

9.5.2 Communication System

The communication system (COMS) provides reliable and effective communications inside buildings (intra-plant), between buildings (inter-plant), and with external locations (plant-to-offsite) during normal operation, maintenance, transient, fire, accident conditions including loss of offsite power (LOOP) and security-related events.

The COMS consists of the following subsystems:

- Portable wireless communication system.
- Digital telephone system.
- Public address (PA) and alarm system.
- Sound-powered system.
- Emergency offsite communication.
- Security communication.

The COMS provides plant-wide coverage for onsite or internal communications. The capability to initiate external communications to key local and federal entities is provided from the main control room (MCR) and the remote shutdown station (RSS). The COMS also provides communication capabilities for security personnel.

The base station equipment such as radio transceivers, digital telephone channel banks, and switches of each subsystem are located in a Seismic Category Criteria I structure in separate rooms to avoid losing multiple communication capabilities during an accident or fire. The sound-powered system is distributed throughout the plant and does not require base station-type equipment. The emergency offsite communication interface system and security communication systems have equipment cabinets housing their dedicated telecommunication trunks, as well as dedicated radio equipment, located in an alternate secured location within the Safeguard or Nuclear Island (NI) Buildings.

9.5.2.1 Design Bases

The communication subsystems described in this section are classified as non-safety related.

Each communication subsystem provides an independent mode of communications. A failure of one subsystem does not affect the capability to communicate via the other subsystem. These diverse communications systems are independent of each other to provide effective communications, including usage in areas exposed to high ambient noise in the plant.

The communications subsystems are designed in accordance with applicable codes and standards regarding adverse environmental conditions (including weather, moisture, noise level, electromagnetic interference (EMI), and radio frequency interference (RFI)).

Except for the sound-powered system, the onsite communication subsystems are powered from the onsite Class 1E emergency uninterruptible power supply (EUPS), which is supported by the emergency and station blackout (SBO) diesel generators to provide backup power. An isolation device is placed between the non-Class 1E COMS system and the Class 1E power supply to provide the required independence per IEEE Std 384-1992 (Reference 2). The interface to the emergency offsite communication system is fed by the EUPS to maintain operability during SBO and LOOP conditions.

The non-Class 1E COMS subsystems that are powered from Class 1E power sources are isolated by a single Class 1E circuit breaker or fuse.

The adequacy of this isolation device as required by IEEE Std 603-1998 clause 5.6.3 (Reference 4), independence between safety systems and other systems is demonstrated as follows:

- Clause 5.6.3.1 is met by the following:
 - The isolation device is classified as part of the safety system (Class 1E power system). The isolation device will be qualified to Class 1E standards.
 - The circuit breaker or fuse used for this isolation is applied so that the maximum credible voltage or current transient applied to the non-Class 1E side of the circuit breaker or fuse does not degrade below an acceptable level the operation of the circuit on the other side of that circuit breaker or fuse, in accordance with IEEE Std 384-1992.
- Clause 5.6.3.2 is met by the following:
 - Following the isolation device, the COMS power circuit is treated as an “associated circuit” and routed with the division from which it originated, or it remains separated from the Class 1E circuit. The separation of Class 1E equipment shall be in accordance with IEEE Std 384-1992.
- Clause 5.6.3.3 is met by the following:
 - Isolation of the communication systems from Class 1E power systems prevents degrading the Class 1E power source below an acceptable level.

The communication system design enables communication for the plant personnel in vital areas during fire conditions, which tend to result in high noise levels. Areas of the plant that are subject to high-ambient noise conditions may require the use of headsets with noise-attenuating double ear cups and dynamic noise-canceling

microphones, including boom or noise-shielded microphones, or acoustic booths or hoods.

In areas where voice pages are not discernible above the ambient noise, alarm-type alerts are used in addition to visual alerts.

The respiratory protective devices to be used with the communication equipment are in accordance with NUREG-0654/FEMA-REP-1, Rev 1, Section II.E.7 (Reference 1).

9.5.2.1.1 10 CFR 50 Appendix E, Emergency Planning and Preparedness for Production and Utilization Facilities

Part IV.E(9) of 10 CFR Part 50, Appendix E, requires that emergency facilities and equipment include at least one onsite and one offsite communications system with each system having a backup power source.

