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TECHNICAL  
REPORT

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# Public Health Preparedness and Response to Chemical and Radiological Incidents

Functions, Practices, and  
Areas for Future Work

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Prepared for the Department of Health and Human Services

This work was prepared for the U.S. Department of Health and Human Services Office of the Assistant Secretary for Preparedness and Response. The research was conducted in RAND Health, a division of the RAND Corporation.

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## **PREFACE**

Public health emergencies may arise directly or indirectly from a wide variety of events, including emerging diseases, natural disasters, industrial accidents, and terrorist attacks. One area that has not been examined in much detail is public health emergency preparedness for incidents involving the release of chemical or radiological agents. As part of RAND's continuing research into public health emergency preparedness, this report characterizes the public health service's role in preparing for and responding to such incidents, describes practices in use by local public health departments, and identifies functional areas of public health emergency preparedness and response for chemical and radiological incidents that may warrant further practice development.

The research described in this report was prepared for the U.S. Department of Health and Human Services Office of the Assistant Secretary for Preparedness and Response and conducted within the RAND Health Center for Public Health Preparedness. In response to a realization both within the United States and abroad that public health is inextricably intertwined with security, RAND Health has woven together a unique group of researchers with the multidisciplinary skill sets to address these emerging challenges. A profile of the center, abstracts of its publications, and ordering information can be found at <http://www.rand.org/health/centers/preparedness/>. RAND Health is a division of the RAND Corporation. More information about RAND is available at our Web site at <http://www.rand.org>.



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## SUMMARY

Concerted efforts to improve public health emergency preparedness in recent years have led to increased capabilities, especially for responses to such biologically based threats as pandemic influenza and biological terrorism. Public health emergencies can arise from a wide variety of incidents and circumstances, however, and it is important for the public health system to be prepared for all types of emergencies that have public health impacts, including natural disasters, industrial accidents, and terrorist attacks. One area of public health emergency preparedness that has not been examined in depth is preparedness for incidents involving the release of chemical or radiological substances. Past experience—with chemical and nuclear plant accidents, train collisions, product tampering, and chemical terrorism—shows that such incidents can have serious public health consequences. This report focuses on the roles of the public health service in emergency preparedness for and response to chemical and radiological incidents. The objective is to characterize public health functions in chemical and radiological incidents, examine current state and local public health department practices in the context of these functions, and identify areas where further practice development may be warranted.

We developed a functional framework for public health roles in chemical and radiological incidents by aligning public health’s capabilities and roles with emergency preparedness and response activities that would be required in a chemical or radiological incident. By identifying areas where public health roles overlap with activities in chemical and radiological incident preparedness and response, we crafted a framework that characterizes the public health functions in chemical and radiological incidents. The chemical and radiological functions in our framework (Table S.1) are presented in the context of the three “core” and ten “essential” public health functions as defined by the Institute of Medicine (1988) and CDC (2008b). This association helps illustrate how public health activities for something as specific as a chemical or radiological incident fit within the larger public health mission.

This functional framework is intended to encompass chemical or radiological release incidents that are overt or covert, where the hazard is initially well understood or poorly characterized, and where the release is accidental (e.g., a transportation accident) or deliberate (e.g., a terrorist attack). The framework emphasizes functions that provide a service to the public over internal capability-building activities, with the exception of conducting training and exercises (which are highly specialized for chemical and radiological incidents). We did not limit the framework to functions where public health would necessarily be in the lead but included those where public health would have an important role.

**Table S.1  
Functional Framework for Public Health Preparedness and Response to Chemical and Radiological Incidents**

<b>Core Function</b>	<b>Essential Function</b>	<b>Chemical or Radiological Incident Function</b>
Assessment	Monitor health status	
	Diagnose and investigate	Monitor indicators of a release Identify agent and characterize footprint Assess victim decontamination and medical needs Conduct initial epidemiological investigation
Assurance	Enforce safety and health laws	
	Link to/provide health care	Provide public information Provide emergency medical supplies Establish victim registry and monitor long-term health Activate laboratory emergency operation protocols Monitor emergency responder working conditions and health Monitor health conditions at shelters and mass care centers Ensure safety of food supply Manage contaminated fatalities Oversee environmental decontamination and reentry
	Assure competent workforce	Conduct training and exercises
	Evaluate health services	
Policy development	Inform, educate, empower	Provide pre-event public education
	Mobilize community partnerships	Coordinate with response partners
	Develop policies	
All	Research	

Using the functional framework as a template, we next conducted a search for practices currently being used by local and state public health departments to prepare for and respond to chemical and radiological incidents. The search included a systematic review of best practices clearinghouses, government reports and guidance documents, and peer-reviewed literature. We also reviewed several state and local health public safety department websites. Finally, we conducted structured interviews with representatives of targeted public health departments and agencies involved in preparing for and responding to chemical and radiological incidents.

Our search identified a variety of practices for public health preparedness and response for chemical and radiological incidents. Few practices were documented in any of the literature we searched; we identified nearly all practices through departmental interviews. We contacted only a small fraction of the nation's public health departments, so the practices we identified represent only a sample of what is currently being done today. However, because we targeted our search to departments near nuclear power plants or chemical weapon storage and destruction facilities, large and well-funded departments, and departments recommended to us by the National Association of County and City Health Officials and others as potentially having interesting practices, we presume that our identified practices represent a sample of the most effective and innovative practices. The lack of documented chemical and radiological incident practices contrasts markedly with the large number of practices addressing pandemic influenza, bioterrorism, and all-hazards preparedness and reflects the greater public health emergency preparedness attention and funding in the latter areas.

Nonetheless, our functional framework indicates that specialized practices are warranted for some critical and specific public health functions in chemical and radiological incidents. Thus, continued development, testing, documentation, and dissemination of chemical and radiological incident practices are important activities for public health departments. We examined the identified practices in the context of the functional framework to identify areas where further practice development may be needed. We used three criteria to target areas that public health can focus on in terms of practice development for chemical and radiological preparedness. The most important functions are those for which

- chemical and radiological incidents require specialized practices
- public health is the lead service
- few practices were identified or practices only partially cover the scope of the function.

There are uncertainties related to each of these criteria, so they cannot be applied with unambiguous precision. Bearing in mind these uncertainties, when we apply the criteria, we found that four functions satisfy conditions for warranting priority for practice development:

- Conduct initial epidemiological investigation.
- Provide public information.
- Establish a victim registry and monitor long-term health.
- Monitor health conditions at shelters and mass care centers.

Based on our analysis, these are functional areas that (a) are essential for chemical or radiological incidents; (b) would likely be led by public health departments, so the public health service must take charge of developing plans, policies, and practices; and (c) do not appear to be adequately supported by current practices. Improving the nation's emergency preparedness and response for chemical or radiological incidents therefore depends on public health agencies investing in efforts to increase their capabilities in these functions.

An initial epidemiological investigation may be needed in cases where a chemical or radiological release is not immediately apparent. There has been some research into obstacles and strategies for applying conventional epidemiological principles to chemical or radiological exposure situations. Well-defined case definitions exist for a wide range of chemical agents. There is now a need to integrate the existing research and case definitions into guidance and tools to enable health departments to conduct epidemiological investigations into unexplained chemical or radiological illnesses.

