UCRL-PRES-150261

Radiological Emergencies; Tools, Training, & National Assistance for First Responders

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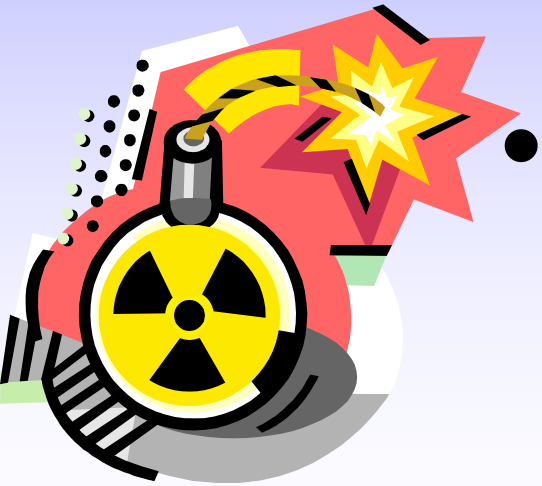
*This work was performed under the auspices of the U.S. Department of Energy by the University of California, Lawrence Livermore National Laboratory under contract No. W-7405-Eng-48.

Objectives

- Examples of Radiological Emergencies
- Defining "First Responders"
- Radiological Assessment Tools
- Training
- Assistance Resources

Types of Radiological Emergency Responses

- Nuclear Facility Release
- Transportation Accident



- Dispersed Radioactive Material
- Lost or Fugitive sources

First Responders

- **Fire Fighters / Paramedics** (Responding to fires, explosions, hazmat spills, and medical calls)

- **Law Enforcement** (investigating suspicious activity, serving warrants, etc..)
- **US Coast Guard** (inspecting vessels, responding to waterborne emergencies)

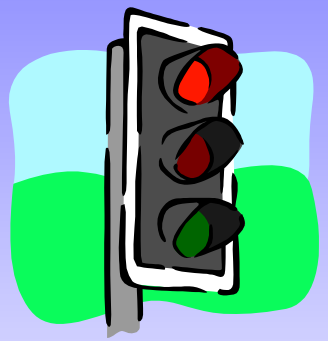
- **Hospital Emergency Department Staff** (large event and walk in emergencies)

Recognition of a Radiological Event

- The radiological nature of **nuclear facility** and **placarded transportation accidents** may be self evident, however
- Less obvious is the radiological component of;
  - Fire involving radioactive materials,
  - Radiological "dirty bomb,"
  - Dispersed material (fire, sprayed, etc..), and
  - Exposed high intensity sources.
- Tools are needed to help first responders recognize the radiological nature of an event.

Desirable Properties for Detection Tools for First Responders

- Alerts user of radiation above background
- Detect alpha & beta radiation
- Records dose
- Alarms in hazardous situations



- Work continuously without user intervention
- Simple and intuitive, requiring little training
- Small size, something easily worn
- Inexpensive to purchase and maintain

Tools: *Electronic Dosimeters*

The Pros

- Alarms in hazardous situations.
- Can identify a significant radiological event.
- Records dose.
- Long battery life.
- Small Size.
- Simple operation and often very rugged

The Cons

- Not necessarily sensitive enough to detect low levels of radiation.
- Won't detect alpha or low energy beta radiation

Tools: *Electronic Dosimeters*

Description:

About the size of a pager, these electronic devices track the total radiation dose received by the wearer. They often use low power silicon chips or small Geiger-Müller (GM) tubes to measure dose. Most have the ability to alarm at certain dose rates or total dose. Although these devices are not sensitive enough to necessarily find fugitive radioactive material, they can quickly detect significant events and **protect the wearer from overexposure**.

Application:

Well suited for emergency responders who may need to quickly enter a scene, these devices can help ensure responder safety by alerting them to potentially hazardous radiation levels without any user activation or operation. The units can also alert the wearer when unusual radiation levels are present, though they may not be sensitive enough to find low levels, i.e., < 5 µSv/hr (< 0.5 mrem/hr).

