



U.S. NUCLEAR REGULATORY COMMISSION

STANDARD REVIEW PLAN

9.5.2 COMMUNICATIONS SYSTEMS

REVIEW RESPONSIBILITIES

Primary - Organization responsible for the review of instrumentation and controls

Secondary - None

I. AREAS OF REVIEW

This review of the communications systems is limited to that portion of the system used in intraplant and plant-to-offsite communications during normal operation, transients, fire, accidents, off-normal phenomena, and security-related events. Examples of normal operation intraplant communication are during in-service testing, inspection, and maintenance. An example of normal operation plant-to-offsite communication is between plant operators and offsite electric power grid transmission organization staff to be informed of the nuclear power plant offsite power status. Examples of normal operation plant-to-offsite communication are between plant operators and the NRC Incident Response Center and local authorities when the plant is operating during natural phenomena such as a tornado, hurricane, flood, tsunami, lightning strike, and earthquake. Systems within the scope of this SRP section include voice communications between personnel and organizations. SRP Sections 7.9 and 13.3 address the review of systems for communicating data between portions of the instrumentation systems and between facilities.

The specific areas of review are as follows:

1. System Capabilities. The communications system is reviewed with respect to the capability of the system and related plant design features to provide effective intraplant communications and effective plant-to-offsite communications during normal plant operations and during transient, fire, and accident conditions, including loss of offsite power.

Revision 3 - March 2007

USNRC STANDARD REVIEW PLAN

This Standard Review Plan, NUREG-0800, has been prepared to establish criteria that the U.S. Nuclear Regulatory Commission staff responsible for the review of applications to construct and operate nuclear power plants intends to use in evaluating whether an applicant/licensee meets the NRC's regulations. The Standard Review Plan is not a substitute for the NRC's regulations, and compliance with it is not required. However, an applicant is required to identify differences between the design features, analytical techniques, and procedural measures proposed for its facility and the SRP acceptance criteria and evaluate how the proposed alternatives to the SRP acceptance criteria provide an acceptable method of complying with the NRC regulations.

The standard review plan sections are numbered in accordance with corresponding sections in Regulatory Guide 1.70, "Standard Format and Content of Safety Analysis Reports for Nuclear Power Plants (LWR Edition)." Not all sections of Regulatory Guide 1.70 have a corresponding review plan section. The SRP sections applicable to a combined license application for a new light-water reactor (LWR) are based on Regulatory Guide 1.206, "Combined License Applications for Nuclear Power Plants (LWR Edition)."

These documents are made available to the public as part of the NRC's policy to inform the nuclear industry and the general public of regulatory procedures and policies. Individual sections of NUREG-0800 will be revised periodically, as appropriate, to accommodate comments and to reflect new information and experience. Comments may be submitted electronically by email to NRR_SRP@nrc.gov.

Requests for single copies of SRP sections (which may be reproduced) should be made to the U.S. Nuclear Regulatory Commission, Washington, DC 20555, Attention: Reproduction and Distribution Services Section, or by fax to (301) 415-2289; or by email to DISTRIBUTION@nrc.gov. Electronic copies of this section are available through the NRC's public Web site at <http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr0800/>, or in the NRC's Agencywide Documents Access and Management System (ADAMS), at <http://www.nrc.gov/reading-rm/adams.html>, under Accession # ML070550037.

2. Inspections, Tests, Analyses, and Acceptance Criteria (ITAAC). For design certification (DC) and combined license (COL) reviews, the staff reviews the applicant's proposed ITAAC associated with the structures, systems, and components (SSCs) related to this SRP section in accordance with SRP Section 14.3, "Inspections, Tests, Analyses, and Acceptance Criteria." The staff recognizes that the review of ITAAC cannot be completed until after the rest of this portion of the application has been reviewed against acceptance criteria contained in this SRP section. Furthermore, the staff reviews the ITAAC to ensure that all SSCs in this area of review are identified and addressed as appropriate in accordance with SRP Section 14.3.
3. COL Action Items and Certification Requirements and Restrictions. For a DC application, the review will also address COL action items and requirements and restrictions (e.g., interface requirements and site parameters).

For a COL application referencing a DC, a COL applicant must address COL action items (referred to as COL license information in certain DCs) included in the referenced DC. Additionally, a COL applicant must address requirements and restrictions (e.g., interface requirements and site parameters) included in the referenced DC.

