Use of Preventive Radiological/Nuclear Detection Equipment for Consequence Management

Daniel J Blumenthal
DOE/NNSA

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• **Preventive Radiological Nuclear Detection (PRND)**: Detect, locate, and identify radioactive material out of regulatory control.

• **Consequence Management (CM)**: Ensure public health and safety against unnecessary exposure to radiation or radioactive fallout as a result of an accidental or deliberate radiological or nuclear release.
Background

• PRND mission supported by significant planning, equipping, and training
• A catastrophic radiological release will overwhelm even the best response plans and infrastructure
• Sophisticated PRND technology can be applied to the CM mission
• Federal project recently completed to support using PRND technology in a CM response
DHS S&T Project Components

• PRND Equipment Categorization identifies PRND that may have an application in CM and their characteristics

• Mission Analysis describes CM mission areas that are appropriate for PRND (exposure control, dose monitoring, radiation survey, contamination survey)

• ConOps provide additional detail on the use of the equipment for the mission areas identified

• Job Aids provide guidance by instrument model on the mission areas and on instrument functions

• Data Management will integrate with RadResponder

• Training developed for just-in-time refresher on use of instruments

• Standards revisions will provide guidance for future PRND system development
Detection Components of CM Mission

- Worker exposure control
- Worker dose monitoring
- Contamination screening for persons and objects
- Radiation survey
- Isotope identification
PRND vs. CM Missions

PRND capabilities that matter for CM:
• Dose rate measurements
• Energy range
• Audible alarm
• Exposure integration
• Visible readout

Problems using PRND for CM:
• Failure at elevated radiation fields
• Quantitative measurements needed
• Energy-dependent responses
• Alpha and beta insensitivity
### PRND Equipment

<table>
<thead>
<tr>
<th>PRND Category</th>
<th>Defining Characteristic</th>
<th>CM Mission Applicability</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Personal Radiation Detector (PRD)</strong></td>
<td>Sensitive, detection near background, alarming, N42.32, most common PRND</td>
<td>Environmental and personal contamination screening in Cold Zone</td>
</tr>
<tr>
<td><strong>Spectroscopic Personal Radiation Detector (SPRD)</strong></td>
<td>Sensitive, detection near background, alarming, N42.48, isotopic ID</td>
<td>Environmental and personal contamination screening in cold zone, isotopic ID</td>
</tr>
<tr>
<td><strong>Extended Range Personal Radiation Detector (ER-PERD)</strong></td>
<td>Sensitive, detection near background, alarming, extended range to 10 R/hr or more</td>
<td>Cold and Hot Zone survey and responder exposure control</td>
</tr>
<tr>
<td><strong>Personal Emergency Radiation Detectors (PERD)</strong></td>
<td>High range, alarming, operates at &gt;10 R/hr, N42.49A, harsh environments</td>
<td>Detection and entry into Hot Zone, exposure control, possible dose monitoring</td>
</tr>
<tr>
<td><strong>Radioisotope Identification Device (RIID)</strong></td>
<td>Sensitive, detection near background, isotope ID, N42.34</td>
<td>Isotope ID for public safety, environmental and contamination surveys</td>
</tr>
<tr>
<td><strong>Human-Portable Backpack</strong></td>
<td>Very sensitive, large volume detector, N42.43</td>
<td>Environmental and personal contamination screening in Cold Zone</td>
</tr>
<tr>
<td><strong>Vehicle-Mounted Detection System</strong></td>
<td>Extremely sensitive, large volume detector, N42.43</td>
<td>Environmental and personal contamination surveys in Cold Zone</td>
</tr>
<tr>
<td><strong>Radiation Portal Monitors</strong></td>
<td>Fixed or transportable, screening for people vehicles or other objects, N42.35, FEMA-REP-21</td>
<td>Personal/object contamination surveys</td>
</tr>
</tbody>
</table>
## CM Mission Areas and Instrument Applicability – Cold Zone

