

BROOKHAVEN NATIONAL LABORATORY
OCCUPATIONAL HEALTH
AND
SAFETY GUIDE

LOCAL FIRE PROTECTION SIGNALING SYSTEMS	4.4.0
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I. INTRODUCTION

All BNL buildings or facilities in which a fire may cause a property loss in excess of \$100,000, occasion a serious delay in a BNL program, result in death or serious injury to an employee or member of the public, or result in significant off-site contamination, attributable to a BNL operation are to be provided with local protective signaling systems. These systems provide automatic fire detection and manual alarm service, supervisory service on the status of protective systems, and automatic actuation of fire protective systems (e.g., extinguishing systems). They also provide suitable output capable of indicating to the Laboratory's emergency forces, via the site fire alarm system, the alarm and operational status of the local system. (See Figure 1 for a schematic of a typical system configuration.)

II. SCOPE

This Guide is applicable to the design, installation, modification, and use of local fire protective signaling systems providing protection to an individual building or group of buildings and utilizing the BNL site fire alarm system to transmit signals to the Laboratory's emergency forces.

This Guide is not applicable to the design, installation, modification, and use of the site fire alarm system except for the interface between this system and the local fire protective signaling system.

III. DEFINITIONS

Actuation Device: A device which initiates an action on receipt of an alarm signal, e.g., a door release or a solenoid valve for an extinguishing system.

Alarm Signal: A signal indicating an emergency that requires immediate action, warns building occupants that an emergency may exist, or initiates the operation of an actuation device.

Alarm Circuit: An electric circuit interconnecting the control unit and local audible or visual signal appliances (e.g., alarm bells, flashing lights) or actuation devices. (These circuits are alarm signal output circuits from the control unit.)

Annunciator Panel: A panel usually located at the control unit which indicates the status of the Local Protective Signaling System usually by means of indicating lamps or LEDS.

Control Unit (CU): An electrical panel performing the following functions:

- a. Receives alarm and supervisory signals from zone and monitoring circuits.
- b. Retains and displays signal information until the signal is acknowledged by manual resetting or restoration of the panel to normal service.
- c. Maintains appropriate local protective signaling system supervisory functions.

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- d. Transmits alarm and supervisory signal information to the site fire alarm system, either through a data gathering panel, or by transmitting equipment integral with the CU.
- e. Transmits alarm signal information to alarm circuits, such as local alarm bell circuits or protective systems actuation device circuits.
- f. Provides primary and backup power services.

Data Gathering Panel (DGP): The interface between the local protective signaling system and the site fire alarm system. Local alarm and monitoring circuits from the control unit, and other local monitoring circuits are connected to the DGP when the CU does not have this service integral to itself.

Initiating Device: Any device used to initiate an alarm or supervisory signal.

Local (Fire) Protective Signaling System (LPSS): A system which employs a complete arrangement of parts, initiating devices, power supply, actuation devices, and associated components and which initiates and processes alarm and supervisory signals over circuits that are electrically isolated from the site protective signaling system.

Monitoring Circuit: A circuit interconnecting one or more supervisory signal initiating devices (e.g., trouble relay, valve tamper switch, low-air pressure switch) with a data gathering panel or a control unit. (These circuits are supervisory signal input circuits to the DGP or CU.)

Project Supervisor: The person responsible for design and installation of the local protective signaling system. For work by outside contractors, this is the BNL technical administrator of the contract, or his designee. For in-housework, this is the BNL supervisor of the project, lead group, or activity responsible for the work.

Protective Systems, Equipment, or Apparatus: Automatic sprinklers, standpipes, Halon systems, and other devices and systems used for extinguishing fires and for controlling temperatures or other conditions dangerous to life or property.

Sensing Device: Any initiating device actuated by fire or fire-related conditions that initiates an alarm signal (e.g., heat or smoke detectors, vane type water-flow indicators, pressure-operated switches, etc.)

