

## 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 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.

**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.

**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 seamless radio coverage. Radio coverage is provided throughout the plant, although radio usage in certain instrumentation and control (I&C) areas are restricted due to potential EMI/RFI considerations. These 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, although the message that is relayed plant-wide will be a siren or signaling tone to either alert the staff or provide status. 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**

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.

#### **9.5.2.2.6 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 14.2.12.11.7 (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.

#### **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.



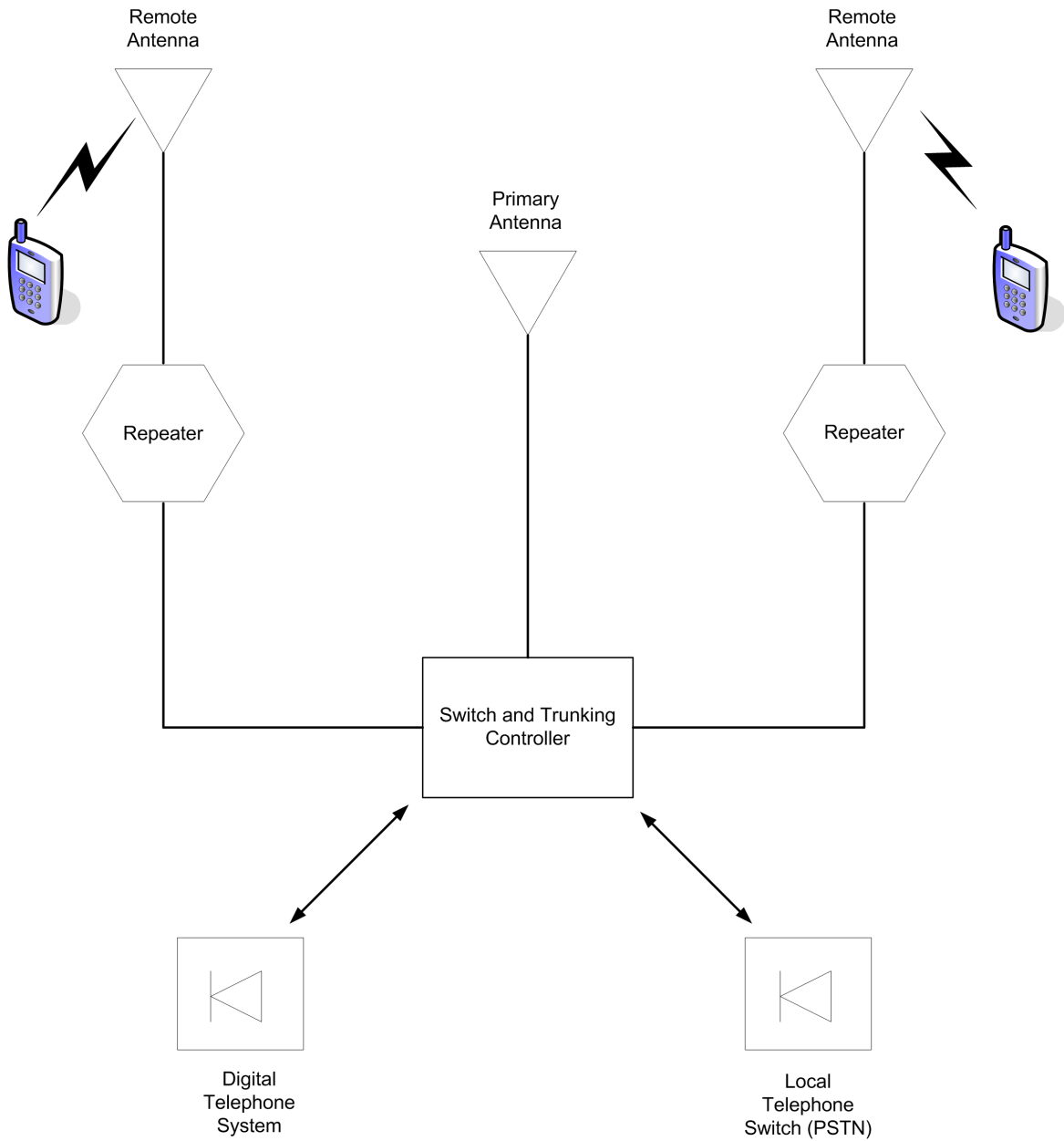
**Table 9.5.2-1—Communication Equipment and Locations**

<b>Primary Area /Location<sup>1</sup></b>
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
Motor Control Center Areas
Switchgear Areas

**Note:**

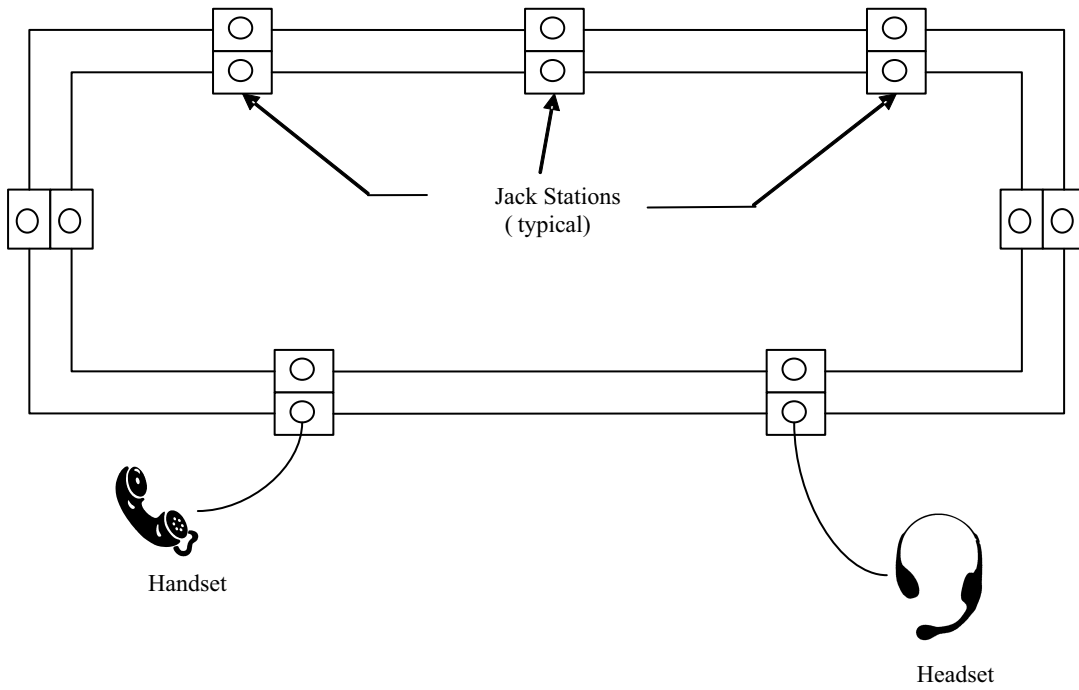
1. Each location is provided with equipment to allow use of the digital telephone system, PA and alarm system, and sound-powered system.

Figure 9.5.2-1—Portable Wireless Communication Systems



EPR3650 T2

Figure 9.5.2-2—Sound-Powered System



EPR3655 T2