Chapter 2
Response Tactics for the First 100 Minutes After the Outdoor Detonation of an Explosive Radiological Dispersal Device

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Abstract The Department of Homeland Security Science and Technology Directorate sponsored a project to operationalize the science-based guidance for dealing with the consequences of a radiological dispersal device, as published in the scientific literature and adopted by the National Council on Radiation Protection and Measurements. The project will morph this scientific guidance into actionable tools for the first-responder agencies that are designed to assist them in developing a simple, concise, and practical radiological- response plan. This effort also will involve a partnership with four cities to pilot and improve these preparedness materials. The principal goal of this project is to leverage scientific guidance to increase the capability of local agencies to respond to a complex radiological event, and assure an effective, coordinated response in the first 100 minutes after the incident.

2.1 Introduction

A summary has been published of the scientific findings at Sandia National Laboratories derived from over 25 years of experiments on the aerosolization of radioactive materials [1]. Based on these data, guidance intended for first responders, planners, and senior decision-makers was developed to promote effective, science-based, response plans [2, 3]. Subsequently, the original guidance was updated. It now reflects new findings from additional experiments with fewer

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uncertainties on the potential ballistic fate of the radioactive material, so offering new advice on the tactics of the response [4].

2.2 RDD Planning Guidance Development and Piloting

Recently, the Department of Homeland Security Science and Technology Directorate initiated a project to promote the use of this scientific information to guide the planning efforts of the local radiological dispersal device (RDD) response teams. Hence, this effort will develop simple, concise, and practical tactics and tools to support their planning processes and improve their capability to initiate an effective response in the first 100 minutes of a radiological crisis. The goal of this project is to develop actionable guidance and planning tools for first responders to pilot the materials in four cities. The feedback and lessons learned will be incorporated into the final deliverables.

The first 100 minutes is a critical time in an RDD response because the local response agencies will be challenged to make critical decisions under highly stressful, chaotic conditions. If these choices and tactics are not optimal in resolving the crisis in the first 100 minutes, it is likely the emergency phase of the response will persist for a much longer, meaning that local officials may lose control of the situation and jeopardize their credibility with the public. This unacceptable outcome can be avoided. With proper tactical planning based on scientific guidance, a prompt, effective response can be mounted in the first 100 minutes, so that the responders effectively carry out the correct actions to save lives and protect the responders and the general public, and stabilize the aftermath of the incident. The goal of the project is to increase the capability of local responders to successfully manage the complexities posed by the consequences of an RDD.

2.3 Tactics for the First 100 Minutes

There is extensive expertise and hardware within the responder community to deal with an uncontrolled release of hazardous material. HAZMAT teams already are equipped and trained to work in an all-hazards environment, including one with ionizing radiation. Thus, the aftermath of an RDD generally can be viewed as similar to an improvised explosive device, coupled with large spill of radioactive material, giving rise to some unique complications that planning and preparedness can mitigate. Similar to the recent emergence of the hazard from the Ebola disease, the HAZMAT team has the skills and resources needed, but some additional planning at the tactical level is required to prepare for the response to specific conditions and challenges. Hence, the response agencies need only to adapt and coordinate their existing capabilities, tactics, and resources to deal with the complexities posed by the consequences of the explosion of an RDD.

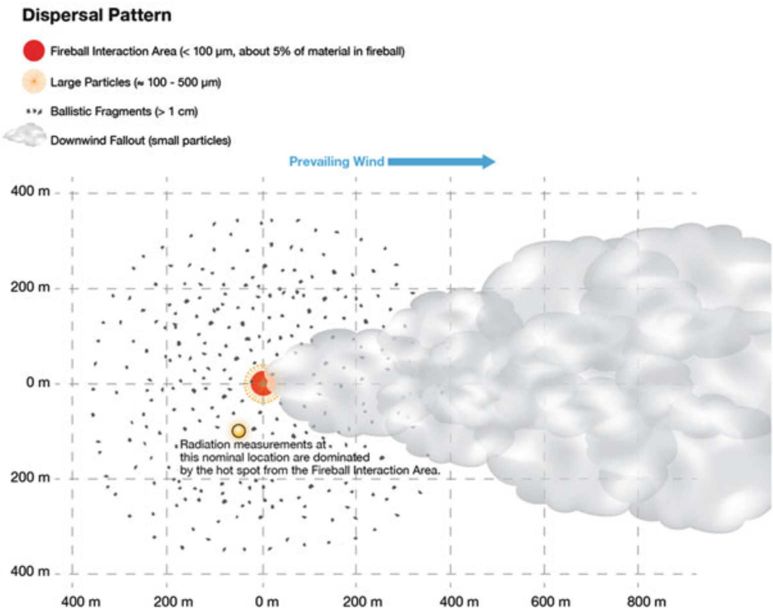

Fig. 2.1 Notional representation of dispersal possibilities. One or more of these fates are possible depending on the form of the radioactive material and the design of the device. Note: These patterns are representative only of the behavior of the radioactive material in the device. Chunks of non-radioactive debris could fall beyond the indicated range for ballistic fragments [4] (The figure was reprinted with permission from the Health Physics Journal and the Health Physics Society)

Because a terrorist incident is expected to occur without warning, early protective actions and decisions must be made in advance so that the preplanned actions become instinctive ones. In principle, this is because the design of the device, and the amount of radioactive material it disperses will be unknown at time of detonation. Thus, it will not be readily apparent whether the contamination is highly localized at the point of detonation, widespread from a plume of aerosol that can deposit contamination over a long distance downwind, or something in-between. Figure 2.1 illustrates the range of possibilities for the fate of the radioactive material.