Site Fire Alarm System (SFAS): A BNL site-wide multiplex computer controlled signaling system which receives signals from and transmits signals to local multiplex interface devices (data gathering panels) or control units by means of communication wires, and interprets the status of local protective signaling systems, monitoring circuits, or other devices or circuits connected to the DGP). In addition to fire protection signals, the SFAS may be used for other site safety monitoring services. The central station for the SFAS is located at Fire Headquarters, Bldg. 599. Fire alarm and fire monitoring signals are automatically transmitted to Security Headquarters, Bldg. 50 and other remote terminals.

Supervisory Signal: A signal, not requiring immediate emergency action, indicating a malfunction or abnormal condition of a fire protection system.

Zone Area: A specifically defined area, such as a building or a part of a building, containing sensing devices or manual stations connected to a zone circuit.

Zone Circuit: A circuit interconnecting one or more alarm-initiating devices (e.g., manual stations and/or sensing devices) with the control unit. (These circuits are alarm signal input circuits to the CU.)

IV. RESPONSIBILITIES

A. **Department Chairmen/Division Heads** are responsible for assuring that buildings and facilities within their areas of responsibility have the appropriate level of protection as provided by protective signaling systems.

B. **Project Supervisor** is responsible for:

1. Designing, procuring, and constructing new or modified local fire protective signaling systems in conformance with conceptual designs prepared by the Safety and Environmental Protection Division, Fire Protection Engineering Group and with this Guide.

Note: When these functions are not performed by the Plant Engineering Division, the project supervisor is to submit drawings and specifications to the Plant Engineering Division for their review from the standpoint of maintenance, operations, and compatibility with other Laboratory systems.

2. Submitting all plans and specifications for new or modified systems to the Safety and Environmental Protection Division, Fire Protection Engineering Group for review.
3. Arranging for an acceptance test by the Fire Protection Engineering Group of each new or modified local fire protection signaling system, and ensuring that any deficiencies observed in the test are corrected. The local protective signaling system is not to be placed in service until an acceptance test is conducted. (See Appendix A, Paragraph I.B.3, 4 and 5.)
4. Formal acceptance of the local protective signaling system.

C. **Safety and Environmental Protection Division** is responsible for assisting in the implementation of this Guide. Specifically, the Fire Protection Engineering Group shall:

1. Function as system manager and operator of the Site Fire Alarm System and Local Protective Signaling Systems interconnected with it.
2. Prepare conceptual designs for new or modified fire protective systems, in consultation with the Safety Coordinator of the responsible Department/Division, with the users, and the project supervisor.
3. Review drawings and specifications submitted by the project supervisor for compliance with this Guide and the conceptual design.
4. Prescribe an acceptance test for each new or modified system.
5. Witness the acceptance test for each new or modified system, follow up the correction of deficiencies with the project supervisor, and provide a written statement of the test to the project supervisor.
6. Prepare jointly with the Plant Engineering Division procedures and schedules for routine testing of local fire protective signaling systems.
7. Audit the adequacy of the testing and maintenance of local fire protective signaling systems.

D. **Plant Engineering Division** is responsible for assuring that local protective signaling systems remain in proper operating condition. Such responsibility is implemented through appropriate maintenance procedures and schedules developed jointly with the Safety and Environmental Protection Division. Adequate records will be maintained by the Plant Engineering Division, which shall advise the Safety and Environmental Protection Division of deficiencies noted and of exceptions to adopted schedules and procedures.

V. GENERAL REQUIREMENTS

A. All local protective signaling system installations are to comply with the design criteria developed by the S&EP Division Fire Protection Engineering Group in consultation with the Plant Engineering Division.

B. General Design.

1. Local protective signaling systems are to be fully compatible and integrated with the existing BNL proprietary system.
2. All local protective signaling systems are to be designed and installed so as to operate successfully under the most severe service conditions likely to occur; and no change, alteration, or addition to reviewed and approved job specifications or work orders is to be made without approval of the project supervisor in consultation with the Safety and Environmental Protection Division.