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Worker Exposure Control</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>○</td>
<td>○</td>
<td>○</td>
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<td>○</td>
</tr>
<tr>
<td>Worker Dose Monitoring</td>
<td>○</td>
<td>○</td>
<td>● if A</td>
<td>● if A</td>
<td>●</td>
<td>○ if A</td>
<td>○ if A</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Person/Object External Contamination Detection (β/γ)</td>
<td>●</td>
<td>●</td>
<td>● if B</td>
<td>● if B</td>
<td>○</td>
<td>●</td>
<td>●</td>
<td>○</td>
<td>●</td>
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<tr>
<td>Radiation Survey (Cold Zone Only)</td>
<td>○</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>○</td>
<td>●</td>
<td>●</td>
<td>○</td>
<td>○</td>
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<tr>
<td>Isotope Identification (^3)</td>
<td>○</td>
<td>○</td>
<td>●</td>
<td>●</td>
<td>○</td>
<td>●</td>
<td>●</td>
<td>○</td>
<td>○</td>
</tr>
</tbody>
</table>

- ●: Appropriate for the mission,
- ○: Marginal, meets minimum requirement,
- ⊗: Insufficient for the mission

A: Instruments with capability to track accumulated exposure or dose.
B: Instruments with capability for low range (down to 0.1 mR/h) exposure monitoring.
C: Instruments that readout in exposure or dose rate and do not automatically adjust for background.
D: Instruments with capability for energy spectroscopic analysis
E: Dosimeter with capability for read out in the field
F: Instruments with capability for high range (up to 10 R/h) functionality.
G: Instruments with capability for very high range (up to 999 R/h) functionality
H: Instruments with loud audible and vibration alarm
# CM Mission Areas and Instrument Applicability – Hot Zone, DRZ

<table>
<thead>
<tr>
<th></th>
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<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td><strong>Hot Zone (&gt;10 mR/h)</strong></td>
<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
<td><img src="image3.png" alt="Image" /></td>
<td><img src="image4.png" alt="Image" /></td>
<td><img src="image5.png" alt="Image" /></td>
<td><img src="image6.png" alt="Image" /></td>
<td><img src="image7.png" alt="Image" /></td>
<td><img src="image8.png" alt="Image" /></td>
<td><img src="image9.png" alt="Image" /></td>
</tr>
<tr>
<td>Worker Exposure Control</td>
<td><img src="image10.png" alt="Image" /></td>
<td><img src="image11.png" alt="Image" /></td>
<td><img src="image12.png" alt="Image" /></td>
<td><img src="image13.png" alt="Image" /></td>
<td><img src="image14.png" alt="Image" /></td>
<td><img src="image15.png" alt="Image" /></td>
<td><img src="image16.png" alt="Image" /></td>
<td><img src="image17.png" alt="Image" /></td>
<td><img src="image18.png" alt="Image" /></td>
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<tr>
<td>Worker Dose Monitoring</td>
<td><img src="image19.png" alt="Image" /></td>
<td><img src="image20.png" alt="Image" /></td>
<td><img src="image21.png" alt="Image" /></td>
<td><img src="image22.png" alt="Image" /></td>
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<td><img src="image24.png" alt="Image" /></td>
<td><img src="image25.png" alt="Image" /></td>
<td><img src="image26.png" alt="Image" /></td>
<td><img src="image27.png" alt="Image" /></td>
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<tr>
<td>Radiation Survey (Hot Zone Only)</td>
<td><img src="image28.png" alt="Image" /></td>
<td><img src="image29.png" alt="Image" /></td>
<td><img src="image30.png" alt="Image" /></td>
<td><img src="image31.png" alt="Image" /></td>
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<td><img src="image34.png" alt="Image" /></td>
<td><img src="image35.png" alt="Image" /></td>
<td><img src="image36.png" alt="Image" /></td>
</tr>
<tr>
<td><strong>DRZ (&gt;10 R/h)</strong></td>
<td><img src="image37.png" alt="Image" /></td>
<td><img src="image38.png" alt="Image" /></td>
<td><img src="image39.png" alt="Image" /></td>
<td><img src="image40.png" alt="Image" /></td>
<td><img src="image41.png" alt="Image" /></td>
<td><img src="image42.png" alt="Image" /></td>
<td><img src="image43.png" alt="Image" /></td>
<td><img src="image44.png" alt="Image" /></td>
<td><img src="image45.png" alt="Image" /></td>
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<tr>
<td>Worker Exposure Control</td>
<td><img src="image46.png" alt="Image" /></td>
<td><img src="image47.png" alt="Image" /></td>
<td><img src="image48.png" alt="Image" /></td>
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<td><img src="image51.png" alt="Image" /></td>
<td><img src="image52.png" alt="Image" /></td>
<td><img src="image53.png" alt="Image" /></td>
<td><img src="image54.png" alt="Image" /></td>
</tr>
<tr>
<td>Worker Dose Monitoring</td>
<td><img src="image55.png" alt="Image" /></td>
<td><img src="image56.png" alt="Image" /></td>
<td><img src="image57.png" alt="Image" /></td>
<td><img src="image58.png" alt="Image" /></td>
<td><img src="image59.png" alt="Image" /></td>
<td><img src="image60.png" alt="Image" /></td>
<td><img src="image61.png" alt="Image" /></td>
<td><img src="image62.png" alt="Image" /></td>
<td><img src="image63.png" alt="Image" /></td>
</tr>
</tbody>
</table>