While the fundamentals of crisis and emergency risk communication are well-known and widely adopted, application to chemical and radiological incidents will require special considerations and approaches. In particular, there is a need for guidance to public health departments and other agencies charged with public communication that describes protective action recommendations and how to convey them. Guidance could address how the recommendations will be developed, including who will have responsibility for providing the technical expertise and what information they will use. It would also be beneficial to understand the details of what the recommended actions would entail and anticipate problems associated with implementing them.

Victim registration and long-term health monitoring may be important in chemical or radiological incidents because exposure to contaminants from such incidents can cause extended illnesses or latent adverse health effects. While existing guidance stresses the importance of creating victim registries, it provides little information about how to go about doing so and does not address long-term health monitoring or how such monitoring data could be used. There is therefore a need for guidance to health departments about establishing a registry and designing a program for long-term health monitoring. Such guidance could draw upon experience from state cancer registries and existing monitoring efforts, such as the World Trade Center Medical Monitoring and Treatment Program and the multinational registry established for the victims of the Chernobyl nuclear reactor accident.

Monitoring health conditions at shelters and mass care centers is important for the control of infectious diseases and for managing the preexisting medical conditions of shelter inhabitants. An additional concern in a chemical or radiological incident is the possibility that shelters and other facilities could become contaminated from the arrival of contaminated people. Research is

needed about the avenues for contamination, the risks to shelter inhabitants and staff, and approaches for mitigating these risks. This research would then need to be translated into guidance that could be made available to health departments, which could ultimately use this guidance to inform shelter planning.



## **ACKNOWLEDGMENTS**

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## ABBREVIATIONS

ASTHO	Association of State and Territorial Health Officials
CDC	Centers for Disease Control and Prevention
DHHS	U.S. Department of Health and Human Services
DHS	U.S. Department of Homeland Security
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
FEMA	Federal Emergency Management Agency
HHS	U.S. Department of Health and Human Services
Hazmat	Hazardous materials
IAEA	International Atomic Energy Agency
ICRP	International Commission on Radiation Protection
NACCHO	National Association of County and City Health Officials
NCRP	National Council on Radiation Protection and Measurements
NRC	Nuclear Regulatory Commission
OSHA	U.S. Occupational Safety and Health Administration
RDD	radiological dispersal device
SARS	severe acute respiratory syndrome
SBCCOM	U.S. Army Soldier and Biological Chemical Command
SNS	Strategic National Stockpile



## 1. INTRODUCTION

### BACKGROUND

Concerted efforts in recent years to improve public health emergency preparedness in the United States have led to increased capabilities in a number of critical public health emergency functions, such as disease monitoring and surveillance, epidemiology, laboratory infrastructure, countermeasures distribution and dispensing, medical surge, and training, exercising, and workforce development (HHS, 2007; CDC, 2008a, 2009; Trust For America's Health, 2008). These efforts have focused primarily on biological agents, which is consistent with public health's traditional primary responsibility for infectious disease control. Such a focus is clearly justified by the demand for public health capability and leadership presented by the 2001 anthrax attacks, the 2003 SARS outbreak, the 2009 H1N1 flu outbreak, and threats posed by pandemic influenza.

However, it is important for the public health system to be prepared for all types of emergencies that have public health impacts, including natural disasters, industrial accidents, and terrorist attacks. One area of public health emergency preparedness that has not been examined in depth is preparedness for incidents involving the release of chemical or radiological substances. The public health consequences of such incidents are well documented. Data from the Hazardous Substances Emergency Events Surveillance system show 39,766 hazardous substance releases in 15 states from 1996 to 2001, of which 8 percent resulted in deaths or injuries (Kaye et al., 2005). Worldwide, the World Health Organization identified 35 chemical incidents from 26 countries over a period of 17 months that met criteria for public health emergencies of international concern (Olowokure et al., 2005). High-profile incidents in the past include the 1984 release of methyl isocyanate from a pesticide plant in Bhopal, India, the spread of radiation from the 1986 Chernobyl nuclear reactor accident, the 1995 terrorist attack on the Tokyo subway using chemical weapons, the 2005 freight train collision in South Carolina that resulted in the release of a deadly chlorine cloud, and product contamination cases such as the 2008 milk scandal in China. In these and in many other incidents, public health agencies have played important and wide-ranging roles: public communication, contamination monitoring, epidemiological investigations, laboratory analysis, and monitoring individual and environmental health in the aftermath of incidents.

The greatest investment in emergency preparedness for chemical and radiological incidents has been for industrial chemical spills and releases of radiation around nuclear reactors. This includes the emergency planning activities mandated by the Emergency Planning and

Community Right-to-Know Act of 1986 (EPA, 2009)<sup>1</sup> and preparedness activities at nuclear reactors and surrounding communities mandated by the Nuclear Regulatory Commission (NRC) and the Federal Emergency Management Agency (FEMA) (NRC and FEMA, 1980). Since the late 1990s, attention has also begun to be paid to what would be needed to respond to chemical and radiological terrorist attacks. For example, the Department of Homeland Security (DHS) national planning scenarios, which are the starting points for national preparedness planning, include an attack using a “dirty bomb” to disperse radiological materials<sup>2</sup> and attacks involving a toxic industrial chemical, nerve agent, and chlorine tank explosion.<sup>3</sup> In addition, DHS’s biannual TOPOFF Full-Scale Exercises have included a dirty bomb attack in 2003, a chemical weapon attack in 2005, and multiple dirty bomb attacks in 2007.<sup>4</sup>

The majority of the emergency preparedness and response planning for chemical and radiological incidents has focused on public safety and emergency management roles. However, public health departments also have important roles in such incidents, and it is important for them to be prepared as well. The public health system at the local, state, and federal levels has become increasingly involved in preparedness efforts for chemical and radiological incidents, but efforts thus far have been conducted independently and without a clear consensus or understanding of the public health service’s role in such incidents. At the federal level, public health agencies have begun to articulate their role in such incidents (e.g., CDC 2005a, b) and to develop planning guidance (CDC, 2001), although this work is in the early stages.<sup>5</sup> Moreover,

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<sup>1</sup> The Emergency Planning and Community Right-to-Know Act (EPCRA) establishes requirements for all levels of government and industry regarding emergency planning and reporting on hazardous and toxic chemicals. The emergency planning section of EPCRA is designed to help communities prepare for and respond to emergencies involving hazardous substances. Every community in the United States must be part of a comprehensive plan. EPCRA stipulates that each state must create a state emergency response commission (SERC), and that the SERC designate multiple local emergency planning districts. A local emergency planning committee (LEPC) is appointed in each district, which must address hazardous facility identification, emergency notification and response procedures, and evacuation plans (EPA, 2009).

<sup>2</sup> Dirty bombs are one method that could be used to disperse radiological materials. However, radiological materials could be dispersed using methods without explosives. The term radiological dispersal device (RDD) captures the broader range of potential dispersal mechanisms.

<sup>3</sup> These scenarios are not publicly available, but details have been provided by Global Security.org on its website: See <http://www.globalsecurity.org/security/ops/ter-scen.htm>.

<sup>4</sup> [http://www.dhs.gov/xprepresp/training/gc\\_1179350946764.shtm](http://www.dhs.gov/xprepresp/training/gc_1179350946764.shtm).

<sup>5</sup> For example, the Assistant Secretary for Preparedness and Response (ASPR) in the Department of Health and Human Services is developing “ASPR Playbooks” to support the Secretary at the strategic level to enhance preparedness and response but has yet to issue

little progress has been made in conveying preparedness plans to the state and local levels and translating those plans into functioning practices that are integrated into public health emergency planning, training, and exercising.