The portable wireless system, PA and alarm system, digital telephone system, and sound-powered system provide onsite communications. With the exception of the sound-powered system, the onsite communications systems have a backup power source.

Offsite communication consists of at least two independent communication subsystems to provide emergency communication links from the Emergency Operation Facility (EOF) to the onsite MCR and Technical Support Center (TSC) as well as to the NRC and other federal, state, and local government agencies. A backup power source is provided for the offsite communication systems. A COL applicant that references the U.S. EPR design certification will provide a description of the offsite communication system that interfaces with the onsite communication system, including type of connectivity, radio frequency, normal and backup power supplies, and plant security system interface.

9.5.2.1.2 10 CFR 50.34 (f)(2)(xxv), Emergency Response Facilities

Details of the emergency response facilities, including the TSC, Operational Support Center (OSC), and the EOF, are provided by the COL applicant as addressed in Section 13.3.

9.5.2.1.3 10 CFR 50.47(b)(8), Equipment and Facilities to Support Emergency Response

Adequate communications equipment to support emergency response is provided, as described in this section. Details of emergency response facilities and associated communication capabilities are provided by the COL applicant as addressed in Section 9.5.2.1.1 and Section 13.3.

9.5.2.1.4 10 CFR 50.55 (a), Codes and Standards

The structures, systems, and components (SSC) of the COMS are designed, fabricated, erected, constructed, tested, and inspected to quality standards as required by industry standards. The SSC are installed in structures and anchored to sustain earthquake or other natural events without causing damage to any Class 1E SSC that are important to safety.

The following codes and standards as applicable are utilized for the COMS design:

- IEEE Std 269-2002, “IEEE Standard Methods for Measuring Transmission Performance of Analog and Digital Telephone Sets, Handsets, and Headsets.”
- IEEE Std 487-2000, “IEEE Recommended Practice for the Protection of Wire-Line Communication Facilities Serving Electric Supply Locations.”
- IEEE Std 692-1997, “IEEE Standard Criteria for Security Systems for Nuclear Power Generating Stations.”
- IEEE Std 1613-2003, “IEEE Standard Environmental and Testing Requirements for Communications Networking Devices in Electric Power Substations.”
- NFPA 70-2005, “National Electrical Code (NEC).”
- NFPA 72-2007, “National Fire Alarm Code.”
- 29 CFR Part 1910.165 Occupational Safety and Health Standards, “Employee Alarm Systems.”
- EPRI TR-102323-R3, “Guidelines for Electromagnetic Interference Testing of Power Plant Equipment.”
- MIL-STD-810F, “Environmental Engineering Considerations and Laboratory Tests.”
- IEEE/ANSI C63.12-1999, “American National Standard Recommended Practice for Electronic Compatibility Limits.”
- ANSI/TIA-603-C-2004, “Land Mobile FM or PM - Communications Equipment - Measurement and Performance Standards.”
- IEC 60529-2004, “Degrees of Protection Provided by Enclosures (IP Code).”

The guidelines provided in EPRI TR-102323-R3 for nuclear power plant emission limits and the recommended equipment susceptibility levels are used in the communication system (COMS) equipment design specifications for electromagnetic interference (EMI) and radio frequency interference (RFI). The related test requirements included in the standards in the EPRI Report are specified for the COMS equipment factory testing. Also, the COMS equipment arrangement and layout design

is based on the practices recommended in the EPRI guidelines for minimizing susceptibility to EMI and RFI.

9.5.2.1.5 10 CFR 50 Appendix A - General Design Criteria

GDC 1, GDC 2, GDC 3, and GDC 4 apply to SSC important to safety. The COMS is classified as a non-Class 1E system, and therefore serves no safety-related functions.

GDC 19 requires equipment at appropriate locations outside the MCR to be provided for prompt hot shutdown of the reactor with a potential capability for subsequent cold shutdown of the reactor through the use of suitable procedures. While there is COMS equipment located in the RSS, the COMS equipment is not required to function for hot or cold shutdown of the reactor.

