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Standard Guide for Installation of Walk-Through Metal Detectors[1]

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1. Scope

1.1 Some facilities require that personnel entering designated areas be screened for concealed weapons and other metallic materials. Also, personnel exiting designated areas are often screened for metallic shielding material and other types of metallic contraband. Walk-through metal detectors are widely used to implement these requirements. This guide describes various elements to be considered when planning to install walk-through metal detectors.

1.2 This guide is not intended to set performance levels, nor is it intended to limit or constrain operational technologies.

1.3 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *NRC Document:*

NUREG-1329 Entry/Exit Control At Fuel Fabrication Facilities Using or Possessing Formula Quantities of Strategic Special Nuclear Material[2]

2.2 *U.S. Government Documents:*

DOE 5632.2A Physical Protection of Special Nuclear Materials and Vital Equipment, February 9, 1988[3]

DOE 5633.3 Control and Accountability of Nuclear Materials, February 3, 1988[3]

2.3 *National Fire Protection Associations (NPA) Life Safety Code Handbook:*

NFPA-101-1988, Chapter 28, Industrial Occupancy[4]

2.4 *ANSI Standard:*

Z41.1-PT-1983 Class 50 and 75—For Non-ferrous and Ferrous Safety Footwear[5]

2.5 *National Institute of Law Enforcement and Criminal Justice (NILECJ) Standard:*

0601.00 For Design, Performance, and Allowable Magnetic Field Strength[3]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *continuous-wave-type metal detector*—a system generally employing one or more pairs of closely coupled coils. One coil is electrically energized to establish an electromagnetic field; the other detects disturbances in that field. In operation, the coils are configured so that the person or object being screened passes through the field. When metal passes through the field, the field is modified by the magnetic and electrical properties of the metal. Any change in the field is sensed by measuring one or more of many possible parameters, including mutual inductance, power loss, phase shift, frequency shift, permeability, etc.

3.1.2 *nuisance alarm*—an alarm not caused by a weapon or shielding material but by other causes such as outside interference or other operationally or environmentally induced stimulus. In practice, these alarms are a nuisance because they are not obvious and must be investigated and the cause eliminated.

3.1.3 *pulse-wave-type metal detectors*—a system in which brief current pulses are generated in transmitter coils when they are switched on. The electromagnetic field generated by these pulses induces eddy currents in metallic objects in the field. The eddy currents decay when the transmitter coils are shut off. The decay of the eddy currents produces secondary voltages in the receiver coils, which are switched on only when the transmitter coils are switched off. The voltages induced in the receiver coils are processed and compared against a bias or background level.

3.1.4 *shielding*—a metallic material configured as a credible gamma-radiation shield for special nuclear materials (SNM).

3.1.5 *throughput*—the actual rate at which a metal detector and system can screen personnel for a given application.

3.1.6 *walk-through metal detector*—a free-standing screening device having an electromagnetic field within its portal structure (aperture) for detecting metallic objects, including some nuclear shielding materials, carried by persons walking through the aperture.

3.1.7 *weapon*—a device intended to do damage to personnel or equipment without intentionally harming the attacker, but requiring the attacker to physically activate or use the device.

[1] This guide is under the jurisdiction of ASTM Committee C-26 on Nuclear Fuel Cycle and is the direct responsibility of Subcommittee C26.12 on Safeguard Applications.

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[2] Available from the U.S. Nuclear Regulatory Commission, Washington, DC 20555.

[3] Available from U.S. Government Printing Office, Washington, DC 20402.

[4] National Fire Protection Association, 1 Batterymarch Park, P.O. Box 9101, Quincy, MA 02269–9101.

[5] Available from American National Standards Institute, 11 W. 42nd St., 13th Floor, New York, NY 10036.

4. Significance and Use

4.1 This guide is intended for use by the designers, evaluators, and users of walk-through metal detectors to be installed to screen persons entering or leaving a controlled access area. This guide is not meant to constrain design liberty but is to be used as a guide in the selection of location and installation of walk-through metal detectors.

5. Safety Considerations

5.1 Warning signs should be posted if the metal detector's electromagnetic field strength is of such a magnitude that personal medical devices may be affected or damaged when they pass through the portal. See NILECJ Standard 0601.00.