Examples:

Canberra Industries: http://ww2.canberra.com/PCatalog.nsf/all/RPI_PDF/$file/ANUDR13.pdf, http://ww2.canberra.com/PCatalog.nsf/all/RPI_PDF/$file/Dosicard.pdf
Far West Technology, Inc: http://www.fwt.com/hpi/hpi_4083ds.htm
MGP Instruments: http://www.mgpi.com/html/en/produits/masque.cfm?le_num_prod=87
POLIMASTER, Ltd.: http://www.polimaster.com/en/products/dosimeters.htm
Science Applications International Corporation (SAIC): http://www.saic.com/products/security/pd3i/pd3i.html
Siemens Environmental Systems - UK: http://www.siemens.co.uk/env-sys/uk/electronic_dosimetry/epd.shtml
Thermo Electron Corp: http://www.thermormp.co.uk/rmp/index.html

This does not represent an endorsement

Tools: *Personal Radiation Proximity Alert Systems*

Pros

- Very sensitive. Alerts the user of any statistically significant changes to the natural background radiation levels.
- Useful for finding contraband radioactive material.
- Good battery life
- Small Size
- Simple operation

Cons

- Will alarm in the presence of legitimate commercial, medical, or naturally occurring sources of radiation.
- Does not accurately measure (or work in) high dose rates which would be of concern to emergency responders performing rescue operations.
- Won't detect alpha or low energy beta contamination (other than by any associated dose field)
- Expensive ($800 – $2,000)

Tools: *Personal Radiation Proximity Alert Systems*

Description: Often called "Radiation Pagers," and similar in appearance to the electronic dosimeters, these units have the very different function of finding low levels of radiation using very sensitive crystal or plastic scintillators. Although good for finding contraband radioactive material, these units do not have the range necessary for personnel protection (i.e., high dose rates).

Application: Well suited for law enforcement or inspectors, these devices can alert the wearer to any unusual radiation in their proximity. These devices are best used when there is an opportunity for a measured response, as most alerts will occur from legitimate commercial, medical, or natural radioactive material. Training and protocols need to be provided to properly resolve any alarms.

Examples:

POLIMASTER, Ltd: http://www.polimaster.com/en/products/ratemeters.htm

Sensor Technology Engineering, Inc http://www.nttc.edu/ertProgram/radpagers.asp

T_ATECHNICAL ASSOCIATES: http://www.tech-associates.com/dept/sales/product-info/dsi-2.html

This does not represent an endorsement

Tools: *Isotope Identification Equipment (Gamma Spectroscopy)*

Pros

- Very sensitive. Alerts the user of any statistically significant changes to the natural background radiation levels.
- Useful for finding contraband radioactive material.
- Often tracks dose rates and total dose of user while on.
- Can identify many common isotopes

Cons

- Although fairly good at identifying common isotopes with simple spectra, these units can not identify all possible isotopes of concern and can also mis-identify isotopes.
- Will alarm in the presence of legitimate commercial, medical, or naturally occurring sources of radiation (though the analysis capability can often help resolve this)
- Expensive ($8,000 - $12,000)
- Won't detect alpha or low energy beta contamination.
- Requires extensive training or support to use properly

Tools: *Isotope Identification Equipment (Gamma Spectroscopy)*

Description:

These expensive and sophisticated units use the different gamma ray "signatures" given off by the radioactive material to identify the originating isotope(s). Proper identification of the isotope is important for determining the appropriate response actions. Although the analysis being performed is complicated, these units offer a simple interface to help non technical users make a measurement. Many of the units have modes of operations similar to the proximity alert and electronic dosimeters.

Application:

Best suited for experienced users or well trained and practiced responders, these units will help identify the radioactive material involved at a scene or in contraband. Good for follow-on radiological emergency response teams or inspectors.

Examples:

Berkeley Nucleonics Corp http://www.berkeleynucleonics.com/radiation/rindex.htm
Bicron/Thermo Electron: http://www.thermormp.co.uk/us/rmp/
Exploranium Radiation Detection Systems: http://www.exploranium.com/gr135pg1.htm
Perkin Elmer (Ortec): http://www.ortec-online.com/safeguards.htm
Quantrad Sensor: http://www.quantradsensor.com/
Radiation Alert: http://www.seintl.com/ursa.htm
XRF Corporation: http://www.xrfcorp.com/products/ics.html

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Tools: *Simplified Contamination Survey Instruments*

Pros

- "Open window" GM for alpha and beta contamination.
- Most have Good Sensitivity.
- Digital models can have set alarm levels
- Small Size
- Simple operation
- Rugged, simple technology.