9.5.2.1.6 10 CFR 73.45(e)(2)(iii), Performance Capabilities for Fixed Site Physical Protection Systems – Communications Subsystems, and 10 CFR 73.45(g)(4)(i), Provide Communications Networks

The COMS provides communication capability for plant security personnel, guards, and watchmen at certain locations as necessary to support the transmission of security information among onsite forces. Additional security communication measures are included as part of the physical protection intercommunication system including the use of private, secure communication radios.

9.5.2.1.7 10 CFR 73.55(e), Requirements for Physical Protection of Licensed Activities in Nuclear Power Reactors Against Radiological Sabotage – Detection Aids, 10 CFR 73.55(f), Communications Subsystems, and 10 CFR 73.46(f), Fixed site Physical Protection Systems, Subsystems, Components and Procedures – Communications Subsystems

The portable wireless communication system and the digital telephone system enable guards, watchmen, or armed response individuals on duty to maintain continuous communication with individuals in continuously manned alarm stations and with law enforcement authorities, as required by 10 CFR 73.55 (e) and (f) and 10 CFR 73.46 (f). Design features required for security, including alarms and communications required by 10 CFR 73.55, are listed in Section 13.6. A physical security plan, as addressed in Section 13.6, is provided by the COL applicant per 10 CFR 52.79(a)(35) that satisfies the requirements of 10 CFR Part 73. Non-portable communications equipment required by these regulations is powered from independent power sources so that it remains operable in the event of a loss of normal power.

9.5.2.2 System Description

9.5.2.2.1 Portable Wireless Communication System

The portable wireless communication system is designed to provide a standalone method of plant-wide communication between designated personnel equipped with, or having access to, wireless two way radios. This system, illustrated in Figure 9.5.2-1—Portable Wireless Communication Systems, is provided for use by fire brigade and other operations personnel required to achieve safe plant shutdown. The radio equipment enables interface to the PA system, as well as to the digital telephone system. The portable radios can dial the digital telephone terminal extensions directly, access a paging channel, or dial to external telephone numbers via an interconnection to the public switched telephone network (PSTN).

The portable wireless communication system is comprised of transmitters, receivers, antennas, amplifiers, and radio base station equipment. Antennas and amplifiers are distributed throughout the plant to enable effective radio coverage. Radio coverage is provided throughout the plant, although radio usage in certain instrumentation and control (I&C) areas is restricted due to potential EMI/RFI considerations. These restricted areas are minimized based on transceiver emissions and recommended equipment susceptibility testing levels as required by Regulatory Guide 1.180, Guidelines for Evaluation of Electromagnetic and Radio Frequency Interference in Safety Related Instrumentation and Control Systems. Additionally, low powered portable radios will be used to limit, as practicable, the need for imposing restricted areas for portable radios. The restricted areas will have posted warning signs. The COMS system is designed, installed, and tested so that I&C system circuits are not adversely impacted by EMI/RFI from transmitting sources.

The portable wireless communication system has adequate number of channels to accommodate anticipated functions such as fire, operations, health physics, fuel reloading, emergency, and security.

Mobile, hand-held units are used for direct, unit-to-unit communication via the base station. These units are robust, highly reliable and can withstand the harsh operating environment of the facility. The air interface and radio equipment parameters are identical to that for the base station, except for transmitter power.

The base station equipment for the portable wireless communication system is housed in NEMA 250 Type 4 rated cabinets, which are physically separated from the other subsystem equipment such as the digital telephone, PA, and alarm system. Physical separation of the cabinets increases protection against a single accident or fire from affecting multiple modes of communication throughout the plant.

Repeaters are utilized to allow seamless radio coverage throughout the plant. Antennas and cables interconnecting the repeaters to the base station equipment are

located in a manner to facilitate the improved radio signal penetration into areas that are not properly served by the primary antenna. Section 9.5.1 provides information regarding RG 1.189 compliance for the protection of repeaters from the effects of fire.

Radio trunking is implemented through the use of a trunking controller. Trunking provides improved channel utilization, spectrum availability, and feature flexibility.

9.5.2.2.2 Digital Telephone System

The digital telephone system provides plant-wide intercom capability for private conversation between personnel via private automatic branch exchange (PABX). The digital telephone system also provides an interconnection to the PSTN, allowing incoming and outgoing offsite communication. Dedicated digital telephone terminals are placed throughout the plant to facilitate access to this mode of communication. This system has access to the PA system, enabling personnel the ability to initiate pages over the PA system loudspeakers.