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3. To the maximum extent practical, all circuits are to be "power limited" as defined in the National Electrical Code, NFPA 70, Article 760.
4. To the maximum extent possible, all circuits and devices are to operate at 24 VDC.
5. Devices are to be located and mounted so that vibration or jarring will not cause accidental operation.
6. LPSSs are to be designed so that they do not depend upon the effectiveness of any ground connection for normal operation, except for parts of circuits or equipment which are intentionally and permanently grounded to provide ground fault detection, or circuit protection grounding.
7. Transmission of an alarm signal on the site protective signaling system is not to be delayed for any reason, such as situations where the SPSS is designed to automatically initiate a local "warning" signal with the local "evacuation" signal initiated by subsequent manual action.

C. Quality Assurance.

Overall, the Site Fire Alarm System and the Local Protective Signaling Systems together are a QA-1 system. Individual subsystems, components and devices within the system may have lower quality assurance levels consistent with BNL QA standards. The QA level of all subsystems, components and devices are determined jointly by the SEP and PE Divisions. As a minimum, the following provisions shall be implemented:

1. **Design Review:** Before installation is begun, complete information regarding the local protective signaling system is to be furnished to the project supervisor, the Safety and Environmental Protection Division, the Plant Engineering Division, and the Safety Coordinator of the responsible department/division. This information is to include specifications, wiring diagrams, circuit plans and floor plans, and an itemized list of all equipment to be furnished. Where items requiring long delivery time need to be ordered before the design review process is completed, these are to be separately submitted for review prior to placing a purchase order.
2. **Equipment:** ALL DEVICES, COMBINATION OF DEVICES, AND EQUIPMENT SHOULD BEAR THE LISTING MARK OR CLASSIFICATION MARKING OF UNDERWRITERS' LABORATORIES, INC., OR FACTORY MUTUAL ENGINEERING CORP. FOR THE SERVICE FOR WHICH THEY ARE INTENDED. Where equipment or devices bearing these labels are not available, specific approval for substitutes must be obtained from the Safety and Environmental Protection Division. See Appendix B for UL and FM product categories.
3. **Acceptance Test:** After a local protective signaling system is installed, an acceptance test of the entire installation is to be made (by the contractor if it is not a BNL job) in the presence of authorized BNL representatives, including representatives from the Safety and Environmental Protection Division (Fire Protection Engineering Group) and the Plant Engineering Division. Tests are to demonstrate proper equipment operation, electrical supervision, and installation in accordance with this Guide.
4. **Connection to Site Fire Alarm System:** Connection of a local protective signaling system to the site protective signaling system through the data gathering panel may be made only upon authorization of the Supervisor, Industrial Safety and Fire Protection Section, Safety and Environmental Protection Division, or his designee.
5. **Connnection to SFAS Prior to Acceptance Test:** New and modified systems may be connected to the SFAS prior to the acceptance test in order to permit:
 - a. Prompt, available, installed protection.
 - b. Detailed testing.
 - c. Coverage investigation.

Interconnection to the SFAS cannot be made until any necessary SFAS database modifications are made. No system will be considered as "in service" until the acceptance test has been completed. While it is not essential to resolve all features of the LPSS before connection to the SFAS, aspects of the LPSS that might lead to successive unnecessary alarms, nonoperation of manual devices, or interference with the SFAS are to be resolved prior to connection. Connection of the LPSS to the SFAS does not imply acceptance of the LPSS. Only the project supervisor may accept the LPSS.

D. Standards.

Unless otherwise specified by this Guide, installation of **LPSSs** are to conform to the latest editions of the following:

NFPA 72D “Proprietary Protective Signaling Systems”

NFPA 72E “Automatic Fire Detectors”

NFPA 70 “National Electrical Code”