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A: Instruments with capability to track accumulated exposure or dose.
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H: Instruments with loud audible and vibration alarm
Concepts of Operations

• Outlined general procedures for using PRND for each mission
• Scientifically validate developed CONOPS through laboratory and field testing
Operational Job Aids

• Summarizes appropriate missions by equipment category
• General guidelines for use in each mission area
• Available online: https://www.dhs.gov/publication/st-frg-using-preventative-radiological-nuclear-detection-equipment-consequence
Information Needed Before Event

1. Understand the Capacities of your PRND Equipment

Make/Model: PRD, SPRD, ER-PRD, RIID, Backpack

Fill in this table with information about your instrument:

<table>
<thead>
<tr>
<th>Key Capability</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operational Range</td>
<td></td>
</tr>
<tr>
<td>How to know if you are in a radiation field outside of its operational range?</td>
<td></td>
</tr>
<tr>
<td>Display (quantity/unit1)</td>
<td></td>
</tr>
<tr>
<td>Accumulated Dose</td>
<td></td>
</tr>
<tr>
<td>Alarm Settings</td>
<td></td>
</tr>
<tr>
<td>Over-range indication</td>
<td></td>
</tr>
<tr>
<td>Display</td>
<td>(yes/no)</td>
</tr>
<tr>
<td>Nuclide Identification</td>
<td>(yes/no)</td>
</tr>
</tbody>
</table>

Exposure Rate

If your equipment meets the following criteria, it may be used for Exposure Rate Monitoring:

<table>
<thead>
<tr>
<th>Function</th>
<th>Cold Zone</th>
<th>Hot Zone</th>
<th>Dangerous Zone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operational Range</td>
<td>(≥) 0.1 - 10 mR/hr</td>
<td>(≥) 0.1 - 2 mR/hr</td>
<td>(≥) 1 - 10,000 mR/hr</td>
</tr>
<tr>
<td>Exposure Rate Alarm Type</td>
<td>Audible/visible</td>
<td>Audible/visible</td>
<td>Audible/visible</td>
</tr>
<tr>
<td>Over-range Indicator</td>
<td>Audible/visible</td>
<td>Audible/visible</td>
<td>Audible/visible</td>
</tr>
<tr>
<td>Display</td>
<td>Exposure or dose rate</td>
<td>Exposure or dose rate</td>
<td>Exposure or dose rate</td>
</tr>
</tbody>
</table>

* A check mark (✓) denotes the optimal capability, whereas a dash (−) denotes a marginal capability.

Summary Table Legend:
- ✓: Instruments with capability for very high ranges (up to 900 R/hr); 1 (functionality)
- ○: Instruments with high accuracy and vibration tolerance

Key Notes:
- 0: Instruments with capability for very high ranges (up to 900 R/hr); 1 (functionality)
- H: Instruments with high accuracy and vibration tolerance

Approved for Public Release
Consequence Management Procedures Using PRND Equipment

Radiation surveys can be performed in both the Cold and Hot Zone. Surveys should NOT be taken in the dangerous radiation zone. Radiation survey results are important data to pass onto radiological emergency response assets.

My turn back exposure rate is: ___________

Start

Appropriate PRND: PRD, SPRD, ER-PRD, PERD, RIID, Backpack, Vehicle Mounted

Step 1: Ensure that the equipment is ready for use prior to entering the work area.
- Bring supplies to capture data (examples: GPS, laptop, cell phone, paper/pen, etc.).

Step 2: To take a radiation survey:
- Hold the PRND equipment approximately 1 meter (~3 feet) above the ground.
- Find an undisturbed area (preferably a flat, non-paved field, away from major landscape changes like ditches or roads, and not under overhead obstructions like trees or overpasses).
- Let the detector stabilize for at least 10 seconds.
- Record the value and units.
- Record the average value over the survey time. If the average is not easily calculated, then record the maximum value.
- Ensure that the proper units are recorded to distinguish between commonly mistaken units (examples: mSv/hr and mRem/hr or mR/hr or mRem/hr and mR/hr).
- Record the location of the survey.
- GPS coordinates are preferred, but street intersections would be acceptable.
- Record your name, agency and PRND equipment make/model.