Review Interfaces

Other SRP sections interface with this section as follows:

1. Verification that the offsite communication system will satisfy emergency plan requirements for accident conditions, including notification of personnel and implementation of evacuation procedures, is performed under SRP Section 13.3.
2. The review of procedures and testing to determine the acceptability of the preoperational and startup tests is performed under SRP Section 14.0.
3. Verification that onsite communications are adequate for the coordination of firefighting, including support of alternative and dedicated shutdown capabilities, is performed under SRP Section 9.5.1. Regulatory Guide 1.189, Revision 1, "Fire Protection for Nuclear Power Plants," provides guidance on communication system functions needed to support firefighting activities.
4. Verification that onsite and offsite communications are adequate for coordination of security activities both within the plant and with external security and law enforcement organizations is performed under SRP Section 13.6.
5. Verification of the adequacy of control room communications and features to support reliable human performance is performed under SRP Chapter 18.

The specific acceptance criteria and review procedures are contained in the referenced SRP sections.

II. ACCEPTANCE CRITERIA

Requirements

Acceptance criteria are based on meeting the relevant requirements of the following Commission regulations:

1. Appendix E to 10 CFR Part 50, "Emergency Planning and Preparedness for Production and Utilization," particularly part IV.E(9), as it relates to the provision of at least one onsite and one offsite communications system, each with a backup power source.
2. 10 CFR 50.34(f)(2)(xxv), "Emergency Response Facilities," (TMI Action Plan Item III A.1.2).
3. 10 CFR 50.47(a)(8), "Equipment and Facilities to Support Emergency Response."
4. 10 CFR 50.55a, "Codes and Standards."
5. General Design Criteria (GDC) 1, "Quality Standards and Records."
6. GDC 2, "Design Basis for Protection Against Natural Phenomena."
7. GDC 3, "Fire Protection."
8. GDC 4, "Environmental and Missile Design Bases."
9. GDC 19, "Control Room."
10. 10 CFR 73.45(e)(2)(iii), "Performance Capabilities for Fixed Site Physical Protection Systems - Communications Subsystems."
11. 10 CFR 73.45(g)(4)(i), "Provide Communications Networks."
12. 10 CFR 73.46(f), "Fixed Site Physical Protection Systems, Subsystems, Components, and Procedures - Communications Subsystems."
13. 10 CFR 73.55(e), "Requirements for Physical Protection of Licensed Activities in Nuclear Power Reactors Against Radiological Sabotage - Detection Aids."
14. 10 CFR 73.55(f), "Communications Subsystems."
15. 10 CFR 52.47(b)(1), which requires that a DC application contain the proposed inspections, tests, analyses, and acceptance criteria (ITAAC) that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, a plant that incorporates the design certification is built and will operate in accordance with the design certification, the provisions of the Atomic Energy Act, and the NRC's regulations;
16. 10 CFR 52.80(a), which requires that a COL application contain the proposed inspections, tests, and analyses, including those applicable to emergency planning, that the licensee shall perform, and the acceptance criteria that are necessary and sufficient to provide reasonable assurance that, if the inspections, tests, and analyses are performed and the acceptance criteria met, the facility has been constructed and will operate in conformity with the combined license, the provisions of the Atomic Energy Act, and the NRC's regulations.

SRP Acceptance Criteria

Specific SRP acceptance criteria acceptable to meet the relevant requirements of the NRC's regulations identified above are as follows for the review described in this SRP section. The SRP is not a substitute for the NRC's regulations, and compliance with it is not required. However, an applicant is required to identify differences between the design features, analytical techniques, and procedural measures proposed for its facility and the SRP acceptance criteria and evaluate how the proposed alternatives to the SRP acceptance criteria provide acceptable methods of compliance with the NRC regulations.

1. Information regarding the requirements of Appendix E to 10 CFR Part 50, Part IV.E(9), will be found acceptable if adequate provisions are made and described for emergency facilities and equipment, including: at least one onsite and one offsite communications system; each system shall have a backup power source.
2. For those applicants subject to either 10 CFR 50.34(f) or the TMI Action Plan, information regarding the requirements of 10 CFR 50.34(f)(2)(xxv) and TMI Action Plan Item III A.1.2 will be found acceptable if provisions are made for an onsite Technical Support Center, an onsite Operational Support Center, and, for construction permit applications only, a nearsite Emergency Operations Facility.
3. Information regarding the requirements of 10 CFR 50.47(a)(8) will be found acceptable if adequate emergency facilities and equipment to support the response are provided and maintained.
4. Information regarding the requirements of 10 CFR 50.55a will be found acceptable if SSCs are designed, fabricated, erected, constructed, tested, and inspected to quality standards commensurate with the importance of the safety function to be performed.
5. Information regarding the requirements of GDC 1 will be found acceptable if SSCs important to safety are designed, fabricated, erected, and tested to quality standards commensurate with the importance of the safety functions to be performed. Where generally recognized codes and standards are used, they shall be identified and evaluated to determine their applicability, adequacy, and sufficiency and shall be supplemented or modified as necessary to assure a quality product in keeping with the required safety function. A quality assurance program shall be established and implemented in order to provide adequate assurance that these SSCs will satisfactorily perform their safety functions. Appropriate records of the design, fabrication, erection, and testing of SSCs important to safety shall be maintained by or under the control of the nuclear power unit licensee throughout the life of the unit.
6. Information regarding the requirements of GDC 2 will be found acceptable if SSCs important to safety are designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunamis, and seiches without loss of capability to perform their safety functions. The design bases for these SSCs shall reflect: (1) appropriate consideration of the most severe of the natural phenomena that have been historically reported for the site and surrounding area, with sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated, (2) appropriate combinations of the effects of normal and accident conditions with the effects of the natural phenomena and (3) the importance of the safety functions to be performed.