There is little in the peer-reviewed literature concerning public health activities in chemical or radiological incidents. Brennan et al. (1999) outline public health–related functions in dealing with chemical warfare agents, such as demarcation of the contaminated area, agent detection and identification, decontamination, informing and protecting the public, medical treatment and antidotes, and surveillance. Barnett et al. (2006) and Miller et al. (2007) discuss public health roles in radiological incidents—including identifying the type and distribution of contamination, providing protective action recommendations to the public, monitoring contamination of victims, evaluating the health effects of contamination on victims and responders, providing guidance on dealing with radioactive contaminants and decontamination, managing contaminated decedents, assisting with monitoring and managing the “worried well,” communicating information on radiological issues, and long-term monitoring and management of victims’ health.

Other research has examined specific activities related to public health preparedness for chemical and radiological incidents, including training and exercise programs (e.g., FitzGerald et al., 2003; High et al., 2008), injury prevention (Varney et al., 2006), epidemiology (Patel et al., 2006; Schier et al., 2006; Bakhshi, 1997), decontamination (Levitin et al., 2003), pharmaceutical surge (Hsu et al., 2007), delivering samples to laboratories (Pennell et al., 2008), and workforce protection (e.g., Byers and Greaves, 2006; Horton et al., 2003). One problem that has received particular attention in recent years is the concern that the emergency response workforce may not be willing or able to report for work in a chemical or radiological incident. Surveys and focus groups have shown that health workers would be far less likely to report following a chemical or radiological incident compared to natural disasters or other large emergencies. Reasons cited include fear and concern for family, tending to dependent care needs, concern about becoming ill, and personal health problems (Becker and Middleton, 2008; DiMaggio et al., 2005; Qureshi et al., 2005; DeSimone, 2009). In one study, emergency medical technicians who had recently received terrorism response training were twice as willing to report to work for a chemical incident as those who had not (DiMaggio et al., 2005). These findings indicate that, in addition to articulating and planning emergency preparedness and response activities, it is also important to address internal capacity issues such as workforce development.

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playbooks for most types of emergencies, including chemical and radiological incidents (see <http://www.hhs.gov/disasters/discussion/planners/playbook/>).

## **OBJECTIVE AND APPROACH**

This report focuses on public health's roles in emergency preparedness and response for large chemical and radiological incidents and the extent to which those roles have been employed in the form of functioning practices at the local and state level. The objective is to characterize public health functions in chemical and radiological incidents, examine current state and local public health department practices in the context of these functions, and identify areas where further practice development may be warranted. The analysis consisted of three parts:

- Characterize public health's role in preparedness and response to chemical and radiological incidents.
- Identify practices in use at the local and state levels that help health departments fulfill this role.
- Recommend critical function areas where greater practice development is warranted.

We began by identifying the functions the public health service would be responsible for during a chemical or radiological incident and developed a framework of the key public health functions. Failing to find very specific plans or practices to address chemical or radiological incidents in numerous public health documents being used at the local and state level, we decided to leverage the existing experience and current understanding about preparing for chemical and radiological incidents from those in high-risk localities: communities close to industrial chemical plants or military chemical weapon storage and destruction facilities and nuclear reactors, as well as cities at risk for terrorist attacks. We conducted interviews with representatives from local and state public health and public safety departments to identify innovative practices in public health emergency preparedness for chemical and radiological incidents. We then examined the practices in the context of the public health functional framework for chemical and radiological incidents. Based on this comparison, we identify public health functions for which further practice development may be warranted and offer suggestions for how new practices could be developed.

## **2. PUBLIC HEALTH FUNCTIONS IN CHEMICAL AND RADIOLOGICAL INCIDENTS**

The first step in our analysis was to identify the public health service's role in preparing for and responding to chemical and radiological incidents. A review of the academic and governmental literature revealed no clear characterization of this role, so we undertook an effort to develop our own. Our approach in this effort was to integrate materials addressing public health's capabilities and roles with guidance and other materials addressing emergency preparedness and response activities that would be required in a chemical or radiological incident. By identifying areas where public health roles overlap with activities in chemical and radiological incident preparedness and response, we crafted a framework that characterizes the public health functions in chemical and radiological incidents.

In its 1988 study, *The Future of Public Health*, the Institute of Medicine undertook to clarify the mission of governmental public health agencies by defining three core functions: assessment (collection and analysis of health status information), assurance (ensuring that necessary health-related services are provided, either by other entities or by public health departments themselves), and policy development (Institute of Medicine, 1988). These core functions were further developed with the introduction of the "ten essential public health functions" in 1994 (CDC, 2008b). Each of these essential functions fits within one of the three core functions and provides a more detailed breakdown of public health's responsibilities. These core and essential public health functions are listed in Table 2.1.

Using these public health functions as a starting point, we next reviewed a variety of different sources describing emergency plans for responding to chemical and radiological incidents. These sources included, but were not limited to, materials focusing on the role of public health departments. They included planning guidance (e.g., CDC, 2001), training materials (e.g., CDC, 2005a,b), chemical and radiological incident annexes to emergency plans, guidance and standards from national and international radiation safety organizations (e.g., NCRP, 2001; ICRP, 2004; IAEA, 2007), emergency planning guidance for communities around nuclear reactors (e.g., NRC and FEMA, 1980), emergency response guidance (e.g., CDC, undated a; Conference of Radiation Control Program Directors, 2006; IAEA, 2006), after-action reports from exercises (e.g., Spitzer, 2008) and real incidents (e.g., IAEA, 1988), scenarios for terrorist attacks involving chemical and radiological weapons (Global Security.org; DHS, 2008), and academic literature (Brennan et al., 1999; Barnett et al., 2006; Miller et al., 2007). These sources provide an overview of the range of emergency preparedness and response activities that would be undertaken in a chemical or radiological incident.

**Table 2.1**  
**Core and Essential Public Health Functions**

<b>Core Function</b>	<b>Essential Function</b>
Assessment	Monitor health Diagnose and investigate
Assurance	Enforce safety and health laws Link to/provide health care Assure competent workforce Evaluate health services
Policy development	Inform, educate, empower Mobilize community partnerships Develop policies
All	Research

SOURCES: Core functions from Institute of Medicine (1988); essential functions and their relationship to core functions from CDC (2008b).

We then compared the chemical and radiological incident activities to the general public health functions to develop a list of public health functions in chemical and radiological incidents. For example, one critical activity in emergency preparedness and response for chemical and radiological incidents is decontaminating victims. One of the essential public health functions is to link people to necessary health services. The natural overlap between these is for public health to assess victims’ decontamination needs and be sure they receive decontamination services (most likely from fire department hazardous materials experts). The outcomes of this logical approach were generally corroborated by public health planning and response guidance, training materials, or after-action reports.

To help ensure that our analysis covered the range of functions that might be needed in a chemical or radiological incident, we considered four variables that distinguish different incident conditions: (1) whether the release is a chemical or radiological substance, (2) whether the release is overt (i.e., detected immediately) or covert (i.e., initially undetected), (3) whether the hazard is initially well understood or poorly characterized, and (4) whether the release is accidental (e.g., a transportation accident) or deliberate (e.g., a terrorist attack). For example, in an incident in which a release is initially undetected and/or the contaminant is unknown, such as product tampering or a covert terrorist attack, an initial epidemiological investigation might be

an important step in understanding what happened. Such an investigation would be less important in the case of an overt, well-understood incident, such as a chlorine tanker explosion.

