New Guidance and Tools for RDD Response
NUSTL support to state and local planning

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NUSTL Division Director
First Responders Group/NUSTL
Science and Technology Directorate
70 YEARS OF SERVING THE NATION

- **Atomic Energy Commission (AEC), Medical Division, Health and Safety Division (1947 - 1953)**
- **AEC, Health and Safety Laboratory (HASL) (1953 - 1974)**
- **Energy Research and Development Administration (ERDA), HASL (1974 - 1977)**
- **Department of Energy (DOE), Environmental Measurements Laboratory (EML) (1977 - 2003)**
- **Department of Homeland Security (DHS), EML (2003 - 2009)**
- **DHS, National Urban Security Technology Laboratory (NUSTL) (2009 - Present)**

Years:
- 1940s
- 1950s
- 1960s
- 1970s
- 1980s
- 1990s
- 2000s
- 2010s
Supporting States & Locals

**RNRR R&D Program provides guidance in advance**

**Domestic Nuclear Detection Office (DNDO)** provides technical support and equipment for detection and interdiction capabilities.

**Federal Emergency Management Agency (FEMA)** provides technical support for preparedness and planning.

**S&T** provides technical support, tools and guidance in advance so state and locals can initiate a response in the first minutes and hours.

**FEMA** coordinates an integrated federal response.

Department of Energy (DOE), Environmental Protection Agency (EPA) and other federal agencies provide technical support and specialized assets.
RDD Response Guidance: Planning for the First 100 minutes

- **Composition**: 5 Missions and 10 Tactics

- **Intent**: to guide planners during the process of developing a plan for their respective jurisdiction

- **Annexes**:
  - Public messaging guidance
  - PPE recommendations
  - Analyst decision-support tools
  - RadResponder integration
  - Planning worksheets
  - Protocol for 10 Pt monitoring

[Link to document](https://www.dhs.gov/publication/st-frg-rdd-response-guidance-planning-first-100-minutes)
DHS S&T & DOE Lab Team
Health Physics, R&D, Local Planning, Responder Product Management

Steve Musolino
Fred Harper

70+ years of experience in scientific research, operational health physics and the DOE/NNSA radiological emergency response community

Orly Amir
Ben Stevenson

NUSTL Mission: Test, evaluate and analyze homeland security capabilities, while serving as a technical authority to first responder, state and local entities in protecting our cities.
Why 100 Minutes?
Timeframe is a starting point; Adjust as Needed

- Admittedly optimistic, but sets a high bar

- Note the assumptions:
  - Unlikely federal and state support arrives immediately; local jurisdictions must use own assets and know-how
  - The recommendations are time-sensitive; local jurisdictions must plan for the how and when to have desired impact

- If objectives and tactics are not achievable for local jurisdiction, use the guidance to identify gaps
5 Missions

- RECOGNIZE
- INITIATE
- EVACUATE & MONITOR
- INFORM
- MEASURE & MAP

EARLY (Emergency Response)
INTERMEDIATE (Incident Stabilization)
10 Time-Phased Tactics

FIELD RESPONSE TACTICS
- Initial Units & On Scene Recognition
- Confirm Presence of Radiation
- Give Report from Scene
- Conduct Lifesaving Rescue Operations
- Secure and Manage the Scene
- Measure Radiation Levels
- Commence Phased Evacuations
- Monitor and Decontaminate

EOC/COMMAND CENTER TACTICS
- Issue Protective Actions to Public through Media Outlets (Public Messages 1-3)
- Notify Partners and Request Assistance
- Consolidate and Map Radiation Data
Science Based Guidance
Informed by Experiments

Tactics are geared towards a realistic impact
Geo-Shapes
Pre-defined Zones at 250m, 500m, and 2000m
Fragmentation ("BBs")
RDD Flavor 1

Dispersal Pattern
- Large Particles (≈ 100 - 500 \( \mu \)m)
- Ballistic Fragments (> 1 cm)

Prevailing Wind

DHS Science and Technology Directorate | MOBILIZING INNOVATION FOR A SECURE WORLD
Small BBs
Aerosol ("smoke")
RDD Flavor 2

**Dispersal Pattern**

- **Fireball Interaction Area** (small particles — < 100 μm — about 5% of material that remains in fireball)
- **Downwind Fallout** (small particles)

*Prevailing Wind*
Smoke
Combination
RDD Flavor 3

Dispersal Pattern

- Fireball Interaction Area (< 100 μm, about 5% of material in fireball)
- Large Particles (≥ 100 - 500 μm)
- Ballistic Fragments (> 1 cm)
- Downwind Fallout (small particles)

