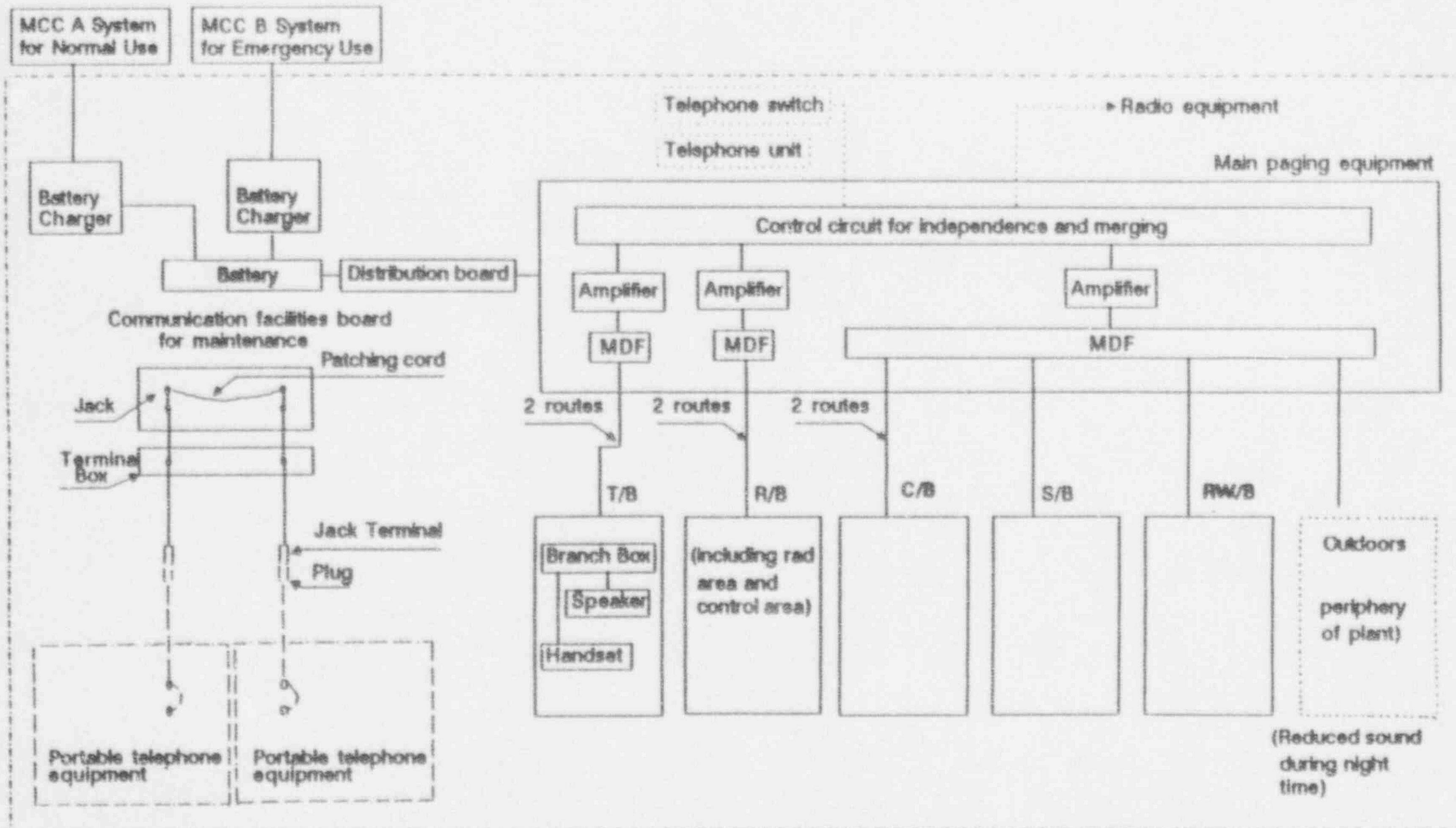
9.5.2.6.4 Safety Evaluation (Interface Requirements)

The system safety evaluation is same as listed in Subsection 9.5.2.4.

9.5.2.6.5 Inspection and Testing Requirements (Interface Requirements)

The system inspection and testing requirements are same as listed in Subsection 9.5.2.5.

NON DFSER pg 5 of 5



(Notes) 1. MDF : Main Distributing Frame
2. Solid lines indicate the extent of ABWR Standard Plant Scope

Figure 9.5-2 OUTLINE - TELEPHONIC COMMUNICATION SYSTEMS