

Summary

The U. S. Department of Homeland Security (DHS) may purchase or provide funding that can be used to purchase radiation detection equipment for use at fixed locations and by field personnel. Selection and use of radiation detectors takes careful consideration and is an important step in protecting responders, and in identifying materials of concern during radiologic incidents. However, any agency or organization proposing to obtain and deploy radiation detection equipment must develop protocols for their use and the appropriate response actions associated with device readings in order to implement an effective and supportable system. These protocols – developed well ahead of field deployment - should include the following:

- Detection Device Objectives
- Conditions of Use
- Procedures for Use
- Radiation Detector/System Selection

Guidelines for the device protocols are summarized in this report. A summary of the protocols may be required as part of the grant process.

Detection Device Objectives

Radiation detection devices exist for detection of different types of radioactivity to different degrees using different mechanisms. It is important in selecting the device to be obtained and deployed that the goal of the radiation detection be defined. Although some detectors can accommodate several objectives, failure to specifically align the device's use with the objective can create dangerous situations and waste time and resources.

In general, radiation detectors/systems would be expected to meet one or more of the following objectives:

- Detect any radiation associated with a specific material.
- Detect any radiation passing a certain point.
- Detect and identify gamma-producing radioactive isotopes
- Detect and identify any radioactive isotope.

Conditions of Use

Once the objective for the detector is defined, then it is necessary to define the conditions under which the device(s) are to be used. For example,

- Will the device be used by line safety or response personnel under field conditions?
- Is the device to be fixed inside a building or outside exposed to the weather or is it a portable/hand held device?
- What kind of alarming is appropriate- remote signal alarm, audible/visual on-scene alarm, or user visual readings?

Conditions of use to be defined include at a minimum:

- Indoor or outdoor use
- Protected or unprotected location
- Secure or unsecured location of device
- Secure or unsecured location of readout/alarms
- Manned or unmanned device station
- Stationary or moving target
- Degree of expertise of user
- Portable or fixed use
- Mobile or fixed storage location
- Level of detection and alarm

Procedures for Use

It is also important to define the procedures for use of the radiation detection device and the resources necessary for proper implementation. For example, if the device provides simple (present, non-present) detection of radioactivity, what is the protocol when an alarm is triggered? Are the resources necessary to respond to the alarm in order to meet the objectives of the detection available?

Procedures or protocols need to exist or be developed for at least the following:

- How will the device be deployed or manned?
- What alarm set points will be used?
- What documentation or reporting is required for use of the device?
- What is the expected response for an alarm condition?
- What resources are necessary to resolve alarms and are they available during times of monitoring?
- Are mechanisms in place to manage individual or public reaction to a detection or alarm event?
- What mechanisms are required for device security, protection and maintenance/calibration?
- What authority, training or knowledge is required to respond to detection or alarm?
- What are the response actions to detection or alarm?
- Is HIPAA compliance a concern and what approach is necessary to maintain HIPAA compliance?

Radiation Detector/System Selection

The objectives and conditions of use allow the proper selection of the specific detector systems, taking into account the limitations of resources or procedures of use identified above. Combinations of devices may be necessary to provide for easy or complete detection, but may cause more complicated resolution of alarms. Device manufacturers should be contacted to clarify specifications and performance requirements. The U.S. Defense Nuclear Detection Office has an ongoing program designed to evaluate the

performance and characteristics of various radiation detection devices, and their resources should be used to facilitate device selection.

Device Protocols

Once a device or devices are selected, the above process should be re-examined to ensure that the capabilities and limitations of the system are fully understood, and that the processes and procedures are adequate to meet the objectives. This review should be summarized in a protocol document that can be used to justify the device purchase and commitment of resources for the detection system.

In the deployment of fixed or portable instrumentation for use at facilities or taken into the field by first responders consideration must also be given to handling unplanned circumstances that may result in a detector alarm condition. Deployment of radiation detection systems must take into consideration the detection of unlawful radioactive materials as well as those individuals or companies who lawfully possess, or are using or transporting radioactive materials. Some common examples of radioactive materials that may be encountered during routine detection activities by EMS, law enforcement and other first responders are described below and detailed in the attached table:

- Individuals receiving radioactive materials for diagnostic medical purposes
- Individuals receiving radioactive materials for therapeutic medical purposes
- Individuals or companies transporting portable radioactive materials devices
- Companies transporting radioactive materials as a routine course of business

Medical uses

On any given day hundreds of patients – mostly outpatients - who have been administered radioactive materials (radiopharmaceuticals) for diagnostic and therapeutic medical purposes are released from medical facilities in Colorado. These patients are and will remain radioactive for a number of hours to days or weeks, depending upon the radiopharmaceutical used and quantity that was administered to them. Released patients may also have been given permanent radioactive materials implants for radiation therapy purposes. Any of these patients may be utilizing public transportation or be in public places when an alarm or elevated radiation levels are detected by first responder instrumentation.

Release of these patients by medical facilities must be done in accordance with the State Radiation Control regulations and under most conditions present only a minimal risk to others, which is the premise behind such releases. Those patients having received higher quantities or higher risk radioactive materials are generally given specific instruction so as to minimize their contact with others. By regulation, all such patients are required to be given general information on reducing dose to others and are provided contact information from the medical facility that administered the radioactive materials.

