

CHAPTER 10

First Responder Radiological Response Training

In 2005, CEMRC was approached by one of the Homeland Security Consortium members (EMRTC at New Mexico Tech in Socorro) to develop a training program for first responders (fire, police, EMTs, military) that would cover responding to radiological emergencies such as following a radiological dispersion device (RDD or dirty bomb). The course was to address first responder needs in ways existing rad training does not.

A three-day course was developed for a class of between 20 and 40 trainees, at about \$1,000 per person, and implemented on three separate occasions from October 2005 to October 2006. The training was a combination of traditional radworker training, dirty bomb specialized training developed at CEMRC and the MERRTT training developed at WIPP. Included was classroom lecture, hands-on sessions with dosimeters and radiological materials, a medical radiological evacuation session, and a final field exercise with actual explosive materials and the participation of the local fire and police departments, LANL-Carlsbad scientists and the MERRTT team lead by Lynn Eaton with Marsha Beekman from WTS (Fig. 10.1). The response was exceptional and most attendees recommended the training to their home organizations. Besides fire and police, attendees included military from the National Guard WMD Civil Support Team in Albuquerque, EPA enforcement officers, Coast Guard WMD team members, and DHS contractors.

BACKGROUND

RDDs, or dirty bombs, are devices that disperse radioactive materials. They take

many forms, from containers of radioactive materials wrapped with conventional explosives, to aerosolized materials sprayed by conventional equipment, to manual dispersion of fine powders into the environment (Koonan, 2002). Also included are radiation-exposure devices (REDs), used to expose people to dangerous levels of radiation but without dispersing material. RDD attacks can produce general panic, immediate death and long-term increases in cancer incidence, long-term loss of property use, disruption of services, and costly remediation of property and facilities.

Radioactive materials are used in many fields in almost all countries around the world, particularly for medical, research, and industrial applications (O'Brian, 2002). Dozens of radiological source producers and suppliers are found on six continents, and about a billion sources exist worldwide although most, like household smoke detectors, have such low activities that they pose no threat (Strub et al., 2003; Van Tuyle et al., 2003). With the increase of radioisotope applications in nuclear medicine, instrument sterilization and food irradiation, the radiological source production and fabrication industry is an emerging growth industry in several countries, particularly in areas with depressed economies.

The rise in the number of terrorist acts during the last ten years has raised concerns about these radiological sources being used in RDDs, or dirty bombs, that could create panic and potentially large economic consequences (Van Tuyle et al., 2003). Because the general public is so frightened about anything radioactive,

panic must be anticipated even if there is no real health threat from the radioactive component. At the same time, the threat is no longer theoretical. Several credible designs for a dirty bomb attack against the United States have been found in Al Qaeda records. Two actual dirty bombs were deployed by Chechen separatists. Both were foiled. Of most concern, however, is the presence of dirty material on the world market. As an example, 38 Alazan missiles outfitted with dirty bomb warheads are for sale from a particular weapons factory.

Therefore, the United States must prepare in some way for an eventual non-nuclear radiological attack, and this preparation can take two forms: 1) dirty bomb training programs specifically geared to first responders, and 2) a $^{137}\text{CsCl}$ melting program for the irradiation industry that changes the powdered form into a more RDD-resistant solid form, coupled with international restrictions on the transportation of powdered ^{137}Cs chloride which can only occur if there is a non-powdered alternative acceptable to the industry. Both of these strategies are underway at CEMRC, and if implemented over the next few years should dramatically reduce our vulnerability to this type of attack (Conca, et al., 2005).

RESULTS

Attendees received all training materials to carry back to their home organizations in the form of hard copy and electronic media. Most of the training materials are available on the website at www.cemrc.org. In particular, a simplified executable 12-step guidance for radiological response was developed for all first responders nation-wide that can be contained on a single, double-sided laminated card to carry in any vehicle. This was

disseminated throughout specific DHS websites, incorporated into the *DHS LLIS Radiological Dispersal Device Incident Response Planning Working Group*, and appeared in the May 2006 issue of the *Homeland Protection Professional* (Conca et al., 2006). This 12-step guidance is given on the next two pages. Although not necessary, this guidance is best executed after training such as provided by this RDD course. Part of the challenge posed by DHS for this course was to make radiological issues relevant and understandable to first responders without unnecessary and confusing information that is more appropriate to radiation workers but not first responders. An example follows for a discussion of the relative risks of progressive dose limits presently given by DHS for first responders but which are not given in any useful context.