Prevailing Wind

Radiation measurements at this nominal location are dominated by the hot spot from the Fireball Interaction Area...
10 Time-Phased Tactics

**FIELD RESPONSE TACTICS**

- Initial Units & On Scene Recognition
- Confirm Presence of Radiation
- Give Report from Scene
- Conduct Lifesaving Rescue Operations
- Secure and Manage the Scene
- Measure Radiation Levels
- Commence Phased Evacuations
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**EOC/COMMAND CENTER TACTICS**

- Issue Protective Actions to Public through Media Outlets (Public Messages 1-3)
- Notify Partners and Request Assistance
- Consolidate and Map Radiation Data
Introduction to the RDD Response Guidance

This is draft product from the Department of Homeland Security, National Urban Science and Technology’s Animated Simulations of RDD Scenarios for First Responder Preparedness & Training project. Contact NUSTL@hq.dhs.gov for a final version of this and other RDD Guidance training animations which will be available after April 2019.

This work performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under Contract DE-AC52-07NA27344. LLNL-VIDEO-749558
MISSION 1: RECOGNIZE...

*that radiation is present at the scene of the incident (p. 13)*

**TACTICS:**

1. Initial Response and On-scene Recognition
2. Confirm the Presence of Radiation

2 readings - 2 locations - 2 instruments
MISSION 2: INFORM...
...responders/public of hazard zones; request assistance. (p. 14)

**TACTICS:**
- **3:** Give report from the scene
- **4:** Issue protective actions to the public
- **5:** Notify partners and request assistance
MISSION 3: INITIATE...
...lifesaving rescue operations without waiting for rad monitoring.
(p. 18)

**TACTICS:**
- **6:** Initiate lifesaving rescue operations
- **7:** Secure and manage the scene
MISSION 4: MEASURE & MAP...

...radiation levels to characterize the contamination. (p. 22)

**TACTIC:**

**Å 8:** Measure and map radiation levels to initially characterize and visualize the extent of the radiological contamination.
**EVACUATE & MONITOR...**

*...impacted populations and open CRCs for radiation screening. (p. 33)*

**TACTICS:**

- **9:** Commence phased evacuations
- **10:** Monitor and decontaminate
TACTIC 10
MONITOR AND DECONTAMINATE
RDD Guidance as a Framework

- PRND for CM
- ROSS
- NCRP Report 179
- Rad-Responder integration
- AEOLUS
- Turbo FRMAC
- Gross DECON 'app'
- Waste est. supt. Tool (WEST)

RECOGNIZE
INITIATE
EVACUATE & MONITOR

INFORM
MEASURE & MAP

EARLY (Emergency Response)
INTERMEDIATE (Incident Stabilization)

0 5 mins 10 mins 15 mins 30 mins 60 mins 90 mins 100 mins

RDD animations for training
# PRND Equipment for Consequence Management

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<th>Model</th>
<th>Vendor</th>
<th>Dimensions (LxWxH in)</th>
<th>Weight (oz)</th>
<th>Battery Life (yrs)</th>
<th>Expected Unit Lifetime (yrs)</th>
<th>Expected Gamma Detector 1 (High Sensitivity)</th>
<th>Gamma Detector 2 (High Range)</th>
<th>Neutron Detector</th>
<th>Weight (oz)</th>
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<td>NukeAlert 951</td>
<td>IPS4, 2+ years</td>
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<td>BNC</td>
<td>945-950</td>
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<td>2+ years</td>
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**Key Equipment Counts:**
- **50 PRDs**
- **65 RIIDs**
- **20 Backpacks**
- **25 Vehicles**
- **30 Portals**
Cold Zone Missions to Consider

Â **Worker Exposure Control**
Warning the worker that they are approaching the Hot Line.

Â **Worker Dose Monitoring**
Measuring a worker’s accumulated exposure or dose.

Â **Person/Object External Contamination Detection (β/γ)**
Determining if the contamination on a person or object exceeds predetermined criteria.

Â **Radiation Survey (Cold Zone Only)**
Hot Zone Missions to Consider

- **Worker Exposure Control**
  Warning the worker that they were approaching the Dangerous Radiation Zone.

- **Worker Dose Monitoring**
  Measuring a worker's accumulated exposure or dose.

