Chapter VIII
Countering Chemical Terrorism:
A Digitized Fire Chief Supporting System for Rapid Onsite Responding to HazMat Emergencies

INTRODUCTION

An industrialized society makes widespread use of toxic chemicals, transported daily in large amounts on the roads or by rail. Approximately 800,000 shipments of hazardous substances, including chemical and petroleum products, travel daily throughout the United States by ground, rail, air, water, and pipeline (DOT, 1998). Although nearly all of these materials safely reach their destinations, many are explosive, flammable, toxic, and corrosive and can be extremely dangerous if released improperly. These materials frequently are transported over, through, and under areas that are densely populated or populated by schools, hospitals, or nursing homes, where the consequences of an acute release could result in environmental damage, severe injury, or death (DOT, 1999; AAR, 2004).

According to the U.S. Hazardous Substances Emergency Events Surveillance (HSEES) system, 643 incidents involving chemicals in the highest-ranked group—designated as those that are easy to obtain, travel far by air if released, are highly toxic, and could be used as weapons—occurred in 15 U.S. states between October 2006 and February 2007. These 643 chemical incidents affected 225 victims (who could be associated with more than one chemical) and resulted in 1,200 persons being evacuated. Table 8.1 displays the disposition of most affected people.

For an industrial chemical incident, the type of chemical agent involved (if released) is normally known during the occurrence. On the basis of the agent's characteristics and possible poisonous effects, an event-based, specific response and associated medical rescue procedure can be generated and implemented to handle and control the situation. When an unexpected chemical attack suddenly occurs

Table 8.1. Treatment location

Treated on scene using first aid	*97*
Treated at hospital (not admitted)	*59*
Treated at hospital (admitted)	*12*
Observation at hospital with no treatment	*3*
Seen by private physician within 24 hours	*7*
Injury reported by officials	*2*

Note that half the victims were treated at the incident sites, suggesting that onsite pre-hospital rescue is crucial to responses to such emergency situations.

however, because responders do not know the type of agent used in advance, the onsite response plan may be general, regardless of the type of incident. For example, a common response involves rushing assistance to the nearest patient/affected people in need. Although this response may be appropriate in the controlled environment of a disaster, it is of little use in the unclear situation that results from the release of a toxic chemical, because responders may become victims themselves, which would increase the burden on rescue efforts.

Air provides not only the basic elements needed for human survival but also a medium through which toxic materials can be propagated and transmitted. Because air is everywhere, unobservable and uncatchable, people exposed may not sense any difference if a salient, colorless, and tasteless toxic chemical floats in the air. Once they reach this recognition, they likely already have been poisoned. In addition, some toxic chemicals, such as cyanide or hydrogen cyanide gas, act very quickly and can knock down people within several seconds at high concentrations. Therefore, if first responders can quickly identify or recognize the agent involved, an agent-specific response procedure would be more effective than a general response plan. According to a report by Trust for America's Health (TFAH, 2007), most routine response forces, including firefighters, police, and EMS, lack sufficient capabilities to identify or recognize chemical terrorism.

In this chapter, we explore an idea of using direct field observations from the incident scene as a means to identify a potentially dangerous chemical substance. As we show in Figure 6-1, different toxic chemical substances have their own unique physical properties and can cause different health impacts, though some initial symptoms and signs appear similar. For example, if a person is exposed through eye contact, he or she will suffer eye irritation, regardless of the type of agent. However, symptom observation data, together with a chemical substance's unique physical characteristics, may indicate whether the symptoms are by a specific agent with particular likelihood.

To implement this idea, we propose a computer-supported chemical discovery system, similar to a potable digitized fire chief. In an event of a chemical, radiological, or nuclear (CRN) incident, firefighters appear on the front line, so the proposed system focuses on helping onsite fire chiefs use their direct scene observations to identify the agent and generate a quick, incident-specific response operation. Without detailed laboratory and animal testing, response commanders lack the basic information needed to make correct judgments and wise decisions. Yet most laboratory testing requires special equipment and a recent sample (i.e., taken within two hours of the exposure). Few fire departments or doctors' offices have such special equipment, and a covert release prevents the collection of samples quickly enough. Moreover, many chemical agents do not generate biological markers in the human

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