Given the broad scope of public health responsibilities, the wide range of emergency preparedness and response activities in chemical and radiological incidents, and the generally collaborative nature of emergency preparedness and response, it is difficult to unambiguously define a precise set of functions for the public health service in chemical and radiological incidents. One area of uncertainty, for example, is accurately characterizing functional areas where public health may have overall responsibility or a collaborative role but specific operational elements may be conducted by other services. Examples include decontaminating victims at public health–run screening centers, collecting samples for analysis at public health–operated laboratories, and conducting field measurements to inform public health–delivered safety messages. Another difficulty is that the distribution of roles and responsibilities among services varies by jurisdiction. Given such uncertainties, we wanted to err on the side of including rather than excluding public health functions.

Other considerations also influenced our characterization of public health chemical and radiological incident functions. To detail public health’s role, we chose to make the functions as specific as possible. We also focused on functions that provide a service to the public rather than internal capability-building activities. However, we included one type of capability-building activity, conducting training and exercises, because training and exercising are important aspects of emergency preparedness and response and are very specialized in the case of chemical and radiological incidents. To ensure that all possible public health functions were included, we did not limit the framework to those functions where public health would necessarily be in the lead but included those where public health would have an important role. We emphasize that the functional framework presented in this report is provisional and will undoubtedly be revised in future work.

We aligned individual public health chemical and radiological incident functions within the hierarchy of core and essential public health functions in Table 2.1. The resulting functional framework is shown in Table 2.2. The 17 public health chemical and radiological incident functions span several essential public health functions, although most are associated with detection and response and hence fall under “Diagnose and investigate” and “Link to/provide health care.” The functions include both preparedness and response activities. Preparedness activities are those that occur prior to an incident; they are often ongoing. Response activities can be short-term (those that contribute to returning conditions to near-baseline) or longer-term (those that may not need to begin immediately).

**Table 2.2**  
**Functional Framework for Public Health Preparedness and Response to Chemical and Radiological Incidents**

<b>Core Function</b>	<b>Essential Function</b>	<b>Chemical or Radiological Incident Function</b>
Assessment	Monitor health status	
	Diagnose and investigate	Monitor indicators of a release Identify agent and characterize footprint Assess victim decontamination and medical needs Conduct initial epidemiological investigation
Assurance	Enforce safety and health laws	
	Link to/provide health care	Provide public information Provide emergency medical supplies Establish a victim registry and monitor long-term health Activate laboratory emergency operation protocols Monitor emergency responder working conditions and health Monitor health conditions at shelters and mass care centers Ensure safety of food supply Manage contaminated fatalities Oversee environmental decontamination and reentry
	Assure competent workforce	Conduct training and exercises
	Evaluate health services	
Policy development	Inform, educate, empower	Provide pre-event public education
	Mobilize community partnerships	Coordinate with response partners
	Develop policies	
All	Research	

Table 2.2 illustrates that the public health service is involved in a wide range of functions in chemical and radiological incidents. Below, we describe the public health chemical and radiological incident functions in more detail and in the context of the core and essential public health functions. Where available, we also cite relevant guidance or research related to public health’s role in those functions.

## **ASSESSMENT FUNCTIONS**

### **Diagnose and Investigate**

#### **Monitor Indicators of a Release**

Public health departments have a traditional surveillance role in detecting health threats. However, in a chemical or radiological incident, this function may differ in important ways. The rapid spread and effect of chemical and radiological releases means that conventional health surveillance tools, such as monitoring physician and emergency room reports, may not be the first indicators of a release. Rather, eyewitness reports, 911 calls, calls to poison control centers, and—when present—real-time environmental monitoring systems may provide the first indications of a release. At the same time, an accidental or intentional chemical or radiological release could go undetected initially, in which case conventional health surveillance tools would be very important. Whatever surveillance and detection methods are used, accurate and rapid detection will depend on timely communications among numerous stakeholders (CDC, 2001).

#### **Identify Agent and Characterize Footprint**

A related function in any chemical or radiological release is to identify the agent that has been released and determine the geographical extent of the chemical or radiological contamination. This is important for making protective action recommendations, planning decontamination and medical treatment needs, and assessing infrastructure and environmental impacts. In most cases, this would be a multiservice undertaking. Hazardous material (hazmat) responders may often provide initial information and be able to provisionally identify the type of chemical or radiological release. Symptoms, environmental indicators, and portable detectors will likely play a role in the initial determination. Determining the extent of contamination, or footprint, is an iterative process that involves both modeling likely contamination and taking field measurements. Further information may be provided by emergency medical service responders and hospital emergency room staff. Additional laboratory tests will need to be conducted to confirm initial indications and, in cases of suspected terrorism, to help determine the provenance of the material and preparation methods used (CDC, undated a; CDC, 2001; Wu et al., 2008).

#### **Assess Victim Decontamination and Medical Needs**

An important function in which public health would be central is assessing the degree of contamination of anyone potentially exposed to chemical or radiological agents and evaluate their need for decontamination and medical treatment. In addition to assessment, this would include overseeing and monitoring decontamination operations and providing medical treatment

referrals; it may also include a range of other services, such as mental health counseling and services for pets and other animals. The CDC has developed guidance for population monitoring in radiological incidents (CDC, 2007), much of which may be applicable to chemical incidents as well. In the TOPOFF 4 exercise, the Portland health department employed “rapid screening points” to conduct this function (Spitzer, 2008). A key aspect of this function is managing large numbers of unaffected people (who are unsure if they are affected) seeking assistance (the “worried well”). Experience in past incidents indicates that the demand for contamination monitoring and medical evaluations exceeded the actual need by factors of five (in the Tokyo subway attack) (Sidell, 1996) to 400 (in the Goiânia, Brazil, radiological accident) (IAEA, 1988).

### **Conduct Initial Epidemiological Investigation**

In the case of a chemical or radiological release that is initially unrecognized or poorly characterized, public health departments will need to use epidemiological techniques to deduce information for understanding the type, time, and/or location of the release. While these techniques might be similar to more conventional methods used for infectious diseases, important details would differ. Work addressing epidemiology specifically for unrecognized chemical exposures highlights the obstacles to recognizing covert chemical releases (delayed health effects, symptoms similar to those of infectious diseases, gradual presentation, and unfamiliarity among clinicians) and clues and strategies to enhance recognition (Patel et al., 2006; Schier et al., 2006; Bakhshi, 1997).

## **ASSURANCE FUNCTIONS**

### **Link to/Provide Health Care**

#### **Provide Public Information**

Once a chemical or radiological incident has occurred, public health performs the risk-communication function, including providing instructions to individuals about sheltering or evacuating based on where they are located, how to decontaminate, what symptoms to monitor, how to determine whether medical attention is necessary, and potential treatments that may be provided. General methods for conveying such information, known as *crisis and emergency risk communication*, have been the subject of much research, and guidance is available from HHS (2002), CDC (2002, 2004a), and other organizations. Public communication guidance specifically for radiological incidents is also available (NCRP, 2001; IAEA, 2007; FEMA, 2007; EPA, 2007).