Step 3: Repeat Step 2 at different locations.

Step 4: Send the survey results (with the value, units, location, PRND equipment make/model, surveyor name and agency) to incident command or follow local procedures for reporting.

Ensure that you are paying attention to your integrated dose.

Where Should I Perform Radiation Surveys?

The **Ten Point Monitoring Strategy** is a standardized methodology for quickly gathering required radiological monitoring information after a potential release. Use of those 10 points would quickly verify the initial plume projection and allow follow on detailed monitoring to be performed.

To execute the Ten Point Monitoring Strategy, the initial responders should gather radiological monitoring data for 10 points in the downwind direction. If the downwind direction is not known, survey in all directions around the release point until the direction of deposition is determined.

Conditions or local terrain may prevent access to some of the 10 points. If that occurs, responders should collect as many of the 10 points as possible. The spacing between the points may vary depending on the severity of the incident.

RAP or the Consequence Management Home Team can help initial responders select 10 locations. An example of the Ten Point Monitoring Strategy is provided in the following figure.

**General guidance on the 10 point locations:**

- One point directly downwind from the release point and as close as possible to the release that is safe for responders.
- 0.5, 1, 1.5, 2 and 2.5 miles directly downwind.
- 1.5 and 2.5 miles downwind at 22.5 degrees on both sides of plume centerline.
- Scale distances as necessary.
Consequence Management Procedures
Using PRND Equipment

Start

Appropriate PRND: PRD, SPRD, Backpack

Step 1
Verify screening levels at which further action is required.

Step 2
Set up a contamination screening location in an area that is close to
background levels of contamination.

The goal is to find a screening location in an area with no or very little
contamination so the environment will not interfere with the screening.

Step 3
Perform targeted screening for highly contaminated individuals in a group
(reception line).

NOTE: Setting audible alarms is undesirable in public monitoring due to the
stress the alarm could cause.

Walk slowly past individuals no faster than 12 inches per second with the PRD
at 12 inches from the individuals, OR

Screen the individual 12 inches away from the most probable contaminated
parts of the body (no faster than 12 inches per second), OR

Have individuals walk slowly (no faster than 12 inches per second) past a
backpack.

NOTE: The alarm function will respond quicker than the numerical values on the
display.

Step 4
If the PRD alarms or screening levels are exceeded, then:

Locate the contaminated individual and follow local guidance.

Possible options are to remove outer layer of clothing and perform a detailed
frisk (see next job aid for details), OR

Refer the person to a Community Response Center, or similar setting, for more
rigorous screening and/or decontamination.
Contact Information for RAP Assistance

The Radiological Assistance Program (RAP) is the nation’s premier first-response resource in assessing an emergency situation and advising decision-makers on further steps to take to evaluate and minimize the hazards of a radiological incident. RAP provides resources (trained personnel and equipment) to evaluate, assess, advise, isotopically identify, search for and assist in the mitigation of actual or perceived nuclear or radiological hazards. The RAP is implemented on a regional basis, with coordination between the emergency response elements of state, local and federal agencies. Regional coordination is intended to provide a timely response capability.

**RAP Regions**

The Radiological Assistance Program can be reached at any time by contacting the DOE Watch Office 24-hour Number: (202) 586-8100

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Contact Information for FRMAC Assistance

The Federal Radiological Monitoring and Assessment Center (FRMAC) is a federal asset available upon request by the Department of Homeland Security and state and local agencies to respond to a nuclear or radiological incident. The FRMAC is an interagency organization with representation from the National Nuclear Security Administration (NNSA), the Department of Defense, the Environmental Protection Agency, the Department of Health and Human Services, Federal Bureau of Investigations and other federal agencies. NNSA has the responsibility to maintain the operational readiness and to deploy the FRMAC upon request.

Radiological emergency response professionals within the Department of Energy’s national laboratories support the Consequence Management Home Team (CMHT), Consequence Management Response Team (CMRT), Radiological Assistance Program (RAP), National Atmospheric Release Advisory Center (NARAC), Aerial Measuring System (AMS) and the Radiation Emergency Assistance Center/Training Site (REAC/TS). These teams supplement the FRMAC to provide:

- Atmospheric transport modeling;
- Radiation monitoring;
- Radiological analysis and data assessments; and
- Medical advice for radiation injuries.

