Emergency Response to a "Dirty Bomb" Incident

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"The parking lot was a mass of fire and flame from burning gasoline and oil and auto parts. A powerful gust of wind cleared the smoke briefly, just enough that he could see that there had been a stadium here…" [1]

This scene from Tom Clancy's "The Sum of All Fears" has become the latest threat to the American public and the latest concern of emergency responders. So how do we safely and effectively respond to such an event? Mike Callan put it into perspective during his closing keynote at the 19th International Hazardous Materials Response Teams Conference when he stressed that from a *hazmat perspective*, a terrorist incident is *still* a *hazmat incident*. And such an approach can help to minimize the fear associated with a terrorist event. So let's look at a "dirty bomb" incident from a *hazmat perspective*…

PREPAREDNESS: BEFORE THE INCIDENT…

Hazard Assessment starts with identification of possible targets within your response area. But most important is tactical planning for such targets. While pre-planning is common practice in the fire service, it is still under-utilized in the hazmat arena. Tactical planning requires more than a laptop and a CAMEO program. Effective tactical planning should consist of a coordinated effort between emergency services providers and the personnel of the potential target. Issues to consider:

1. *Secondary Hazards:* Pre-existing hazards that may intensify the incident, panic, lack of egress, lack of integrity of structures.

2. *Scene Control:* Resources to protect and limit bystander and public access, preparedness of law enforcement, communications resources and limitations.

3. *Evacuation Issues:* Limitations of routes of evacuation, mass transportation resources, evacuation versus "shelter-in-place".

4. *Mass Decon:* Available equipment and resources within the area of the target, WATER, WATER, WATER!

5. *Care of the Injured and Displaced:* The "walking wounded", non-ambulatory victims, preparedness of EMS and hospitals, shelter resources and safe food and water supplies.

6. *Mitigation Resources:* If you *need* it and you *don't have* it, where can you *get* it?

7. *Technical resources:* Who are the *experts* and how do you reach them?

Training is probably the single most important element that can make the difference between life and death, loss and preservation, "incident" and "tragedy". Training objectives to consider:

1. Individual Responder and Personnel Preparedness: COMPETENCE!

COMPETENCE! COMPETENCE!

2. Public Preparedness: Information and education programs, media resources.

3. Target-Specific, Hands-on Experience: PRACTICE! PRACTICE! PRACTICE!

Additional Issues of consideration should include obtaining resources in advance. This can be an effective tool to alleviate some of the burden and stress during the event. Consider the following resources:

1. Do you have the right "tools" in your "tool box" to handle the incident? Are your personnel competent at using those tools?

2. Availability and contact information for private contractors, Red Cross, Salvation Army.

3. Financial Considerations: Acquiring pledges of involvement and contributions from local businesses, disaster relief.

4. Political Considerations: Communication with and support from local and state politicians.

RESPONSE PROCEDURES FOR A "DIRTY BOMB" INCIDENT

1. Self Preservation: Monitoring, observation and assessment of *all* possible hazards should begin as you *approach* the scene. Meters should already be in operation monitoring O2 levels, flammable atmospheres, toxic gasses and radioactivity *before* you reach the scene.

"Odor, dead animals or fish, fire, a visible cloud, a pursing hiss, and irritation to the skin or eyes can signal the presence of a hazardous material. An important consideration in dealing with chemicals is the fact that some can impair an individual's sense of smell, others have no smell at all, and some by the time you smell them some harm has occurred." [2]

The condition of victims is an indication of mechanism and severity: ambulatory or non-ambulatory, trauma or no apparent trauma, burns, seizure activity, the presence of oral or respiratory secretions or respiratory distress, level of consciousness or loss of consciousness, deceased victims. Unexploded munitions and secondary devices may be present in any form from a simple backpack to a box truck. Radiation *cannot* be detected by human senses.

2. Evaluation of the Hazard: What are the meters telling you about the atmosphere? What is the condition of victims telling you about the atmosphere? Other important evaluations include the use of pH strips, colorimetric tubes and WMD Direct-Read instruments.