### **Provide Emergency Medical Supplies**

The federal Strategic National Stockpile (SNS) program maintains and delivers stockpiles of medical supplies for disaster response. One component of the Strategic National Stockpile, known as CHEMPACK, is made up of separate caches of chemical antidotes and supplies that are delivered more quickly than the 12 hours required for the standard stockpile components (CDC, 2004b). All states maintain plans to receive and dispense CHEMPACK medications. Some state and local jurisdictions also maintain local caches of specialized medical supplies to help bridge the time gap between an incident and the arrival of Strategic National Stockpile supplies (Hsu et al., 2008). Emergency medical caches must be stored in adequate environments to ensure expected lifetimes of supplies. Inventories must be maintained and monitored for resupply (e.g., when medications expire). Plans must be developed and resources assigned for distributing supplies to points of dispensation, and for dispensing medications to those who need it. Chemical or radiological incidents will require specialized medical supplies (e.g., chemical and radiological prophylaxes, antidotes), each with its own specific storage and distribution requirements.

### **Establish a Victim Registry and Monitor Long-Term Health**

Another important public health function will be conducting long-term health monitoring to assess the effects of exposures to the chemical or radiological materials involved in the incident. These investigations would start with the creation of a registry about potentially exposed individuals including, for example, contact information, location at time of incident, duration of the exposure at that location, and symptoms. These data would allow individuals to be contacted for follow-up evaluations and treatment and provide a baseline for monitoring the evolution of health effects. The initial registry data would then be supplemented with subsequent data from medical examinations, interviews, and surveys. Potential long-term consequences experienced by individuals involved could be identified and further treatments provided (CDC, 2007).

### **Activate Laboratory Emergency Operation Protocols**

A key function for public health is for laboratories to analyze clinical samples, clothing, and environmental samples. These analyses would be used to help characterize the type and extent of contamination in a chemical or radiological incident, as well as to confirm medical diagnoses and prescribe treatments. Chemical and radiological analyses require special sample handling (Pennell et al., 2008), laboratory equipment, and techniques. In a large incident, the demand for laboratory tests may increase substantially, and steps would be needed to deal with

increased sample processing (CDC, undated a), which in turn may require prioritization schemes to determine the order in which items should be processed.

### **Monitor Emergency Responder Working Conditions and Health**

Working in collaboration with occupational safety agencies, public health would be involved in giving instructions to emergency responders at incident, screening, decontamination, and treatment sites as to the appropriate level of protective actions they should take against chemical and radiological exposure. Emergency responders and their working conditions may then need to be monitored for potential hazards. While guidance on exposure limits and protection approaches is well developed for localized, containable incidents (e.g., liquid spills from tanks) (e.g., ICRP, 2004; OSHA, 1986), this guidance is often not appropriate or applicable to airborne, widespread, and/or nonlocalized contamination (LaTourrette et al., 2003). In addition, concerns about secondary chemical contamination from victims must be addressed (Horton et al., 2003; OSHA, 2005).

### **Monitor Health Conditions at Shelters and Mass Care Centers**

Shelters and mass care centers must be equipped to handle arriving populations in many different types of emergencies. So another public health function is to monitor conditions at these facilities to ensure healthy living conditions, including access to water, adequate sanitation, and safety (Landesman and Morrow, 2008). A particular concern is infectious disease control in crowded conditions (e.g., CDC, undated b; Murray et al., 2009; Vest and Valadez, 2006). A special concern in a chemical or radiological incident is monitoring contamination levels at shelters to ensure that they remain safe.

### **Ensure the Safety of the Food Supply**

Monitoring and assessing the contamination and safety of water, stored food, crops, and livestock is also a general function in which public health is involved. Chemical pollutants, in particular, are persistent in the global environment and strong measures are taken to protect the integrity of the human food chain (e.g., Schafer and Kegley, 2002). In a chemical or radiological incident, ensuring the safety of food, animal feed, and water may require implementing such protective actions as condemning supplies or switching livestock to stored feed (ICRP, 2004; EPA, 1992).

### **Manage Contaminated Fatalities**

Contaminated fatalities could pose particular problems in a chemical or radiological incident. Public health departments would be involved in establishing protocols and facilities for

collecting, storing, examining, and interring bodies that ensure the safety of workers and the environment and are sensitive to the needs of the survivors. Particularly in mass casualty events, bodies would be examined by pathologists and law enforcement officials and may need to be photographed and fingerprinted for identification purposes. Protective measures for handling and burying bodies may be required because some radiological materials could pose a long-term hazard (CDC, 2008c; DOE, 2007; SBCCOM, 2003).

### **Oversee Environmental Decontamination and Reentry**

If a long-term hazard persists in the built and natural environment, public health departments would support efforts to determine whether decontamination activities could diminish potential hazards in contaminated areas. Decisions would need to be made about appropriate decontamination methods, acceptable levels of contamination for reentry to evacuated areas, and limitations that may be imposed for reentry. Raber et al. (2004) examined decontamination after exposure to chemical warfare agents and suggest using different thresholds for residual contamination levels for different populations and exposure times. They propose separate values for initial reentry, long-term monitoring, and “no-effect” levels appropriate for round-the-clock exposure conditions (such as residences). Guidance on cleanup after radiological contamination highlights numerous factors, including local needs and desires, health risks, costs, and technical feasibility, and emphasizes the importance of transparency, inclusiveness, effectiveness, and shared accountability (ICRP, 2004).

### **Assure Competent Workforce**

#### **Conduct Training and Exercises**

Specialized training and exercising are important because chemical and radiological incidents are characterized by unusual hazards and responses. Important health-related training topics include environmental and clinical signs of exposure, protective action recommendations, health effects and treatment options, sampling and analysis, and decontamination procedures. Discussion- or operations-based exercises are designed to test response plans to a chemical or radiological incident. Training and exercises have been receiving substantial attention, from both federal granting agencies (e.g., CDC’s Centers for Public Health Preparedness and Advanced Practice Centers) and researchers (e.g., FitzGerald et al., 2003; High et al., 2008).

## **POLICY DEVELOPMENT**

### **Inform, Educate, Empower**

#### **Provide Pre-Event Public Education**

As noted above, communicating health risks and health-improvement guidance to the public is a quintessential public health role. As a component of risk communication, educating the public prior to an incident aims to ensure familiarity with anticipated hazards, provide guidance for action, and strengthen relationships between communities and public health departments. Public health departments would use public education efforts to communicate what chemical or radiological hazards people are at risk for, how individuals should respond to incidents, and what resources officials will provide during such an event.

#### **Mobilize Community Partnerships**

#### **Coordinate with Response Partners**

Responding to any large incident could involve local health departments, local public safety and service departments, and state and federal public safety and health agencies. Coordination of the various activities will be critical. Because chemical and radiological incidents present special circumstances, such as unfamiliar health hazards, special medical treatment and supply needs, and environmental health concerns, they may require coordination among organizations not normally covered under more-general coordination practices. Thus, chemical and radiological incidents may require special practices to coordinate specific kinds of information or among specific organizations.

### **3. PUBLIC HEALTH PRACTICES IN CHEMICAL AND RADIOLOGICAL INCIDENTS**

Using the functional framework as a template, we next conducted a search for practices currently being used by local and state public health departments to prepare for and respond to chemical and radiological incidents.<sup>6</sup> Our objective was to examine the extent to which local public health departments have prepared for their role in a chemical or radiological incident. We focused on current guidance for general public health emergency planning, plans that are in place for responding to the potential release of hazardous industrial chemicals and radiation around nuclear reactors, and preparations more recently designed for radiological and chemical terrorist attacks. Although this analysis addresses public health emergency preparedness for chemical and radiological incidents, we did not limit our search for practices exclusively to public health–focused sources. Our intention in looking more broadly was to identify practices that may have been developed or managed by another service but for which public health may have a supporting role.