The telephone system utilizes a switching system capable of providing a telephone service for voice, paging, modem, and fax connections. The system is compatible with interface equipment or circuits used throughout the facility.

The main distribution frame of the telephone system consists of several distribution sections. A distribution section is provided for each Safeguard Building. The incoming lines of one division are collected together in the same section.

The PABX is equipped with a DC power unit and connected to a rectifier/charger and battery system having two hours of backup battery capacity. The rectifier/charger unit has sufficient rating to concurrently power a fully equipped PABX system and simultaneously provide charging current to the battery. The charging current requirement is based on a fully discharged battery being recharged to 100 percent over a twelve hour period. Maintenance-free, sealed batteries are used.

9.5.2.2.3 Public Address and Alarm System

The PA and alarm system facilitate broadcast of messages, sirens, or tones to plant personnel via the paging feature. Non-broadcast communication capabilities are provided via dedicated access terminals that allow one-to-one conversation between parties. The entire plant is reachable via the PA system. It is possible to manually initiate whole-plant alarms or alarms just for specific buildings at the control panel in the MCR and at the RSS.

The PA system utilizes amplifiers, loudspeakers, tone generators, sirens, and party-line access terminals and transceiver equipment to supply verbal and alarm signal communication throughout the entire plant. The PA system utilizes two modes of

verbal operation: voice paging and party-line. The PA system also utilizes one mode of non-verbal operation: siren/tone signaling.

The first mode of verbal operation is voice paging. This mode is used as the primary type of plant-wide communication. A network of amplifiers and loudspeakers is distributed throughout the plant in an effort to provide comprehensive access to messages and announcements that are broadcast simultaneously over the paging channel to all areas of the plant. The paging channels are accessible from the MCR or the RSS via microphones or telephone transceiver units that are dedicated to the PA system. There is also an interconnection between this system and the digital telephone system which allows paging channel access directly through a PABX telephone by dialing an extension to activate the voice paging broadcast capabilities of the PA system. Voice paging is one-way communication only, broadcasting messages over the loudspeakers to plant personnel.

The second mode of verbal operation is the party-line communication. This mode is used to enable personnel the ability to respond to voice pages or initiate party-line communication with select recipients. This method of communication is useful for personnel that may be responding to a voice page, whereby the PA announcement will indicate what channel should be used for subsequent party-line conversation. Party-line handsets are distributed throughout the plant at fixed locations for easy access. Noise-canceling headphones with directional microphones or acoustic booths are provided in areas of the plant that are subject to high ambient noise conditions.

A non-verbal mode of operation is deployed using the same conceptual basis as the voice paging system. The message that is relayed plant-wide is a signaling tone to either alert the staff or provide status. A tone generator produces five warning tones: (1) pulse, (2) siren, (3) yelp, (4) warble and (5) steady. Tones are activated by a number of external sources, including fire equipment, or by manually closing user-supplied contact switches. Higher priority tones can be programmed to override those of lower priority. This unit is user-programmable and is programmed by the COL applicant. In areas with high noise levels, strobe or beacon lighting is provided to complement the siren or tone. This system is interconnected with the alarm systems to incorporate alarm functionality via the PA system. For dedicated areas with a highly fluctuating noise level an automatic loudspeaker volume control is used.

Announcements are made from a variety of sources, such as an engineer test panel, operator access panels, telephones via PABX interface, radio via PABX interface, and digitally recorded messages. A trunk cable connects the PABX to the PA system.

9.5.2.2.4 Sound-Powered System

A sound-powered system, independent from the other COMS subsystems, is provided for normal and abnormal and accident conditions. This system allows uninterrupted

communication between the MCR and the control rod drive equipment areas, refueling platform area, turbine generator operating deck, areas containing switchgear, motor control centers, and other maintenance areas.

