

RADIATION DETECTION EQUIPMENT FOR FIRST RESPONDERS

Overview

The use by terrorists of radioactive materials in a malicious act would challenge first responders to detect the presence of radioactive material and confirm complete decontamination of personnel and equipment.

Radiological hazards that may be encountered when responding to a radiological incident of such an act include 1) penetrating radiation exposure from a nearby source; 2) radioactive contamination in the form of solids, liquids, or gases deposited on people, equipment surfaces, and the ground; 3) airborne radioactivity in the form of gases, aerosolized liquids, and finely dispersed solids.

First Responder Radiological Equipment Committee

The First Responder Radiological Equipment Committee was tasked with providing an equipment recommendation that would assist first response organizations in selecting equipment that could be used in responding to a terrorist event that may include radiological materials. The Committee was comprised of representatives from state and local agencies familiar with equipment and response roles. Those agencies included Ohio Emergency Management Agency (EMA) (Chair), Ohio Department of Health (ODH), Ohio State Highway Patrol (OSHP), Ohio State Fire Marshall's Office, Public Utilities Commission of Ohio (PUCO), Emergency Management Association of Ohio, Ohio Fire Chief's Association, Ohio State Fire Association, Ohio Medical Transportation Board, Cincinnati Health, Emergency Medical Services (EMS) of Ohio, Strongsville Fire Department and Painesville Township Fire Department.

RADIOLOGICAL EQUIPMENT RECOMMENDATION

The below equipment recommendation is graduated to meet varying needs of emergency responders. The recommendations focus on equipment that will provide early detection and protect the health and safety of all levels of response personnel. The recommendation also includes guidance on equipment radiation level set points and limits of exposure.

*Note: The SAIC PD-10i that was previously recommended in Feb. 2003, still meets the Committee's criteria for an Electronic Personal Dosimeter (EPD); however, due to new technology in this field, two different EPD's are now being recommended. The additional features such as an vibrate alarm, more robust ruggedness, larger numbers and the opportunity to adjust alarm set points more easily in the field are the apparent advantages of the MiniRadiac and the RadEye G EPD's.

Level 1 (Initial Response—first on the scene) (Awareness trained)-

This first level supports those who arrive first on the scene and are primarily tasked with identification of the hazard and restriction of the area affected by the hazard such as municipal and township police, sheriff deputies, fire, EMS and State Highway Patrol. These personnel must be trained to the awareness level.

Recommended Equipment

It is recommended that each response vehicle be equipped with self-alarmed dosimetry that can detect small amounts of radiation and produce an audible alarm. This equipment should be mounted so as to be easily removed by the first responder if necessary to gain closer access to the incident. The instrument can be used to detect the presence of radiation. The primary intent of this instrument for this level of responder is the early detection of radiation. The Electronic Personal Dosimeter (EPD) serves initially as a gamma radiation detector, alerting the responder to the presence of a radiation hazard.

Recommended EPD:

<u>Make</u>	<u>Model</u>
Canberra	MiniRadiac
“OR”	
Thermo Electron	RadEye G

Recommended exposure rates and equipment set points for first responders Electronic Personal Dosimeter (EPD):

The recommended detection rate alarm set points for first responder EPDs are 0.1mr/hr (investigate) and 2mR/hr (isolate). This setting will provide responders with adequate sensitivity for the early detection of radiation and the establishment of the initial exclusion/restricted area perimeter. The dose alarm set points are 900 mR (warning) and 1,000 mR (limit) accumulated dose. The primary intent of the instrument for this level of responder is the early detection of radiation.

Level 2 (Post initial response) (Operations trained)

This second level of equipment is for use by responders who are primarily tasked to set up radiological areas/zones inside the original restricted area. An additional tasking may be to monitor individuals and equipment leaving the restricted area for radiological contamination. These responders include fire personnel, EMS and law enforcement. These second level responders are trained to the operation level.

Recommended Equipment

These responders should have equipment capable of detecting radiological contamination as well as the Electronic Personal Dosimeter (EPD) (as recommended for Level 1 responders). The EPD would be used at this level to monitor for total dose accumulation. The radiological contamination meter would be used to detect low levels of radiation making it useful in setting up the radiological areas/zones. The recommended instrumentation will provide responders with the ability to detect radiation, measure specific levels of contamination, and record accumulated radiation dose received.

Recommended Equipment:

<u>Make</u>	<u>Model</u>
Canberra "Or"	MiniRadiac
Thermo Electron	RadEye G
Ludlum	14C with 202-608 meter face and 44-9 detector.

Recommended exposure rates and alarm set points:

The self-alarmed dosimeter for this level of responder is primarily used as an accumulated dose meter. The EPD should have at least two rate alarm set points: 0.1 mR/hr for early detection of radiation (investigate), 2 mR/hr (isolate), and be resettable up to 1,000 mR/hr (turnback dose rate for all activities except lifesaving). The EPD should also have at least two accumulated dose limit alarms: 900 mR (dose warning), 1000 mR (dose limit), resettable up to 25,000 mR for lifesaving missions. Life saving activities should be under the direction of the incident commander.