#### **WHAT IS A PRACTICE?**

Practices related to public health emergency preparedness and response need to be understood in the context of a broad range of roles and activities for which the public health service is responsible. Because emergencies are relatively uncommon and generally do not constitute the normal operating conditions of a public health organization, many of the activities conducted in emergencies may not use established procedures and systems but rather are specialized activities that may only be implemented under emergency conditions. For example, jurisdictions would generally not maintain a registry of individuals and monitor their long-term health status except in the aftermath of a disaster or other recognized toxic substance exposure. This raises the question of how to distinguish between guidance and practice—does planning to follow guidance constitute a “practice”? In the case of chemical or radiological incidents, this question is further complicated by the fact that most jurisdictions have never dealt with a chemical or radiological emergency and hence may have never implemented relevant guidance or a practice.

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<sup>6</sup> We had initially intended to apply established criteria to identify “best” or “promising” practices (e.g., Bardach, 2005; Tanielian et al., 2005) from among the practices we identified. However, when we began researching practices, it soon became apparent that we would not be able to identify enough practices to differentiate them in terms of quality in any useful way.

We define a *practice* as a program, procedure, system, or other tangible action that is either in regular use or for which planning, training, and exercising are occurring to make possible its use when necessary. So, a plan to follow certain guidance would be considered a practice if this plan included such things as the assignment of responsibilities, identification of resources to carry out the plan, training sessions, and exercises. This definition is similar to other definitions of practices presented in the context of best practices research.<sup>7</sup> Although this distinction between practice and guidance can sometimes be ambiguous, it helps us to focus on efforts at the state and local levels that reflect some development and commitment beyond the guidance being provided by federal agencies or other external organizations.

## IDENTIFYING PRACTICES

We began our search for practices to carry out the public health functions defined in our framework for chemical and radiological incidents by reviewing various documents and materials. Our research into the functions and roles of emergency services in chemical and radiological incidents, described in the previous chapter, indicated that the status of the functions and roles in responding to chemical and radiological incidents is immature relative to those for responding to more common and familiar incidents. Given the uncertainty in functions and roles, we sought to cast a wide net and not to restrict our search solely to sources focused on public health.<sup>8</sup> At the same time, our focus was specifically on state and local practices, so we did not include federal programs or resources in our search. The materials we reviewed included the following:

- Best practices clearinghouses
  - National Association of County and City Health Officials (NACCHO) “Toolbox”<sup>9</sup>
  - National Association of County and City Health Officials “Model Practice Database”<sup>10</sup>

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<sup>7</sup> Other definitions of practices include “a program, activity, or strategy. . . system, methodology, process, formula, technique, tactic, approach . . . [that] has clearly defined parameters that can be assessed for effectiveness and compared against other similar practices” (Compassion Capital Fund National Resource Center, undated); “any activity that a state or local health department engages in that enhances the achievement of critical capacities and/or benchmarks” (Tanielian et al., 2005).

<sup>8</sup> We did not comprehensively examine sources focused primarily on health care providers and facilities, because the roles and practices for health facilities and providers are largely distinct from those of the public health service. For example, the vast majority of material relevant to health care providers is guidance about treatments for different chemical and radiological illnesses.

<sup>9</sup> See <http://www.naccho.org/toolbox/>

- Association of State and Territorial Health Officials (ASTHO) “Promising Practices in Public Health Preparedness”<sup>11</sup>
- New York Academy of Health’s “Resource Guide for Public Health Preparedness”<sup>12</sup>
- DHS’s “Lessons Learned Information Sharing”<sup>13</sup>
- U.S. Army Chemical Stockpile Emergency Preparedness program materials for communities near Army chemical weapon storage and disposal sites
- FEMA and NRC emergency guidance for communities near nuclear power plants
- SNS CHEMPACK materials
- FEMA’s “Partnerships in Preparedness” reports
- Academic literature.

These materials were systematically reviewed. Best practices clearinghouses were searched using variations of the words “chemical” and “radiological.” The academic literature was searched back to 2000 using the PubMed database for the terms “chemical” or “radiological” and “public health” and various relevant terms related to the functions in Table 2.2. In addition, we examined a number of state and local public health and public safety department websites. In the end, we identified very few practices from these sources. Several sources provided various forms of guidance, some of which helped identify and characterize the public health chemical and radiological incident functions in Chapter 2. But there was little that described anything resembling practices relevant to public health and chemical and radiological incidents.

To supplement the findings from the literature, we conducted interviews with representatives of public health departments and agencies involved in preparing and responding to chemical and radiological incidents. In keeping with our desire to cast a wide net, we included some emergency management and fire departments in our interviews in an attempt to identify practices or insights that might be adoptable by public health departments. We held telephone discussions with representatives of 16 departments, of which 10 were public health departments and 6 were emergency management or fire departments. The departments we interviewed are listed in Appendix A. Because we focused on incidents involving the release of chemicals and radiation, we targeted departments that are near nuclear power plants or chemical weapon storage and destruction facilities. We also contacted large and well-funded departments and

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<sup>10</sup> See <http://archive.naccho.org/modelPractices/>

<sup>11</sup> See <http://www.astho.org/pubs/PromisingPracticesMainPage.html>

<sup>12</sup> See <http://www.phpreparedness.info/index.php>

<sup>13</sup> See <http://www.llis.dhs.gov/index.do>

departments recommended to us by NACCHO and others as having potentially interesting practices. In some cases, we were given recommendations for other offices or representatives known to have dealt with chemical or radiological incidents.

Individual department representatives were initially emailed a letter describing the study and requesting their participation. They were subsequently contacted by phone to answer any questions and arrange an interview time. Interviews were conducted by telephone and generally lasted about one hour. Interviews typically included two members of the study team and one to three department representatives. Interviews were guided by a standardized discussion protocol to maintain consistency among the interviews (see Appendix B). The protocol inquires about past chemical or radiological incidents that the department may have responded to, then solicits practices in the different public health functions for chemical and radiological incidents. Note that we included the practice areas listed in item 7 of the discussion protocol in the introductory email and stepped through them systematically in each interview. For each practice, we attempted to obtain information about the motivation for its development, its strengths and weaknesses, and the extent to which it has been used and evaluated.

## **IDENTIFIED PRACTICES**

From all the sources we consulted, we identified the 31 practices summarized in Table 3.1. Given the uncertainty regarding the relative roles of different services, practices did not necessarily need to have a documented public health role to be included. Practices were deemed to be potentially applicable to public health and included in Table 3.1 if they were contributed by a public health department or source or if they applied to the public health chemical and radiological incident functions in Table 2.2. While the majority of listed practices did come from public health departments, a few cases came from other services but address relevant public health functions. We identified which functions in our framework each practice applied to based on the practice description and objectives as well as on the practice-function associations raised in the interviews. Some practices are relevant to more than one function. Note that we include only practices for which at least some aspects were designed specifically for chemical or radiological incidents, including industrial accidents (labeled as “Type I”) or chemical or radiological terrorism (“Type II”). Beyond those practices listed, we also identified numerous practices developed for more general emergency situations (“all hazards” practices) that would apply to chemical or radiological incidents. While many such practices would require special tailoring to be used in chemical or radiological incidents, their existence does not necessarily reflect any special preparation for chemical or radiological incidents. Therefore, we did not include them in our analysis.