With the exception of medical uses at federal facilities (VA hospitals, or military bases), all medical use of radioactive material is regulated by the Radiation Management Unit of the Colorado Department of Public Health and Environment (CDPHE). There are

approximately 100 licensed medical facilities using radioactive materials throughout Colorado.

(NOTE: Routine X-rays, CT or “CAT” scans, fluoroscopy, MRI procedures or administration of barium contrast media are not procedures that involve radioactive materials and patients will not be radioactive as a result of those procedures. However, excretions from patients receiving radiation diagnostics or therapy may also be radioactive and these materials may be detected if improperly managed.)

Transportation

The transportation of radioactive material – a category of hazardous material – is regulated by the U.S. Department of Transportation (DOT). The CDPHE Radiation Management Unit does not regulate transport of radioactive materials in transit. However, the CDPHE does verify that DOT requirements are being met by licensees at the point of receiving and shipping such materials as a part of routine inspection of licensed facilities. In-transit shipments of radioactive materials or by common carriers (FedEx) are not inspected by CDPHE.

Unlike almost any other hazardous material, radioactive materials shipments are unique in the fact that radiation levels external to the package are both expected and permitted – within limits. These radiation levels are readily detected on the outside of radioactive materials packages (and sometimes external to vehicles) often found in-transit. Vehicles transporting radioactive materials are not required to be placarded with radioactive materials placards except when certain radiation limits are exceeded.

Radioactive materials are transported on a frequent and daily basis by licensees and their employees, and may be contained in simple cardboard containers or boxes, plastic or vinyl carrying cases, metal cans or extremely durable, large, steel- and/or lead-shielded containers. Radioactive materials may also be transported as fixed devices mounted on vehicles.

Radioactive materials are routinely transported by:

- Common carriers and trucking companies such as FedEx;
- The military and Department of Energy;
- Nuclear pharmacies;
- Mobile nuclear medicine companies;
- Industrial radiography companies;
- Well logging companies;
- Construction and engineering companies;
- Universities;
- Radioactive waste broker companies;
- Uranium mines and milling facilities transporting uranium ores or yellowcake;
- Hauling companies transporting water treatment plant residues containing uranium or radium (TENORM).

Thus, first responders may encounter or detect radioactive materials during their routine transport. While many uses and associated transport are licensed by Colorado or the Nuclear Regulatory Commission or other states, there are many radioactive materials that are exempt from regulation, or are regulated through general licensing mechanisms with limited documentation, as demonstrated in the attached table.

Resources

The DHS intends to establish technical expertise to support widespread use of radiation detectors and systems, and this mechanism should be the first resource for questions about detected materials (as described in the procedures discussed above). However, responders may also contact the CDPHE Radiation Management Unit since the facilities shipping or receiving the radioactive materials are most likely one of our licensed facilities or companies. Our program may be contacted at:

- (303) 692-3119 during business hours; or
- (303) 877-9757 24-hour notification number

In addition to the implementation and application issues discussed in this document, consideration should be given to other reference documents for technical specifications for detectors used for homeland security and related applications, such as:

ANSI N42.32-2003 - American National Standard
Performance Criteria for Alarming Personal Radiation Detectors for Homeland Security

ANSI N42.33-2003 - American National Standard for
Portable Radiation Detection Instrumentation for Homeland Security

ANSI N42.34-2003 - American National Standard
Performance Criteria for Hand-held Instruments for the Detection and Identification of Radionuclides

ANSI N42.34-2003 - American National Standard for
Evaluation and Performance of Radiation Detection Portal Monitors for Use in Homeland Security

A FIRST RESPONDERS GUIDE TO PURCHASING PERSONAL RADIATION
DETECTORS (PRDS) FOR HOMELAND SECURITY PURPOSES, Version 2
Paul Bailey, Environmental Measurements Laboratory, U.S. Department of Homeland
Security, 201 Varick Street, 5th Floor, New York, NY 10014-7447, November 2004,

Some Potential Radiation Sources Detected in Colorado

Regulated Material

- Exempt materials
 - Smoke detectors
 - Calibration sources
- General License materials
 - Tritium exit signs
 - Static eliminators
 - X-Ray fluorescence
 - Electron capture detectors
 - Calibration tools (check sources)
 - Other laboratory devices
- Specific Colorado Licenses
 - Uranium milling
 - On-site ore
 - Uranium and degradation products
 - Yellowcake
 - Device manufacturers
 - Radiopharmaceuticals
 - Irradiators
 - Research & Development
 - Service providers
 - Remediation contractors
 - Analytical laboratories
 - Equipment servicing
 - Industrial radiography
 - Portable gauges
 - Fixed gauges
 - Waste management and disposal
 - Well Logging
 - Well Tracer surveys
 - Medical use

Naturally occurring radioactive materials

- Water treatment plant residuals
- Oil & gas operation scale or residues
- Mineral process residues

Unregulated Material

- Natural minerals and ore
 - Uranium ore
 - Mineral water/hot springs
- Natural minerals in products
 - Fertilizer
 - Natural minerals in food
- Bananas
- Beer
- Low-sodium salt
- Production wastes
 - Coal ash

Specific NRC or DOE Licensees

- Military
- USGS
- NCAR
- Ft. St. Vrain IFSI