Cons

- Sensitive enough alarm in the presence of legitimate commercial, medical, or naturally occurring sources of radiation.
- Many models can not be used in high dose rates which would be of concern to emergency responders performing rescue operations (>0.1 Sv/hr | >10R/hr).
- Low accuracy (i.e., uses pancake GM for dose measurement)

Tools: *Simplified Contamination Survey Instruments*

Description: These simplified meters use thin window (GM) detectors to measure alpha & beta surface contamination as well as dose rates. Although often ***more sensitive than the electronic dosimeter***, these devices are not as sensitive as the radiation proximity alert systems. Although they have a ***higher range than the personal radiation proximity alert systems***, many models will still not function well in the emergency response dose rate ranges (0.1 Sv/hr or 0.1 Sv). Their simplified operation is designed for the occasional user.

Application: Well suited for emergency responders and hospital staff who may need to quickly determine if radioactive ***contamination*** is present. The units can also alert the wearer when unusual radiation levels are present. Training must be provided on their use as successful contamination monitoring requires specific techniques.

Examples:

Canberra Industries: http://ww2.canberra.com/PCatalog.nsf/all/RPI_PDF/$file/radiagem4.pdf
T_A TECHNICAL ASSOCIATES http://www.tech-associates.com/dept/sales/product-info/tbm-3.html
Berkeley Nucleonics Corp: http://www.berkeleynucleonics.com/PalmRAD/
Health Physics Instruments: http://www.fwt.com/hpi/hpi_4020ds.htm
Radiation Alert Instruments: http://www.seintl.com/mon5.htm, http://www.seintl.com/dig50.htm, http://www.seintl.com/inspect.htm, http://www.seintl.com/insp_exp.htm

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First Responder Training Objectives

- Keep the messages simple! Focus on what you want them to remember a year later.
- At the awareness level (the vast majority) this should be;
  - That medical emergencies take precedent over radiological monitoring,
  - Used correctly, your instruments and protocols ensure responder safety, and
  - The difference between contamination and radiation.
- The overall objective: Increase the responder's comfort level so they can respond effectively.

Effective Training Methods

- "Hands On" training with the tools used by the responders.
  - **Demonstrate** the principles of radiation (types of radiation, distance & shielding effects, etc..)
  - **Utilize the responders own equipment** with actual radiation sources.
- Trainers need to be able to address the radiological concerns of the students.
- Leave training materials that are interesting and can be used as a reference

Training Materials

- Many high quality, low cost training programs exist in the federal government.
  - *"Compendium of Weapons of Mass Destruction Training"* produced by the federal government.
  - Department of Energy's (DOE) Transportation Emergency Preparedness Program (TEPP).
- "Train the Trainer," Interactive Computer Based, or Web Based Training formats used for cost efficiency

Hospital

File Help Terrorism WMD Prop. Treat. Proc. Skills Protect. Proc. WMD Lib. Scenario

TREATMENT PROCEDURES

DECONTAMINATION PROCESS

Decontamination Deltas

- *The Large Number of Victims* is the first major difference between standard HAZMAT and WMD incidents. Responders may be required to control, triage, decontaminate, and track hundreds, if not thousands, of people at the site.
- *Scene Control* may involve a larger area, a mass casualty situation with numerous responders who all want to "help," and a huge press corps seeking information about the

PREVIOUS CONTINUE MENU EXIT

Radiological Emergency Assistance Resources for First Responders

- Local Fire and Hazmat Responders
- County/State Department of Health Services
- National Guard Civil Support Teams
- Federal assistance also available:
  - DOE's Radiological Assistance Program (RAP) Teams
  - FBI WMD/HAZMAT teams
  - Other National Assistance (FEMA)
  - Training and equipment resources available through the Department of Justice, Office for Domestic Preparedness Homeland Defense Equipment Reuse (HDER) Program. {Calibration and Training Support Provided by HPS}

Department of Energy's Radiological Assistance Program (RAP)

- Regional, On-Call Responders
- Specialized Equipment
- Volunteers with Extensive Radiological Experience
- Outreach to help 1st Responder Preparation
- Tailored Response that provides access to **all of DOE assets.**

Department of Energy's Radiological Response Assets

ARAC
Atmospheric Release Advisory Capability
Computer Modeling of Transport Diffusion and Disposition of Radioactive and Hazardous Material

RAP
Radiological Assistance Program
Radiological measurements and advice to public sector

AMS
Aerial Measurement System
Airborne radiological sensing and surveying capabilities

Consequence Management

FRMAC
Federal Radiological Monitoring Assessment Center
Operational and logistical management cell focused on radiological consequence management

REAC/TS
Radiation Emergency Assistance Center/Training Site
Expert medical assistance for radiation exposure accidents

ARG
Accident Response Group
Safely recover nuclear weapons

Summary:

- **Detection tools.** There are many different detection tools for first responders, always consider;
  - The Task
  - The User

- **Training** must be provided to give the responder the confidence to respond properly. Even simple detection tools can lead to inappropriate responses without training.