**Table 3.1  
Identified Practices**

Name	Functions	Summary	Type*
Subway Safety Initiative	Monitor indicators of a release Identify agent and characterize footprint	Created a map of background radiation in the subway system that enables authorities to determine the actual increase in radiation levels as a way of determining if a radiological weapon has been used in the subway system. The initiative also included response planning for a radiological incident on the subway system.	II
Securing the City Initiative	Monitor indicators of a release Identify agent and characterize footprint Assess victim decontamination and medical needs Establish a victim registry and monitor long-term health	A suite of activities aimed at better preparing a city for a large-scale chemical or radiological release. One element of the initiative entails deploying permanent radiological detectors over a wide (~50 mile radius) area to provide early warning of an advancing contaminant plume. A second element concerns plans for setting up public reception centers to provide screening, decontamination, registry, and mental health services to reduce the impact of concerned citizens on hospitals.	II
Passive Environmental Radiation Monitoring	Monitor indicators of a release	Involves a variety of ways to measure radiation levels around the city. One approach entails periodically deploying radiation portal monitors for vehicles to strategic locations, including entrances to bridges and tunnels. Another is to periodically issue orders for all field units to activate vehicle-mounted and personal radiation detectors, so live detectors are roaming the city. The practice is primarily intended to detect unforeseen radiological releases, but it could also be used in the immediate aftermath of a known release to help map the footprint.	II
Remote Chemical/Radiological Detectors	Monitor indicators of a release Identify agent and characterize footprint	Health department deploys commercial environmental sensors that monitor for chemical and radiological releases during special events. A smaller number of sensors are permanently installed in public spaces.	II
Public Health Intelligence Analyst	Monitor indicators of a release	A local public health department has two staff positions assigned full-time to the local intelligence fusion center, which is managed by law enforcement agencies and acts as a hub for exchanging intelligence information among local, state, and federal agencies. The public health representatives will be available to answer questions, provide information, and act as a liaison between public health and other agencies.	II
Weekly Health Threat Assessment	Monitor indicators of a release	The public health department gathers and monitors information about 23 factors from various agencies and databases relevant to public health. Data include information related to transport of radiological or chemical materials, theft of radiological materials, hazardous materials detection, and water/air/soil sampling. All the data are used to identify possible abnormalities and assess potential health risks.	I
Facility Reports	Identify agent and characterize footprint Coordinate with response partners	Office of Emergency Management monitors types and amounts of hazardous materials stored at facilities within its jurisdiction. The reports are developed by facilities and include facility-specific response plans that account for hazardous materials, facility characteristics, and historical wind patterns to predict plume direction.	I
Sentinel Laboratories	Identify agent and characterize footprint	Public health department has an agreement with local laboratories to conduct radiological monitoring during a possible incident and to characterize the contamination footprint. The department also coordinates with laboratories to monitor background radiological levels.	I
Webpuff	Identify agent and characterize footprint	A computational model to help assess how a chemical or radiological release might progress over time given a set of parameters (e.g., substance involved, amount released, point of origin, wind patterns, topography). It also allows for sharing the results over a computer network. One application of this information is to help determine when individuals should stop sheltering in place. It was designed to address the risk to communities near chemical weapon destruction facilities, but could be adapted for response to a transportation or chemical or radiological terrorist incident.	I

Name	Functions	Summary	Type*
Environmental Emergency Response Team	Identify agent and characterize footprint Assure safety of food supply	Public health personnel have been trained and equipped to assess the impact of a hazardous material incident in level C hazmat protective equipment. This makes it possible for public health personnel to assess the impact of an incident on water supplies, food venues, and other resources.	I
State Radiological Emergency Response Team	Identify agent and characterize footprint	State health department is chief of field operations in an incident involving a radiological release and takes the lead in plume modeling and in deploying field monitoring teams that work with public safety services to make field measurements of contamination. Field monitoring teams work near the edge of the plume to help define the boundaries.	I
Radiation Counting Laboratory	Identify agent and characterize footprint Identify agent and characterize footprint	A local public health department maintains a specialized laboratory for radiological measurements of clinical and environmental samples.	II
Post-Incident Screening Points	Assess victim decontamination and medical needs Establish a victim registry and monitor long-term health	An office of emergency management has plans and policies in place to set up post-incident screening points in conjunction with public health officials to triage injuries, refer individuals to hospitals for additional medical assistance, and help contain the effects of contamination.	I
Personnel Processing Points	Assess victim decontamination and medical needs Establish a victim registry and monitor long-term health	Personnel processing points will be set up to assist populations fleeing the area of a chemical or radiological terrorist incident. Their initial function would be to determine whether individuals leaving the area are contaminated. If individuals are determined to be contaminated, they are given instructions for how to decontaminate. This may include provision of decontamination and medical resources at specified facilities. Arrangements could also be made with neighboring jurisdictions to enable fleeing populations to be decontaminated and treated in hospital-organized facilities.	I
Mobile Monitoring / Screening Sites	Assess victim decontamination and medical needs Establish a victim registry and monitor long-term health	In the case of an incident, monitoring centers would be set up where individuals could be screened for contamination or for other effects of the incident. The centers would also identify individuals who might need medical treatment and help set up a victim registry.	I
Caches of Chemical-Specific Medical Supplies	Provide emergency medicinal supplies	Local jurisdiction maintains a supply of chemical antidotes for rapid administration to large populations in a short time frame. Auto-injectors are utilized to decrease the administration time. This practice was designed to address the risk to communities near chemical weapon destruction facilities but could be adapted for response to a transportation or chemical terrorist incident.	I
State Emergency Drug Delivery and Resource Utilization Network	Provide emergency medicinal supplies	State maintains standardized caches of chemical incident response medication and supplies distributed among emergency medical service agencies that can be delivered to hospitals and other sites within an hour of a request. Program maintains information on the antidotes held by poison control centers; medication caches within health care settings; medicine stockpiles built by other state agencies; and supplies available within other areas of the public health system. It also maintains a list of pharmaceutical companies with contact information so that the health department can reach out to them during an incident to purchase additional medication, if needed.	II
Victim Registration	Establish a victim registry and monitor long-term health	Local public health department collects relevant information from exposed victims to facilitate follow-up and epidemiology. Hazmat responders would be responsible because public health officials are rarely on the scene.	I
Radiological Response Training	Conduct training and exercises	State health department provides radiological response training (classes, drills, and materials) to local health, medical, and public safety agencies. Training targets radiological dispersal devices (RDDs) and transportation accidents and covers various types of RDDs, different scenarios, as well as how to use radiation detectors.	I
Integrated Radiological Response Training	Conduct training and exercises	Provides integrated and consistent training for all types of emergency responders (e.g., fire, police, hospitals, health department, environmental protection agency, media), so everyone has the same information and operates with common understandings, protocols, and practices. All responding vehicles have similar equipment. Training is also used to help identify who would be in command during incidents.	I