In support of field operations, the FRMAC provides geographic information systems, communications, mechanical, electrical, logistics and administrative support. The size of the FRMAC is tailored to the incident.

First responder data for consequence management incidents (i.e., where wide spread radioactive contamination has occurred) should be given to the Consequence Management Home Team (CMHT) as soon as possible. CMHT can be activated upon request through the DOE Watch Office 24-hour Number: (202) 586-8100.

When the CMHT is activated, send data via the following:

cmht@nnsa.doe.gov

Or share via:

[RadResponder Network](#)
When Acute Whole Body Radiation Doses Become Dangerous

The four stages of Acute Radiation Sickness (starting around 100 rad or 100,000 mR)

- **Prodromal Stage**: Nausea, vomiting, anorexia and diarrhea. Occurring from minutes to days after exposure.
- **Latent Stage**: Patient can look and feel well for hours up to weeks.
- **Manifest Stage**: Symptoms depend on specific syndrome and last from a few hours to months.
- **Recovery or Death**: Most patients who do not recover will die within several months of exposure. Recovery can take weeks to years.

<table>
<thead>
<tr>
<th>Dose (Rad)*</th>
<th>Exposure (mR)</th>
<th>Potential Biological Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,000</td>
<td>1,000,000 mR</td>
<td>Death due to central nervous system damage within hours.</td>
</tr>
<tr>
<td>≥ 800</td>
<td>≥ 800,000 mR</td>
<td>Neurovascular Syndrome; death occurs within 3 days.</td>
</tr>
<tr>
<td>≥ 600</td>
<td>≥ 600,000 mR</td>
<td>Gastrointestinal (GI) Syndrome; survival is extremely unlikely with this syndrome. Destructive and irreversible changes in the GI tract and bone marrow. Death usually occurs within 2 weeks.</td>
</tr>
<tr>
<td>350</td>
<td>350,000 mR</td>
<td>No treatment; death within 60 days for 5% of exposed population with treatment, up to 800 Rad.</td>
</tr>
<tr>
<td>300</td>
<td>300,000 mR</td>
<td>Male sterility.</td>
</tr>
<tr>
<td>200</td>
<td>200,000 mR</td>
<td>Female sterility.</td>
</tr>
<tr>
<td>≥ 100</td>
<td>≥ 100,000 mR</td>
<td>Hematopoietic Syndrome; begin symptoms of acute radiation sickness. Medical attention required at this dose level or greater.</td>
</tr>
<tr>
<td>25</td>
<td>25,000 mR</td>
<td>Detectable blood changes.</td>
</tr>
<tr>
<td>15</td>
<td>15,000 mR</td>
<td>Temporary decreased sperm count.</td>
</tr>
</tbody>
</table>

*UPF May 2017

Health and Safety Information: Stay Times

Exposure rates or total doses in the shaded areas exceed guidance levels and are to be used only when critical or lifesaving actions are warranted. This table is for gamma only - if airborne alpha or beta are present, appropriate respiratory protection must be used.

<table>
<thead>
<tr>
<th>Exposure rates</th>
<th>Up to 5,000 mrem limit for emergency operations</th>
<th>Up to 10,000 mrem when lower does not practicable, only for protecting valuable property or infrastructure</th>
<th>Up to 25,000 mrem when lower does not practicable, only for lifesaving or protecting large populations</th>
</tr>
</thead>
<tbody>
<tr>
<td>100 mR/hr</td>
<td>50 hours</td>
<td>100 hours</td>
<td>250 hours</td>
</tr>
<tr>
<td>1000 mR/hr</td>
<td>5 hours</td>
<td>10 hours</td>
<td>25 hours</td>
</tr>
<tr>
<td>5000 mR/hr</td>
<td>1 hour</td>
<td>2 hours</td>
<td>5 hours</td>
</tr>
<tr>
<td>10,000 mR/hr</td>
<td>30 min</td>
<td>1 hour</td>
<td>2.5 hours</td>
</tr>
<tr>
<td>25,000 mR/hr</td>
<td>12 min</td>
<td>24 min</td>
<td>1 hour</td>
</tr>
<tr>
<td>50,000 mR/hr</td>
<td>6 min</td>
<td>12 min</td>
<td>30 min</td>
</tr>
<tr>
<td>100,000 mR/hr</td>
<td>3 min</td>
<td>6 min</td>
<td>15 min</td>
</tr>
</tbody>
</table>

Zone Definitions per NCRP Report 165

- **Cold Zone ≤ 10 mR/hr**
- **Hot Zone ≥ 10 mR/hr and < 10,000 mR/hr**
- **Dangerous Zone ≥ 10,000 mR/hr**
Dose Accumulations

Starting dose amount: ______________

Ending dose amount: ______________

Date and time of shift: ______________

Formula for dose accumulation:
Ending dose – Starting dose = Dose accumulated

Add accumulated doses from each operational period to determine your total dose.