5.2 Local fire and safety codes should be reviewed concerning requirements for areas selected for metal detector installation. Metal-detector installations needing exemption from the fire and safety requirements should be approved in advance.

6. Throughput Consideration

6.1 The rate at which persons may be screened is generally an important factor in security applications. Metal-detector systems should be capable of dealing with large transient traffic flow such as found during shift changes.

6.1.1 Throughput varies from one metal detector model to the next. Throughput also varies from one application to the next. Applications that require high-sensitivity settings will have lower throughput.

6.1.2 Once the application specific throughput for a detector model has been established, the number of detector lanes required to achieve system throughput at peak times can be calculated. See 9.2.

7. Other Considerations

7.1 Review applicable regulatory orders and policies of appropriate regulatory agencies and facilities for information pertinent to metal detector installation and operation.

7.2 Examine the power capability of the building electrical system to ensure that it is adequate to support the metal-detector system, especially current, voltage, and voltage stability.

7.3 Confirm that the available primary and emergency power are free of noise and transients. If not, install a filtering or regulating system, or both. An uninterruptable power system can provide both filtering and emergency power.

7.4 Establish where the metal-detector alarms are to be transmitted and who will be responsible for alarm assessment.

7.5 Provide a means for related functions such as space for nearby door opening and closing, door latching, and additional audible or visual alarms, or both, as needed to meet all safety and security requirements.

7.6 Where it is necessary to operate metal detectors in close proximity to each other, they should be of the same manufacturer and model so that the coils can be synchronized or operated at different frequencies in accordance with the manufacturer's recommendations. If it is necessary to operate metal detectors of different models or manufacturers, a test should be conducted for interference before the detectors are installed. Where metal detectors are not compatible it may be necessary to isolate the fields of each detector by as much as 20 to 30 ft.

7.7 If all electronic equipment is not designed for outdoor use, provide cover and protect the equipment from the elements, especially high temperature and high humidity. Adequate ventilation should also be provided. Make sure the metal-detector system is stable over a wide range of environmental factors (temperature, humidity, etc.). All metal detectors are sensitive to changes in the surrounding electromagnetic environment, and that should be the only factor affecting stable operation.

8. Layout of the Installation Site

8.1 The site layout for walk-through metal-detector installation should be designed to minimize the guard force personnel required and to avoid processing delays. The site may be in a new area or building, or in an existing area modified to house security screening devices.

8.2 It is good practice to channel people through separate entry and exit lanes. In areas where more extensive outbound screening is required, separate lanes and equipment are even more desirable so that equipment can be optimized for detection of the specified objects on entry or exit.

8.3 If alarms are remotely monitored, the response tactic (guard's action, intercept corridors, lockdown schemes, etc.) to alarms must be considered early in the design process to ensure effective and efficient interdiction.

8.4 Installation of equipment should be arranged to minimize nuisance alarms from outside interference. If nuisance alarms are too numerous, the guard force will lose confidence in the equipment, and security may be compromised.

8.5 Security equipment often must fit into a space-critical site, but adequate space is the single greatest asset for a security screening area. Maintaining a well-defined screening area is essential so that when an alarm occurs, the security inspector can clearly identify and isolate the person that caused the alarm.

8.5.1 Layout of the area selected for installation of a walk-through metal detector should provide adequate space for calibration and maintenance of the metal detector.

8.5.2 Locate equipment in a manner to clear doors, duct work, piping, and other equipment.

8.5.3 The site layout should provide an alternate means to screen personnel while the metal detector is out of service. See Appendix X1.

8.5.4 The layout should also provide adequate ventilation for the electronic equipment.

8.6 Since metal-detector portal width is typically less than the minimum doorway width required by the Life Safety Codes, bypass routes that meet the Life Safety Codes requirements should be included in the layout design. (See NFPA-101.)

8.7 Metal detector coil assemblies should be securely anchored to prevent swaying or tip over. The floor should be solid and not prone to transfer vibration to the metal detector. A reinforced concrete floor is recommended. The concrete should be free of steel except for grounded reinforcing bars and electrical conduit which should be grounded. Raised computer room floors are not solid and should be avoided.

8.8 A metal detector will respond to nearby moving metal objects, but its sensitivity is less for moving material outside