The sound-powered phone works on the principle of creating an electrical signal from sound waves. An electro-mechanical transducer in a sound-powered telephone converts sound pressure from a user's voice into electrical current. The electric current is sent through standard telecommunication wiring to the receiver. At the receiving end, the electrical current is converted back to sound energy by the receiving transducer. The phones require no batteries, amplifiers, or power supplies. The sound-powered phone circuit emits no electromagnetic or radio frequency interference. Several stations (phones) can be connected to the same circuit.

The sound-powered system provides party-line communication between designated areas by the use of corded headsets or handsets that are plugged into dedicated phone jacks throughout the facility. The jacks are connected in a loop configuration throughout the plant which does not require any switching or manual intervention to acquire the desired channel. Figure 9.5.2-2—Sound-Powered System, illustrates the loop configuration of the system. The jacks are designated with unique identification labels to determine which channel is associated for each jack.

The sound-powered system does not require an external power source.

9.5.2.2.5 Emergency Offsite Communication

To facilitate two-way (incoming and outgoing) emergency communications from onsite to offsite facilities and agencies, a minimum of two independent communications links are provided. The onsite facilities provided with the emergency communications links are the main control room (MCR), remote shutdown station (RSS), Technical Support Center (TSC) and Operations Support Center (OSC). The offsite facilities include the Emergency Operations Facility (EOF), NRC resident office, and federal, state and local government agencies as identified in the emergency response plan. COL Item 13.3-1 in Table 1.8-2 specifies that the COL applicant is responsible for providing a site-specific emergency plan. The two independent communications links are:

1. Dedicated "hotline" telephones that provide direct communications to the selected locations in an off-hook condition. The provisions for "hotline" telephones are incorporated into the design of the onsite digital telephone subsystem.
2. Provisions for two-way radio communications via the portable wireless communication subsystem for personnel with access to specific wireless radios onsite and for the offsite personnel as required by the COL applicant.

Specific details about the type of "hotline" telephone connectivity (cable or voice over IP), the number of parties to be connected, the radio frequency (UHF, VHF or

microwave), normal and backup power supplies, plant security system interface, etc., for the offsite communication system is provided by the COL applicant as indicated in COL Item 9.5-21 in Table 1.8-2.

Testing of the offsite communications system is addressed by COL Items 13.3-1 and 14.3-1 in Table 1.8-2.

9.5.2.2.6 Security Communication

Design features required for security, including communications, are listed in Section 13.6. A physical security plan and a site-specific security assessment are provided by the COL applicant as addressed in Section 13.6.

9.5.2.3 System Operation Communications Stations

Various communication stations are provided throughout the plant. Table 9.5.2-1—Communication Equipment and Locations, lists the minimum communications stations. The COL applicant referencing the U.S. EPR certified design will identify additional site-specific communication locations necessary to support effective communication between plant personnel in all vital areas of the plant during normal operation, as well as during accident conditions.

9.5.2.4 Inspection and Testing Requirements

Each subsystem is unique and requires specific sets of test procedures for use by the plant operations and maintenance staff. Following construction, modification, repair, or replacement of COMS equipment, sufficient testing is performed to demonstrate that equipment performs satisfactorily in service and that design criteria are met. Refer to Section 14.2 (Test #130) for the initial plant testing to verify the adequacy of intra-plant and offsite communication systems. The digital telephone system is tested in accordance with IEEE Std 269-2002 (Reference 3) to verify proper operation of the system.

Communication equipment is tested in accordance with the procedure recommended by the equipment supplier to verify COMS operability under the predicted worst-case EMI/RFI environment. In addition, communications equipment is tested periodically to verify that COMS equipment can operate under maximum plant noise conditions.

The COMS is typically composed of commercial grade equipment. To verify delivery and installation of quality product, the Supplier is required to have a quality management system (QMS) for the design, manufacture, installation management, and services that incorporate certain aspects of the guidelines and methods provided in EPRI documents NP-5652 (Reference 5) and TR-106439 (Reference 6). The COMS equipment is appropriately qualified commensurate with the safety significance of the equipment functions. The COMS is classified as a non-safety-related system in

Table 3.2.2-1. Compliance with 10 CFR 50, Appendix B and 10 CFR 21 for the COMS is not required.