<table>
<thead>
<tr>
<th>Name</th>
<th>Date/Time In</th>
<th>Date/Time Out</th>
<th>Starting Dose</th>
<th>Ending Dose</th>
<th>Respirator (Y/N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>John Doe</td>
<td>9/5/2017   0900</td>
<td>9/5/2017      1700</td>
<td>0 mrem</td>
<td>50 mrem</td>
<td>Y. SCBA</td>
</tr>
<tr>
<td>John Doe</td>
<td>9/6/2017   0900</td>
<td>9/6/2017      1700</td>
<td>0 mrem</td>
<td>25 mrem</td>
<td>N</td>
</tr>
<tr>
<td>TOTAL DOSE</td>
<td></td>
<td></td>
<td></td>
<td>75 mrem</td>
<td></td>
</tr>
</tbody>
</table>
Equipment-Specific Job Aids

- Canberra UltraRadiac Plus
- RAE Systems GammaRAE IIR
- BNC NucALERT 951
- D-Tect MiniRad-D
- Polimaster PM1703MO-1
- Polimaster PM1703GN
- Thermo Radeye PRD
- Thermo Radeye PRD-ER
- Thermo Radeye SPRD
- Thermo Radeye G
- STE Pager
- STE Pager S
Thermo Radeye PRD-ER: Consequence Management

Cold Zone: < 0.1 mH
Hot Zone: > 0.1 mH
Danger Zone: > 100 mH

Worker Exposure Control
- Personal/Protective Detection
- Monitor and Record
- Zero dose
- Calibration

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Emergency workers operate under reference values and guidelines rather than regulatory dose limits while working in an emergency exposure situation. Initial alarm set points are provided that correlate to national and international reference values and guidelines for emergency response. It is expected that many agencies will have alternate alarm set points defined by internal policy and the Job Aids are being provided in an editable PowerPoint format so that they may change the Job Aids to match their policies.

Exposure Rate Alarms:
- Low 10 mR/h (0.01 mR/h) is used to identify the hot line (ASTM) or outer perimeter, or 0.01 R/h boundary of the Hot Zone or Low Radiation Risk Zone.
- High 10 R/h represents the boundary to the Dangerous Radiation Zone or Dangerous Fallout Zone.

Recommended Setttings:

<table>
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<tr>
<th>Dose Rate</th>
<th>Alarm 1</th>
<th>Alarm 2</th>
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<tr>
<td>10 mR/h</td>
<td>50 R/H</td>
<td>4.5 R/H</td>
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References:
- 29 CFR Part 1910.129 (Ionizing Radiation) for OSHA occupational limit. Under the OSHA Ionizing Radiation standard, the annual occupational limit for whole body radiation exposure for adults (age 18 years) is 5 mSv (50 mrem).
Training

Material developed and piloted during 3 DOE just-in-time training events with local responders
Standards

• Identify and document next generation PRND equipment standards for CM missions

• ANSI N42.60 will address training and testing criteria associated with CM scenarios and the use of PRND

• Revise existing ANSI standards over time
Future Work

- Validate instrument-specific job aids
- Continue to add data logging capability in RadResponder
- Conduct additional training
- Codify in response plans
  - Materials are on CMWeb
  - Make materials available on RadResponder
Plan to Use Your Preventive Radiological Nuclear Detection Equipment During a Response

• PRND equipment may be utilized for “right of boom” response/consequence management tasks
  • Person/object contamination screening
  • Responder exposure monitoring and control
  • Area radiation surveys
  • Isotope identification

• A specific model’s detection and alarm capabilities determine how the instrument may be used effectively and safely

• ConOps, Job Aids and Training are available for responders

• Contact your regional Department of Energy or Department of Homeland Security (CWMD or FEMA CBRN) representatives for additional information