7. Information regarding the requirements of GDC 3 will be found acceptable if SSCs important to safety are designed and located to minimize, consistent with other safety requirements, the probability and effect of fires and explosions. Noncombustible and heat resistant materials shall be used wherever practical throughout the unit, particularly in locations such as the containment and control room. Fire detection and fighting systems of appropriate capacity and capability shall be provided and designed to minimize the adverse effects of fires on SSCs important to safety. Firefighting systems shall be designed to assure that their rupture or inadvertent operation does not significantly impair the safety capability of these SSCs.
8. Information regarding the requirements of GDC 4 will be found acceptable if SSCs important to safety are designed to accommodate the effects of and to be compatible with the environmental conditions associated with normal operation, maintenance, testing, and postulated accidents, including loss-of-coolant accidents. These SSCs shall be appropriately protected against dynamic effects, including the effects of missiles, pipe whipping, and discharging fluids, that may result from equipment failures and from events and conditions outside the nuclear power unit.
9. Information regarding the requirements of GDC 19 will be found acceptable if equipment at appropriate locations outside the control room shall be provided (1) with a design capability for prompt hot shutdown of the reactor, including necessary instrumentation and controls (I&C) to maintain the unit in a safe condition during hot shutdown, and (2) with a potential capability for subsequent cold shutdown of the reactor through the use of suitable procedures.
10. Information regarding the requirements of 10 CFR 73.45(e)(2)(iii) will be found acceptable if communications subsystems and procedures are provided for notification of an attempted unauthorized or unconfirmed removal of strategic special nuclear material so that response can be such as to prevent the removal and satisfy the general performance objective and requirements of § 73.20(a).
11. Information regarding the requirements of 10 CFR 73.45(g)(4)(i) will be found acceptable if communications networks are provided to transmit rapid and accurate security information among onsite forces for routine security operation, assessment of a contingency, and response to a contingency.
12. Information regarding the requirements of 10 CFR 73.46(f) will be found acceptable if each guard, watchman, or armed response individual on duty shall be capable of maintaining continuous communication with an individual in each continuously manned alarm station required by 10CFR 73.46(e)(5), who shall be capable of calling for assistance from other guards, watchmen, and armed response personnel and from law enforcement authorities; each alarm station required by 10 CFR 73.46(e)(5) shall have both conventional telephone service and radio or microwave transmitted two-way voice communication, either directly or through an intermediary, for the capability of communication with the law enforcement authorities; and non-portable communications equipment controlled by the licensee and required by 10CFR 73.46(f) shall remain operable from independent power sources in the event of the loss of normal power.
13. Information regarding the requirements of 10 CFR 73.55(e) will be found acceptable if all alarms required by 10 CFR 73.55 annunciate in a continuously manned central alarm station located within the protected area and in at least one other continuously manned station not necessarily onsite, so that a single act cannot remove the capability of calling

for assistance or otherwise responding to an alarm. The onsite central alarm station must be considered a vital area and its walls, doors, ceiling, floor, and any windows in the walls and in the doors must be bullet-resisting. The onsite central alarm station must be located within a building in such a manner that the interior of the central alarm station is not visible from the perimeter of the protected area. This station must not contain any operational activities that would interfere with the execution of the alarm response function. Onsite secondary power supply systems for alarm annunciator equipment and non-portable communications equipment as required 10 CFR 73.55(f) of this section must be located within vital areas. All alarm devices including transmission lines to annunciators shall be tamper indicating and self-checking, e.g., an automatic indication is provided when failure of the alarm system or a component occurs, or when the system is on standby power. The annunciation of an alarm at the alarm stations shall indicate the type of alarm (e.g., intrusion alarms, emergency exit alarm, etc.) and location. All emergency exits in each protected area and each vital area shall be alarmed.