The contamination meter will be able to detect the standard contamination limit of 300 counts per minute (cpm) above background (beta/gamma), or 2x background (alpha). Note: Responders might want to just consider 2x background for everything to make it simpler for the responder. They won't necessarily know what type of radiation is there initially. Monitoring of personnel and equipment should be conducted in areas indicating less than 0.1 mR/hr.

Level 3 (HAZMAT Teams) (Technician trained)-

This third level of equipment is for use by responders who enter the scene to determine the radiological source and mitigate its effects. These responders are typically the hazmat teams and are trained to the technician level.

Recommended Equipment

The equipment recommended for this level of response includes the Electronic Personal Dosimeter (EPD) and the Ludlum 2241-3RK Response Kit that includes the Ludlum 2241-3 digital survey meter, 44-9, 44-2, 133-7, 133-8 detectors, probe cable, carrying case, 1 cesium check source with check source holder (affixed to side of instrument). The dose rate meter will detect higher radiological levels as may be encountered by hazmat teams. This meter will give the best indication and range concerning rates of exposure.

Recommended Equipment Models:

<u>Make</u>	<u>Model</u>
1. Canberra	MiniRadiac
“Or”	
Thermo Electron	RadEye G

2. Ludlum 2241-3RK Response Kit

3. Landauer OSLD

“Or”
Global
Dosimetry wallet cards
Note: Landauer also produces wallet cards

Recommended exposure rates and alarm set points:

The self-alarmed dosimeter for this level of responder is primarily used as an accumulated dose meter. The EPD should have at least two rate alarm set points: 0.1 mR/hr for early detection of radiation (investigate), 2 mR/hr (isolate), and be resettable up to 1,000 mR/hr (turnback dose rate for all activities except lifesaving). The EPD should also have at least two accumulated dose limit alarms: 900 mR (dose warning), 1000 mR (dose limit), resettable up to 25,000 mR for lifesaving missions. Life saving activities should be under the direction of the incident commander.

Note: the RadEye G does have the capability for telemetry to relay dose rates back to a team member outside of the area of concern from those deployed inside the area; however, this requires the purchase of the special telemetry system.

The 44-9 detector can be used as a frisker for contamination. The 44-2 detector will detect gamma from background to 25 mR/hr; the 133-7 from 25 mR/hr to 100R/hr; and the 133-8 up to 1000 R/hr. The 133-8 was included to comply with Homeland Security standards.

Personnel at the Technician Level should also be equipped with a dosimeter that has a permanent record capability such as an OSL (Optically Stimulated Luminescent) dosimeter or a TLD (Thermo-Luminescent Dosimeter). The OSL dosimeter is recommended because it records doses at the lowest level. The OSL and the TLD are normally exchanged quarterly. Another option for a permanent record dosimeter is the wallet card. The wallet card is recommended for those who are not typically radiological emergency responders or occupational workers. The card is leased for minimal cost, is good for a year, and is exchanged only upon use or expiration. It can be conveniently carried inside a wallet so it would be constantly available to most users. The wallet card can be made with a logo, ID#, and expiration date on the front with usage information on back.

Special Cases:

A. For the detection of illicit radiological materials, a personal radiation detector should be used that is very sensitive to small amounts of radiation. The Thermo Electron RadEye PRD can be used. This device is not a dosimeter; it will not accumulate total dose. It is a low-level gamma detector. Once alerted to the presence of radiation, a dosimeter such as the MiniRadiac or the Radeye G would still be required with the same settings as for the Technician level. The RadEye PRD should be used only by those responders that have been trained to at least the Technician level.

B. For first responders that are screening large populations in the warm zone (Operation trained) for contamination, a portal monitor, the Thermo Electron TPM-903 or the Canberra MiniSentry can be used to expedite screening. These portal monitors can also be modified to screen vehicles for contamination. The portal monitors will most likely be purchased for regional use. The first responders operating the portal monitors will require Operations level training and be required to use a dosimeter (Canberra MiniRadiac or Thermo Electron RadEye G). The settings for the dosimeters are the same as for the Operations Level.

First Responder Actions

At first indication of the presence of radiation (e.g., Electronic Personal Dosimeter (EPD) alarming), the first responders should move to an upwind location, to a distance at which the EPD dose rate function no longer alarms (below the 2 mR/hr alarm). In addition, the first responder should don the state recommended PPE (personal protection equipment/ first responder kit) that will limit contamination on skin surfaces and limit the inhalation of airborne activity. The move beyond the alarming distance for the EPD will also limit penetrating radiation exposure.

It is important that all responders receive the necessary training required to respond to an incident involving radioactive materials to include training on the radiological detection equipment that is purchased.

Equipment Maintenance

Instruments must be properly maintained and calibrated annually. The Ohio Emergency Management Agency (EMA) operates the Radiological Instrument Maintenance and Calibration (RIM&C) facility. It is one of three facilities in the United States that is certified under the National Voluntary Laboratory Accreditation Program (NVLAP) and uses processes in compliance with national standards. All of the recommended instruments can be calibrated and repaired by Ohio EMA. For information related to the laboratory or information on the recommendations in this document contact – Carol O’Claire – (614) 799-3915.