- **Radiation Survey (Hot Zone)**

Dangerous Radiation Zone Missions to Consider

- **Worker Exposure Control**
  Warning the worker that they were approaching a predetermined turn-back radiation level.

- **Worker Dose Monitoring**
  Measuring a worker's accumulated exposure or dose.
Job Aids Developed for Responders

Using Preventative Radiological Nuclear Detection Equipment for Consequence Management Missions

Operational Job Aids
2017 First Edition

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A means for local health physicists and other personnel with radiological knowledge to support radiological response operations in an emergency.

As envisioned, ROSS will support emergency operations by:

- Supporting the incident command system structure,
- Helping access specialized federal resources and tools,
- Interpreting and explaining health physics response data and predictive modeling results,
- Providing guidance to responders, incident commanders, elected officials, and decision-makers on appropriate protection actions for responders and the public, and
- Aiding public and responder communication efforts.

ROSS can serve in a range of different roles depending upon the volunteer’s skills, knowledge, and abilities.
Rad Decontamination Tool
http://www.radresponder.net

Radiation Decontamination Tool

Purpose
This application is intended to serve as a decision aid in preparing for and responding to large-scale radiation incidents. It is not intended to provide a single definitive solution but rather a set of prioritized response options, which after discussion by appropriate stakeholders, can be formed into an overall response strategy for the incident.

Important Information Regarding This Application
- The application provides response options for inhabited areas. An inhabited area can be defined as locations where people spend their time, and generally includes residential, industrial and recreational spaces.
- The application prioritizes response options by impacted surfaces, including for example, interior and exterior building surfaces, roads, soils and vehicles.
- The application requires only two inputs from a user: an identification of impacted surfaces and the radionuclides present. In lieu of identifying specific radionuclides, the user can instead identify the type of incident which caused the radiological release.
- This application focuses on early phase response actions that can be taken during or just after the initial phase of life safety measures are being undertaken by emergency management personnel.
- The application prioritizes options for final consideration by evaluating all possible response actions against various factors and constraints, such as the actual radionuclide(s) released, time costs, social and technical considerations, expected dose reduction (i.e., effectiveness) and waste generated by the response.
- This application is specifically designed for use by local, state, and federal government agencies and personnel with emergency management and/or environmental remediation responsibilities.
- As a decision aid, this application will provide an array of prioritized response options by impacted surfaces. To effectively develop an overall response strategy for an incident, the results generated by this decision aid should be shared with and discussed with appropriate stakeholders involved with the response or impacted by the incident.
- The software builds upon the information and decision logic outlined in the UK Recovery Handbooks for Radiation Incidents: 2015, Inhabited Areas Handbook (released June 5, 2015).
- Throughout this application, hyperlinks are provided to assist the user gain access to various reference sources, including the technical data sheets on each possible response option as outlined in Section 7 of the UK Handbook, as

(Need to be logged into RadResponder)
Surfaces Impacted

- Buildings - external surfaces
- Buildings - indoor surfaces and objects
- Semi-enclosed
- Vehicles
- Roads and paved areas
- Soil and vegetation

Radonucleides Present

- Known
- Scenario

Radonucleides Available

- Search
- Cobalt-60 (60Co)
- Selenium-75 (75Se)
- Strontium-90 / Yttrium-90 (90Sr/90Y)
- Zirconium-95 (95Zr)
- Molybdenum-99 / Technetium-99m (99Mo / 99mTc)

Results

Prioritized Management Options

- Radonucleides Present
  - Strontium-90 / Yttrium-90
  - Molybdenum-99 / Technetium-99m

Selected Radonucleides

- Strontium-90 / Yttrium-90
- Molybdenum-99 / Technetium-99m
Waste Estimate Support Tool (WEST)

- A GIS-based tool that can assist in planning/preparedness activities at all levels of government
  - Radiological Dispersal Device (RDD) waste management issues linked with decontamination and restoration timeline
  - Waste management decisions need to be made early

- Waste Estimation Support Tool (WEST) facilitates
  - First-order estimate of waste quantity and activity
  - Pre-selection of disposal options
  - ID of potential triage/staging/storage within each zone or surrounding area
  - Assessment of impact of decontamination strategies on waste generation
  - Assessment of impact of waste management strategies on decontamination decisions
  - Identify starting points for waste policy discussions
Waste Estimate Support Tool (WEST)

Satellite Image  WEST Analysis
RDD Guidance as a Framework

Compendium of documents and tools to support State and Local First responders plan for, prepare for, respond to and recover from an RDD