In planning for the first 100 minutes of an RDD response, first responders need not reinvent their procedures for incident command, medical triage, or emergency messaging, but rather coordinate their actions with other response agencies and incorporate RDD-specific tactics into their concept of operations:

Tactic-1

Initially, the local responders will know only that an explosion has occurred with an associated radiological signature, possibly from one field measurement near the point of detonation. They will not know any of its characteristics, such as those illustrated in Fig. 2.1. Lacking more information, sheltering is recommended to protect

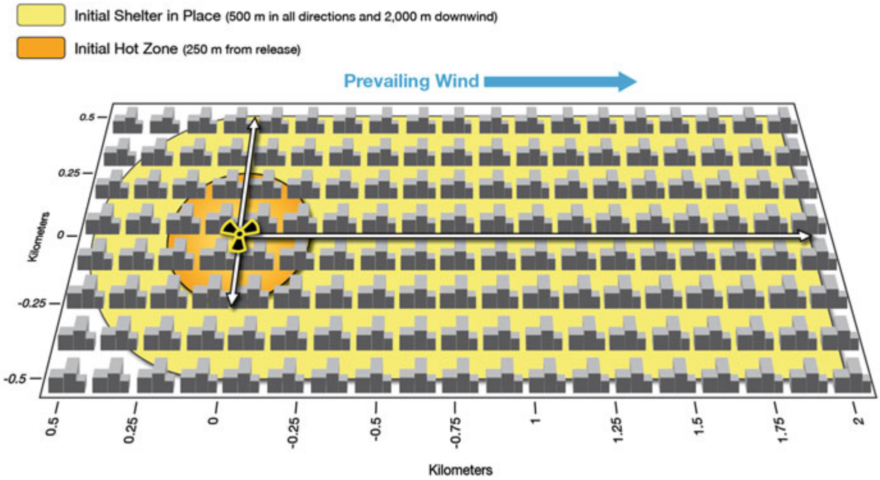

Fig. 2.2 Recommended boundaries for initial Shelter-in-Place and Hot Zones [4] (The figure was reprinted with permission from the Health Physics Journal and the Health Physics Society)

the public until the actual contamination "footprint" is measured and mapped. In this initial period, two tactical default hazard-boundaries are recommended:

1. Define the initial Hot Zone as a 250 m radius around the point of detonation. Do not decide anything based on the perceived direction of the wind, especially in an urban setting where the wind field can be very complex [2, 4]. Later, after collecting field measurements, redefine the Hot Zone based on actual contamination levels and the recommendation of the National Council on Radiation Protection and Measurements of 0.1 mGy h^{-1} [3].
2. Define the boundary to the Shelter-in-Place Zone as 500 m around the point of detonation, and 2,000 m in the direction of the prevailing wind.

Figure 2.2 depicts these recommendations.

Tactic-2

As soon as possible, record the radiation readings near the point of detonation to identify whether or not there is an obvious coherent hotspot. Observe and record the extent to which broken windows are apparent, and the approximate diameter of the crater. A coherent hotspot is an indicator of a large aerosol fraction, and range of broken windows and crater size indicates the amount of explosive (large or small).

Tactic-3

At approximately 1 km, transect (cut across) the Shelter-in-Place Zone and record radiation measurements along this path. The results will indicate whether or not there is contamination over a long distance, and where to conduct the next survey. If null results were obtained, move the next transect closer to the point of detonation, and visa versa if contamination is present.

Tactic-4

Based on the existing inventory of radiation detectors within the city's responder community, and a predetermined plan, rapidly collect and map measurements at long distances (2–10 km) and at 360° around the place of detonation.

Assessment

Consolidate the radiological data from Tactics 2, 3, and 4 on to a map to visualize the information and identify the largely uncontaminated areas surrounding the affected area. Share this information with the public to calm the many concerned citizens, and then identify where others should remain sheltered until directed to evacuate along uncontaminated routes.

2.4 Conclusions

The tactics described above serve as the starting point for a more fully developed tactical RDD response guidance and preparedness materials. The good news is that we know enough from research about RDD detonations to assist first responders in correctly scripting their decision points, and response tactics in the first 100 minutes, allowing cities to prepare through written response plans and exercises. Through the development and piloting of RDD preparedness materials over the next 2 years, expectedly cities will tailor the concepts outlined here, improve them, and possibly develop other new and pragmatic tactics to promote success in the first 100 minutes of an RDD response.

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