10 rem acute dose - In the working hot zone for a day - no measureable health effects

- Fighting a dumpster fire
- Hand-cuffing an inebriated nuisance

25 rem acute dose - In the working hot zone for a few days

- Fighting a three-alarm fire from the street
- Disarming a perpetrator who has no weapon

50 rem acute dose (DHS responders suggested upper limit for saving life in large numbers) - In the working hot zone for a week

- Running into a burning building not at risk of collapse
- Disarming a perpetrator who has a knife

100 rem acute dose - In the working hot zone (0.1 to 1 rem/hr) for a month/~10 min priority rescue at Ground Zero

- Running into a burning building at risk of collapse
- Disarming a perpetrator who has a gun

***First Responder 12-point Guidance in the Event of a
Dirty Bomb, RDD or other Radiological Incident***

1. Assume all explosions, particularly car explosions, could be dirty.
2. If no dose or activity readings are available, set up an affected or exclusion zone boundary at 500 m from ground zero.

If readings are available, set the full exclusion zone (around ground zero) outer boundary as about 1 rem/hr (10 mSv/hr). This boundary will also be the hot zone inner boundary. Set the hot zone outer boundary as about 0.1 rem/hr (1 mSv/hr).

Within this zone, essential personnel can operate for several hours without accumulating significant dose. Exact adherence may not be feasible because of logistical or geometric issues and plus or minus a factor of 2 can be expected.

Set the outer boundary of the warm zone (affected area) to about 2 mrem/hr (20 μ Sv/hr) depending upon operability. Local decisions may warrant establishing boundaries at 2x or 4x background, but these may be miles from ground zero.

3. All personnel in the hot zone should wear full PPE (turnout or bunker gear) with a particulate full face mask and have an updating, alarming cumulative dosimeter that can be used to track total dose. Take any precaution necessary to avoid inhaling or ingesting dust and particulates. Radioactivity will be in particulate form.
4. When it is determined the situation is radiological, immediately alert the appropriate secondary response teams, such as CST, RAP and FBI, as advised in the unified command protocols for your region. If necessary call:

National Response Center	1-800-424-8802	NRC	1-301-816-5100
National Guard CST	1-800-343-6701	DHS	1-202-727-6161
FBI (ATF bomb)	1-888-283-2662	FEMA	1-202-586-8100
DOE (RAP Coordinator)	1-505-845-4667	DOE OEM	1-202-586-8100

5. Occupancy time outside the hot zone but within the warm zone is unrestricted for essential personnel for the duration of the initial response (days to weeks). Establish Incident Command upwind of ground zero at the closest point outside the affected zone. Have alternative positions ready in case of change in wind direction.
6. Evacuate all people from the affected area (> 2 mrem/hr) and exclude non-essential personnel thereafter. Expect self-evacuation for large populations of uninjured persons and provide them with safe designated routes out of the affected area (work with building managers to establish subterranean routes). Try to establish quick dose-rate screening, or radiological monitors, to determine those relatively few needing decontamination, but do not attempt mass decon of large populations. Instead, advise removal of external clothing,

bag if possible, avoid eating, drinking or touching facial region, go directly home, shower with warm water and soap, and do not use hair conditioner, hair color, or other fixative hygiene products.

Local decisions may warrant establishing large fire hose wash down curtains along decon corridors for rapid decon of evacuees and equipment, however, in large urban settings this will not be feasible.

7. Do not decontaminate vehicles or structures during the initial response phase. Do not try to contain contaminated water, but allow, or even encourage, it to enter the municipal stormwater drainage system. Alert City Manager or wastewater treatment facility manager for possible diversion strategies.
8. For those heavily contaminated persons, e.g., where there is obvious surface radioactive material or where they are heavily injured from the blast, establish decon areas and decon corridors connecting the hot zone to the boundary of the warm zone or affected area. Provide those with heavy external contamination of the upper body with follow-up exams to determine possible contaminant inhalation or ingestion. Countermeasures, e.g., Prussian Blue, should be evaluated promptly.
9. Separate persons needing immediate medical attention and remove outer garments, survey for surface contamination, decon if necessary and possible, wrap in clean blankets in decon zone and evacuate. Inform the receiving medical facility that the person has little or no surface contamination or they may deny admittance.
10. Commence mapping the affected area to obtain a rough dose profile of the area, marking hot and cold spots to assist in avoiding large doses during operations, and to assess the magnitude of the situation.
11. Essential personnel within the affected area should record cumulative dose, if possible, and not exceed about 5 rem (50 mSv) total unless protection of critical infrastructure is deemed imperative and no alternative exists.

Do not exceed about 10 rem (100 mSv) except to save lives and protect critical infrastructure. Note: no health effects ever observed for doses less than 10 rem.

Do not exceed about 25 rem (250 mSv) unless the responder decides voluntarily, and with full knowledge of the risks, to save large numbers of lives and protect critical infrastructure that may harm large populations if not secured.

Do not exceed about 50 rem (500 mSv).
12. Sheltering in place is only advisable if the population is aware of the radiological nature ahead of the plume, unlikely in most cases.

Evacuate buildings along determined safe routes away from the hot zone.

Do not shut down building ventilation systems. Modern ventilation systems will filter most radioactive particulates and shut down may cause chimney effects.



Figure 10.1: Collage of Activities During a Dirty Bomb Training Course at CEMRC