14. Information regarding the requirements of 10 CFR 73.55(f) will be found acceptable if each guard, watchman or armed response individual on duty is capable of maintaining continuous communication with an individual in each continuously manned alarm station required by 10 CFR 73.55(e)(1), who shall be capable of calling for assistance from other guards, watchmen, and armed response personnel and from local law enforcement authorities. The alarm stations required by 10 CFR 73.55(e)(1) shall have conventional telephone service for communication with the law enforcement authorities as described in 10 CFR 73.55(f)(1). To provide the capability of continuous communication, radio or microwave transmitted two-way voice communication, either directly or through an intermediary, shall be established, in addition to conventional telephone service, between local law enforcement authorities and the facility and shall terminate in each continuously manned alarm station required by 10 CFR 73.55(e)(1). Non-portable communications equipment controlled by the licensee and required by 10 CFR 73.55 shall remain operable from independent power sources in the event of the loss of normal power.

III. REVIEW PROCEDURES

The reviewer will select material from the procedures described below, as may be appropriate for a particular case.

These review procedures are based on the identified SRP acceptance criteria. For deviations from these acceptance criteria, the staff should review the applicant's evaluation of how the proposed alternatives provide an acceptable method of complying with the relevant NRC requirements identified in Subsection II.

The reviewer will evaluate information provided in the safety evaluation report (SER) pertaining to the design of the communication system and related plant features to determine that intraplant communication equipment needed in vital areas during recovery actions from transient, fire, or accident conditions is provided in a manner that supports proper operation of other plant equipment.

The staff will review the design basis, design criteria, and system description sections and the analyses that demonstrate the effectiveness of the system when plant noise levels are at their maximum during incident and accident conditions to verify that the communication system will function effectively. Reviewers use engineering judgment in conjunction with a comparison of the system capabilities with equipment and communication systems provided for previously approved plants.

1. For new applications, the review should involve the following activities:
 - A. Verify that effective communication will not be impeded by transmission through barriers, high-noise areas, personnel use of protective equipment, inadequate number of communication channels, interference between channels or subsystems, or interference from other electronic or electrical equipment.
 - B. Verify that coverage of wireless communications capability is adequate to support needed communications with plant and offsite personnel.
 - C. Verify that the number and location of hardwired communication sets are adequate to support communications with plant and offsite personnel.
 - D. Verify that the features to alert personnel in high-noise environments to use the communication systems are adequate.
 - E. Verify that system equipment required to mitigate the consequences of a specific design-basis event (e.g., natural phenomena, violent external attack) is independent of, and physically separated from, the effects of the design-basis event (e.g., fire suppression actuation, loss of offsite power) to the degree necessary to retain the required communications capability.
 - F. Verify that functional testing is planned under conditions that simulate the maximum plant noise levels generated during the various operating conditions, including fire and accident conditions, to demonstrate system capabilities.
 - G. Verify that the communications equipment, including offsite equipment, will remain operable in the event of loss of primary power and that secondary power supplies for nonportable equipment are located within vital areas.
 - H. Verify that communications systems and equipment have been evaluated to determine their applicability, adequacy, and sufficiency to assure a quality product in keeping with the required functions. Communication systems will typically be composed of commercial equipment. Therefore, the equipment should be appropriately qualified commensurate with the safety performance of the equipment functions. The guidance of EPRI NP-5652, "Guideline for the Utilization of Commercial-Grade Items in Nuclear Safety-Related Applications," describes qualification processes and criteria that, while not directly applicable to nonsafety systems, should be considered in the qualification of communications system equipment. In a similar manner, the guidance of EPRI TR-106439, "Guideline on Evaluation and Acceptance of Commercial Grade Digital Equipment for Nuclear Safety Applications," (accepted by an NRC safety evaluation dated July 17, 1987, should be considered if computer-based equipment is involved.
 - I. Verify that communications equipment will be compatible with the electromagnetic interference (EMI) and radiofrequency interference (RFI) environment of the plant and that design measures have been taken such that there will be no interference between wireless communications systems and other plant equipment. Regulatory Guide 1.180, "Guidelines for Evaluating Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation and Control Systems," identifies electromagnetic environment

operating envelopes, design, installation, and test practices acceptable to the staff for addressing the effects of EMI, RFI, and power surges on I&C systems and components important to safety. While nonsafety systems are not part of this regulatory guide, control of EMI/RFI from these systems is necessary to ensure that safety-related I&C systems can continue to perform properly in the nuclear power plant environment. When feasible, the emissions from nonsafety-related systems should be held to the same levels as those from safety-related systems.