9.5.2.5

References

1. NUREG-0654/FEMA-REP-1, Section II.E.7. "Criteria for Preparation and Evaluation of Radiological Emergency Response Plans and Preparedness in Support of Nuclear Power Plants," Revision 1, U.S. Nuclear Regulatory Commission, 1980.
2. IEEE Std 384-1992, "IEEE Standard Criteria for Independence of Class 1E Equipment and Circuits," Institute of Electrical and Electronics Engineers, Inc., 1992.
3. IEEE Std 269-2002, "IEEE Standard Methods for Measuring Transmission Performance of Analog and Digital Telephone Sets, Handsets, and Headsets," Institute of Electrical and Electronics Engineers, Inc., 2002.
4. IEEE Std 603-1998, "IEEE Standard Criteria for Safety Systems for Nuclear Power Generating Stations," Institute of Electrical and Electronics Engineers, Inc., 1998.
5. EPRI NP-5652, "Guideline for the Utilization of Commercial Grade Items in Nuclear Safety Related Applications," Electric Power Research Institute, 1988.
6. EPRI TR-106439, "Guideline on Evaluation and Acceptance of Commercial Grade Digital Equipment for Nuclear Safety Applications," Electric Power Research Institute, 1996.

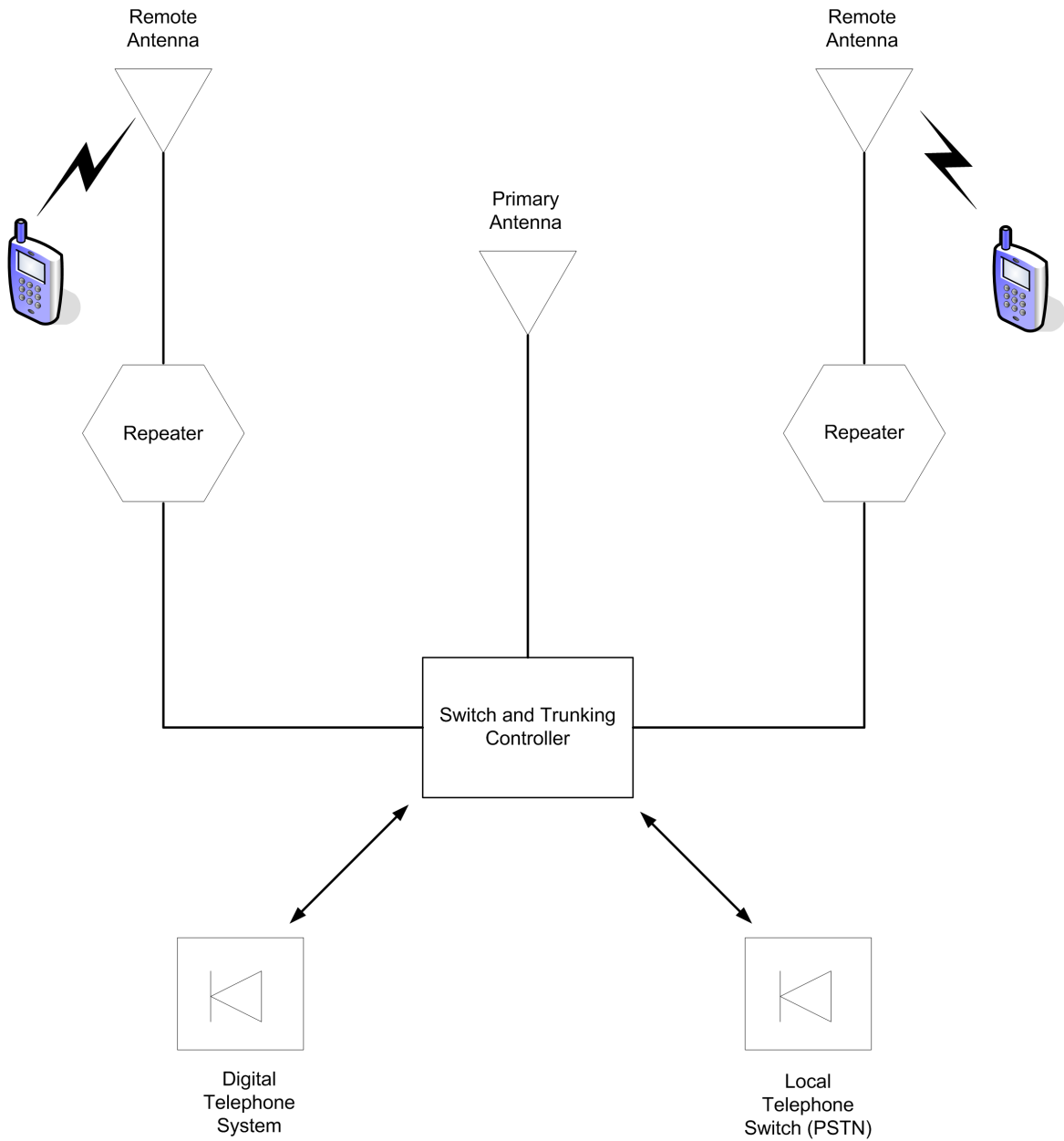
Table 9.5.2-1—Communication Equipment and Locations