- **Forge links with radiological responders**. Many local response agencies may not be aware of the resources available to them.

Questions

References

The devices pictured and web pages referenced in this presentation were chosen as examples and in no way represent an endorsement of any manufacturer or product.

Homeland Defense Office of the U.S. Army Soldier and Biological Chemical Command, "Compendium of Weapons of Mass Destruction Training produced by the federal government" [online]. Available at http://hld.sbccom.army.mil:80/downloads/dp/compendium_wmd_aug_2000.pdf

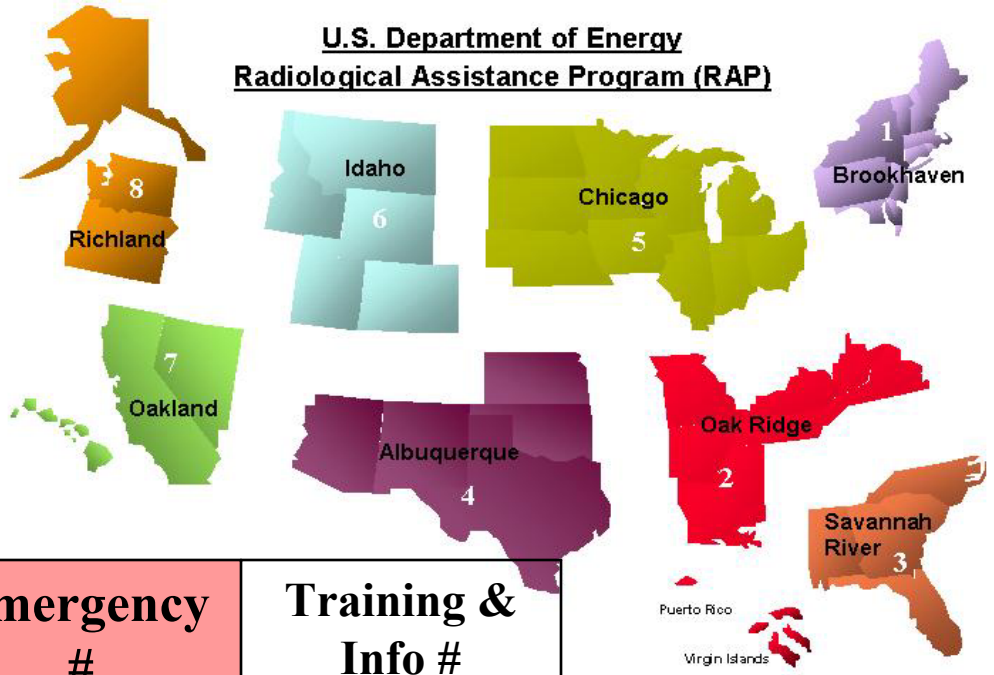
The Department of Energy, Transportation Emergency Preparedness Program (TEPP) [information available online] http://www.em.doe.gov/otem/program.html

A Practical Guide To Incident Response, ARSCE 2002; WPM-A.4 James G. Barnes, CHP Rocketdyne/Boeing

The Department of Energy's "Partners in Emergency Response" Publication. [information available online] http://www.doeal.gov/opa/Freedom.htm

The Department of Energy, Emergency Operations Training Academy (EOTA), **Computer Based Training (CBT)** for the response to Weapons of Mass Destruction CDs can be copied and have been distributed to each state's FEMA representative who can be found at www.fema.gov/fema/statedr.shtm or by contacting DOE's Emergency Operation Training Academy at www.eota.doe.gov or call (505) 845-5170 ext.172

DOE Emergency Assistance or Training Info, Contact:



Region	NNSA Regional Response Coordinator	Emergency #	Training & Info #
1	Steve Centore	(631) 344-2200	(631) 344-7309
2	Steve M. Johnson	(865) 576-1005	(865) 576-9740
3	Christina T. Edwards	(803) 725-3333	(803) 952-6613
4	James E. Straka	(505) 845-4667	(505) 845-5581
5	Christine Van Horn	(630) 252-5731	(630) 252-2498
6	Steven A. Morreale	(208) 526-1515	(208) 526-0199
7	Mike Cornell	(925) 422-8951	(925) 422-0138
8	Kathy Beecher	(509) 373-3800	(509) 376-8519
HQ	Duty Officer, Washington, DC	(202) 586-8100	(202) 586-3201