When selecting radiation meters, there are three important considerations. The first consideration is the ability to monitor for alpha, beta and gamma radiation. Selection of

radiation detection equipment should be based on the ability to adequately detect all three types of radiation. Neutron radiation should also come into consideration. Although neutron emitters are not as common as other radioactive isotopes, they do exist. At this time neutron detectors are expensive compared to other radiation meters. However, if neutron emitters are utilized by industry in your response area, a meter should be considered, or at minimum, a resource identified for the provision of a neutron detector in an emergency.

Second, it is important to understand the great variation of energy levels associated with the radiation emitted from radioactive isotopes. For example, beta radiation energy levels of Strontium 90 vary from 546 kilo electron volts to 2.3 mega electron volts. One detector is able to detect Strontium 90 with only 38% efficiency while another detector is not able to detect it at all. It's interesting to note that even the 2000 Emergency Response Guidebook addresses this issue as stated in Guide 163.

"Some radioactive materials cannot be detected by commonly available instruments." [3]

It is important to be familiar with the energy level limitations of your radiation meters.

Third, the intensity of radiation exposure can very from microrems to hundreds or thousands of rems. Most detectors are limited in their range of accurate detection. And while radiation levels in microrems are more of an industrial hygiene issue than an emergency response issue, the emergency responder could be confronted with atmospheres varying from millirems to hundreds of rems. For that reason, it is important to have detection that can sense the different levels of radiation exposure. No **single** radiation detector can do it **all**! There should be, at minimum, at least two different types of radiation detectors in your tool box. And in a response situation it is important to keep in mind that the readings on the radiation monitors are an indication of the *minimum* level of radiation that is present in the atmosphere. It is very possible that there is additional radioactivity which the meters are not able to detect.

3. Selection of PPE:

"The human body can be harmed via four avenues: inhalation, ingestion, injection and absorption" [4]

PPE selection should be based on *all* of the hazardous properties present at the incident. Currently, there is a great assortment of PPE to protect responders from oxygen deficient atmospheres, toxic gasses, skin-by-contact and skin-by-absorption products. However, current PPE offers little protection from flammable or radioactive environments. Standard turnout gear still remains the best protection in a flammable environment. And while a responder can be shielded from alpha radiation with the use of any type of chemical protective clothing or standard turnout gear and beta shielding can be as simple as using metal foil or ¼" thick plastic, (depending on the energy level of the beta radiation.), to date there is no PPE that will offer protection from gamma radiation. Another consideration is that PPE provides no protection from weaponized projectiles. In the case of flammables, high-energy beta and gamma radiation or secondary devices, if the situation cannot be corrected by safe, immediate intervention, than the only adequate protection is distance

and shielding. With respect to PPE in any response, respiratory protection should be utilized until the atmosphere is determined to be safe based on meter readings and sound science.

4. Rescue: Perhaps some of the most difficult decisions made during a WMD event will be those made with regard to rescue. The survival of viable victims as well as responders may depend on the ability to recognize victims who are mortally wounded or exposed to lethal levels of chemicals or radiation. In the case of a radioactive atmosphere, it is possible that levels may be too high for rescuers to make entry. However, the latest information with regard to "dirty bombs" provided by government officials indicates that radiation levels are not anticipated to be of such a high level. Blood cell changes have been observed with radiation exposures as low as 25 rems. The EPA recommends that procedures performed by responders in an emergency situation which result in levels of exposure above 25 rems be done only on a voluntary basis. Also, such responders must be educated on the risks associated with exposures above 25 rems prior performing such a task. Death can occur at as low as 450 rems, (LD 50/30).

5. Establishment of Zones: Establishment of isolation zones should based on two important pieces of information; the hazards present and the results of air monitoring. In any response situation it is expected that initial isolation zones will have the greatest diameter and that the initial zones can be decreased as the event evolves based on the use of technology (monitoring) and sound science.

Three *initial* zones worth mentioning are addressed in the 2000 Emergency Response Guidebook; 1000 feet for radioactive materials (Guide 163), up to 1.0 mile for bombs or explosive materials (Guide 112), and over 7.0 miles for **weaponized** Sarin or **weaponized** GB (the "green" pages).