- J. Verify the adequacy of any special equipment facilitating communications with personnel using protective equipment (e.g., respirators, underwater diving equipment).
2. The reviewer may decide that, for a specific case, specific aspects of the design should receive emphasis, while other aspects of the design need not receive the same emphasis and indepth review. Typical reasons for such nonuniform emphasis are the introduction of new communication system designs or the use of communication systems previously found acceptable in similar circumstances. However, in all cases, the review must be sufficient to conclude conformance to the requirements of the NRC's regulations. For deviations from these specific acceptance criteria, the staff should review the applicant's evaluation of how the proposed alternatives to the SRP criteria provide an acceptable method of complying with the relevant NRC requirements identified in Subsection II above.
3. For review of a DC application, the reviewer should follow the above procedures to verify that the design, including requirements and restrictions (e.g., interface requirements and site parameters), set forth in the final safety analysis report (FSAR) meets the acceptance criteria. DCs have referred to the FSAR as the design control document (DCD). The reviewer should also consider the appropriateness of identified COL action items. The reviewer may identify additional COL action items; however, to ensure these COL action items are addressed during a COL application, they should be added to the DC FSAR.

For review of a COL application, the scope of the review is dependent on whether the COL applicant references a DC, an early site permit (ESP) or other NRC approvals (e.g., manufacturing license, site suitability report or topical report).

For review of both DC and COL applications, SRP Section 14.3 should be followed for the review of ITAAC. The review of ITAAC cannot be completed until after the completion of this section.

IV. EVALUATION FINDINGS

The reviewer verifies that the applicant has provided sufficient information and that the review and calculations (if applicable) support conclusions of the following type to be included in the staff's safety evaluation report. The reviewer also states the bases for those conclusions.

The communication system includes all components for intraplant and plant-to-offsite communications. The scope of review of the communications system for the plant includes verification that offsite equipment is capable of

providing for notification of personnel and implementation of evacuation procedures, and verification that onsite communications are adequate in the event of an emergency.

The basis for acceptance of the communication system in the review is conformance of the design, design criteria, and design bases to staff positions and industry standards and the ability of the system to provide effective communications between plant personnel in all vital areas during the full spectrum of accident or incident conditions under maximum potential noise levels.

The staff concludes that the design of the communications system meets the staff's criteria and industry standards and is therefore acceptable.

For DC and COL reviews, the findings will also summarize the staff's evaluation of requirements and restrictions (e.g., interface requirements and site parameters) and COL action items relevant to this SRP section.

In addition, to the extent that the review is not discussed in other SER sections, the findings will summarize the staff's evaluation of the ITAAC, including design acceptance criteria, as applicable.

V. IMPLEMENTATION

The staff will use this SRP section in performing safety evaluations of DC applications and license applications submitted by applicants pursuant to 10 CFR Part 50 or 10 CFR Part 52. Except when the applicant proposes an acceptable alternative method for complying with specified portions of the Commission's regulations, the staff will use the method described herein to evaluate conformance with Commission regulations.

The provisions of this SRP section apply to reviews of applications submitted six months or more after the date of issuance of this SRP section, unless superseded by a later revision.

VI. REFERENCES

1. Regulatory Guide 1.189, Revision 1, "Fire Protection for Nuclear Power Plants," March 2007.
2. EPRI NP-5652, "Guideline for the Utilization of Commercial-Grade Items in Nuclear Safety-Related Applications," Final Report, Electric Power Research Institute, June 1988.
3. EPRI Topical Report TR-106439, "Guideline on Evaluation and Acceptance of Commercial Grade Digital Equipment for Nuclear Safety Applications," Electric Power Research Institute, October 1996.
4. Regulatory Guide 1.180, Revision 1, "Guidelines for Evaluating Electromagnetic and Radio-Frequency Interference in Safety-Related Instrumentation and Control Systems," Office of Nuclear Regulatory Research, U.S. Nuclear Regulatory Commission, October 2003.

5. Safety Evaluation by the Office of Nuclear Reactor Regulation, "EPRI Topical Report TR-106439," July 17, 1997.

PAPERWORK REDUCTION ACT STATEMENT

The information collections contained in the Standard Review Plan are covered by the requirements of 10 CFR Part 50 and 10 CFR Part 52, and were approved by the Office of Management and Budget, approval number 3150-0011 and 3150-0151.

PUBLIC PROTECTION NOTIFICATION

The NRC may not conduct or sponsor, and a person is not required to respond to, a request for information or an information collection requirement unless the requesting document displays a currently valid OMB control number.