Primary Area /Location¹
Main Control Room
Remote Shutdown Station
Technical Support Center
Operational Support Center
Emergency Diesel Generator Operating Areas
Control Rod Drive Equipment Area
Refueling Platform Area
Turbine Generator Operating Area
Emergency Power Supply System (EPSS) Motor Control Center and Switchgear Areas ²

Note:

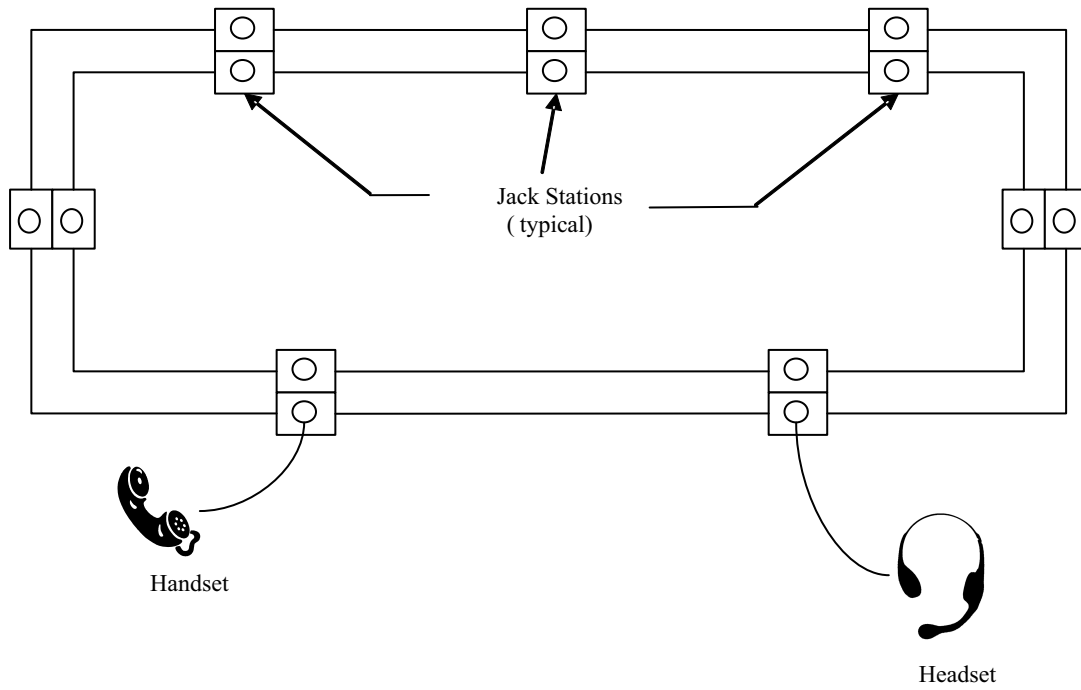
1. Each location is provided with equipment to allow use of the digital telephone system, PA and alarm system, and sound-powered system and sufficient radio coverage to allow use of the portable wireless communication system.
2. Equipment is located in various rooms of Safeguards Buildings, Emergency Power Generation Building, and Essential Service Water Pump Station.

Figure 9.5.2-1—Portable Wireless Communication Systems



EPR3650 T2

Figure 9.5.2-2—Sound-Powered System



EPR3655 T2