So unless you have the resources and personnel to work a 14-mile-diameter "hot zone", you can appreciate the importance of monitoring and sound science! A consideration with a radioactive dirty bomb is the debris fallout area and radioactivity associated with that debris. Take for example the images of the debris cloud over lower Manhattan following the collapse of the World Trade Towers and think about how long that cloud lingered. Now imagine such a debris cloud as the result of a nuclear detonation and you can begin to appreciate the number of exposed victims and the type of area responders would encounter. Another consideration with nuclear dirty bombs is whether it is safer to evacuate or shelter in place. You can use the following link to order from the EPA the "Manual of Protective Action Guides and Protective Actions for Nuclear Incidents" which provides information on sheltering and evacuation.

Manual of Protective Action Guides and Protective Actions for Nuclear Incidents

6. Decon ..."One of the best ways to decontaminate is to **avoid** being contaminated in the first place." [5]

Responder decontamination *can* successfully be accomplished in less than 19 steps! The four stages of decontamination developed by Frank Docimo are an effective and practical approach.

Stage one: self decon.

Stage two: outer wash and rinse.

Stage three: a second outer wash followed by removal of PPE.

Stage four: full body shower and a change of clothes.

Monitoring should be done following the second outer wash, prior to the removal of the PPE to ensure decontamination. If meter readings are not within acceptable limits, the procedure should be repeated until levels are within acceptable limits. If this objective cannot be obtained, care should be taken not to further contaminate responders when removing the contaminated PPE. Monitoring should also be done after stage four to assure effective decontamination and showers repeated as necessary until readings are within acceptable limits.

The four-stage approach with some modification can also be adapted to the decontamination of ambulatory victims.

Stage One: Monitor the victim for contamination and proceed to stage two if contamination is present.

Stage Two: Remove as much outer clothing as possible without compromising the modesty of the victim. (Either set up the decon area to maintain modesty or allow the victim to wear under garments.)

Stage Three: Shower victim, monitor and repeat until meter readings are within acceptable limits.

Stage Four: Provide a change of clean clothing and triage the victim for medical treatment or release.

Additional considerations: It is important to record victim information (contact information) and contamination levels. This may not seem practical but it can be as simple as writing the patient's pre and post contamination levels on the back of his/her hand with a "Sharpie" marker, controlling victim egress from the decon area ("cattle chutes") and having volunteers in a separate area record victim information.

Note:

Looking back on the role of the hazmat responder on September 10th of 2001, it now seems all so simple then when compared to the events that have taken place since September 11th. We have, as emergency responders, been drafted to the front lines of the "new war". And we have lost some of the most experienced and talented people in this field. But the rest of us continue on because it's what the others would have wanted us to do. We have had to learn "everything we didn't want to know about anthrax, and were afraid to ask". But we did learn and we did respond. I remember thinking when I took my first hazmat tech class that the first time our team was called to a bio-terrorism incident would be the day I quit. But anthrax has come and gone and I'm still with the team. From a ***hazmat*** *perspective, a*

*terrorist incident is **still** a hazmat incident. And if we confront our latest challenge, the "dirty bomb" incident, from a hazmat perspective, we will again "rise to the challenge"!* ***Cheryl E. Weaver***

Additional Recommended Articles at Docimo.com

"Ask These Three Questions in a Hazardous Material Incident"

"Air Monitoring Rational for WMD"

"Decon…Cleanliness Is Close To Godliness" Frank Docimo

Footnotes

[1] "The Sum of All Fears" Tom Clancy © The Berkley Publishing Group, 1992

[2] "Ask These Three Questions in a Hazardous Material Incident" Frank D. Docimo

[3] "Monitoring the Environment to Ensure Responder Safety" Frank D. Docimo © Docimo and Associates, 1993

[4] 2000 Emergency Response Guidebook

[5] "Decon…Cleanliness Is Close To Godliness" Frank D. Docimo

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