Name	Functions	Summary	Type*
Awareness Training for Chemical Terrorist Incidents	Conduct training and exercises Monitor indicators of a release	Provide emergency responders with training on how to operate in the unfamiliar operational environment of a release of a hazardous chemical. Training involves how to use personal protective equipment and accomplish decontamination. This practice was designed to address the risk to communities near chemical weapon destruction facilities but could be adapted for response to a chemical terrorist incident.	I
Yearly Full-Scale Chemical Exercise	Conduct training and exercises	Conduct an annual exercise involving all aspects of the emergency response community (e.g., police, volunteer fire departments, medical facilities, federal agencies). The time of the year, the chemical agent type, and the aspect of the response exercised varied each year. Relevant personnel from other jurisdictions were invited to learn and/or share their knowledge. This was designed to address the risk to communities near chemical weapon destruction facilities, but could be adapted for response to a transportation or chemical terrorist incident.	I
Block Captain Hazardous Material Training	Conduct training and exercises	Individuals are selected to act as block captains, given hazmat awareness training, charged with sharing this information, and asked to identify people in their areas that might require assistance in an emergency. The project was developed to improve the resilience of a community at risk from accidents at industrial chemical plants.	I
Shelter-in-Place Public Information Program	Provide pre-event public education	Educates the public before an incident about response plans and how they should react in various emergency situations so as to improve the ability of individuals to respond to recommendations of officials during an incident. This program focused in particular on how to shelter in place after the release of a hazardous chemical. The program displayed information on billboards and distributed calendars containing information such as what to include in a preparedness kit, how to shelter in place, and the evacuation routes.	I
Shelter-in-Place Video	Provide pre-event public education	A community at risk from an accident at an industrial chemical facility created and distributed a 15-minute video on DVD to instruct individuals on how to prepare for and implement sheltering in place. The video could also help in preparing for a chemical terrorist attack.	I
Shelter-in-Place Kits and Information	Provide pre-event public education	Shelter-in-place kits are made available to the public as part of a broader public information campaign. The materials (e.g., duct tape and plastic sheeting) are provided, along with instructions. Project was designed to address the risk to communities near chemical weapon destruction facilities but could be adapted for response to a chemical terrorist incident.	I
Industrial Radiography Reciprocity Project	Coordinate with response partners	Through a licensing system that requires notification of the time and location of portable radiography equipment being brought into the city, emergency responders, including the Department of Health, are notified, thereby allowing them to adjust their preparedness planning and resources accordingly. This information is collected in a database.	II
911- Public Health Coordination	Coordinate with response partners	A county coordinates all 911 calls that could be hazardous to human health (e.g., chemical spills) with public health officials. When a call comes in, public health officials are notified and, depending on the incident, will go on scene or be available for consultation with emergency responders.	I
Suspicious Substance Protocol	Coordinate with response partners	Defines roles and procedures among all agencies (public health, fire, police, etc.) for service calls reporting suspicious substances.	I
Environmental Data Exchange Network	Coordinate with response partners	A web-based information-sharing system that enables organizations at all levels (local, state, federal) to share with key stakeholders hazardous materials analysis data collected to measure the progression of a chemical or radiological threat over time.	I
Hazardous Materials Data Capture	Coordinate with response partners Characterize footprint	This practice enables responders to wirelessly transmit field data from handheld hazardous materials sensors to a central database, EDEN. This allows all stakeholders to access real-time data collected in the field after a chemical or radiological incident.	I

\*I: Practices that originated to address accidents (e.g., hazardous materials transportation, chemical plants, nuclear reactors)

II: Practices that originated to address chemical and radiological terrorism.

Our search identified a variety of practices for public health preparedness and response for chemical and radiological incidents. Some are quite novel and are in use only by a single organization (e.g., Subway Safety Initiative, Hazardous Materials Data Capture); others are likely in widespread use. We attempted to be comprehensive in our review of the literature, but since we contacted only a small number of public health departments, we cannot say that these practices are comprehensive of what is currently being done. However, because we focused our search on large cities and communities at increased risk of chemical or radiological accidents, we assume that our identified practices represent a sample of some of the most effective and innovative practices.

As noted above, our literature search, which included existing compilations of best practices, revealed that few chemical or radiological practices have been documented. This contrasts markedly with the large number of practices addressing pandemic influenza, bioterrorism, and all-hazards preparedness documented in these same sources. To some extent, this difference presumably reflects the fact that the vast amount of attention and funding in public health emergency preparedness has centered on pandemic influenza, bioterrorism, and all-hazards preparedness. Given this focus, it is not surprising that the majority of public health practice development has occurred in these areas. A second possible reason for the dearth of documented chemical and radiological incident practices is that public health departments may feel that they do not need specialized practices for chemical and radiological incidents. They may take this position either because they generally have a supporting (rather than leading) role in such incidents or because they feel that much of what they would need to do in a chemical or radiological incident could be accomplished using their existing general emergency preparedness practices. Indeed, some interview respondents confirmed this rationale.

But our functional framework indicates that there are some critical and specific functions for public health in chemical and radiological incidents for which specialized practices are warranted. Results from the interviews indicate that some public health practices for chemical and radiological incidents are being developed and implemented. In many cases, the identified practices are under development, untested, or not clearly defined, indicating that chemical and radiological incident preparedness is relatively immature. Currently, therefore, it may be difficult for the departments that develop practices to implement and sustain them. And without documentation and field-testing, it is impossible for other organizations to know about those practices and replicate them. While many of the practices we identified were developed for specific purposes or conditions that may not be relevant to all public health departments, nearly any jurisdiction is at risk for chemical or radiological releases that could occur as a result of a terrorism or transportation accidents. Thus, continued development, testing, documentation, and

dissemination of chemical and radiological incident practices are important activities for public health departments.

### **Accident Practices**

The threat posed by accidents involving the release of chemicals or radiation has prompted the development of numerous specialized practices (Type I in Table 3.1), many of which could be useful more widely in the event of a terrorist attack or accidents involved in the transportation of industrial chemicals or radiological isotopes. Eight practices address education, training, and exercises for awareness and response to chemical and radiological incidents: Four of these involve programs to provide specialized training and exercises to help prepare professional responders for chemical and radiological incidents; four others relate to providing education, training, and supplies for the public about recognizing and responding to a hazardous materials incident.

Four practices address coordination among response partners, including public health departments. One community coordinates 911 dispatch information with the health department and deploys public health representatives to any incident with potential public health concerns. In the wake of the anthrax attacks of 2001 and the ensuing confusion about how to respond to so-called “white powder” incidents, the public health and public safety departments in one jurisdiction coordinated the development of a “suspicious substance protocol” to define procedures, roles, and responsibilities for responding to calls about suspicious substances. Another health department developed a web-based network for uploading and sharing environmental data collected during a hazardous materials response; this network will eventually be open to all responding agencies at multiple levels (i.e., local, state, and federal). Finally, one jurisdiction is deploying technology to health department and hazmat teams to enable wireless transmission of data from handheld sensors to central servers, where it can more quickly help inform decisionmaking. This also helps characterize the contamination footprint.

Four additional practices help health departments identify the contaminating agent and characterize the footprint of the contamination from a chemical or radiological release. One uses public health laboratories as sampling stations during possible releases to help determine the type and extent of contamination. Another practice that is in standard use in communities surrounding Army chemical weapon storage and destruction facilities is to model the predicted dispersal of an airborne contamination plume based on the contaminant, source location, and current meteorological conditions. One health department specially trains and equips staff to conduct health inspections in potentially contaminated areas to help assess the extent to which contamination may have entered the food or water supply. This practice also addresses the

function of ensuring the safety of the food supply. And in one state, the health department leads field monitoring efforts to define the extent of the contaminated area.

In many cases, chemical or radiological contaminants can cause severe health effects in a matter of minutes or hours, in which case very rapid medical countermeasures are needed. While the response time for the chemical element of the federal Strategic National Stockpile is designed to be quicker than the 12-hour response time for the main stockpile elements (CDC, 2004b), even this more rapid response will be too late to help victims in some scenarios. Consequently, two practices entail maintaining local caches of chemical antidotes for rapid administration at a chemical exposure incident.

Three different cities described a broadly similar practice of setting up victim screening centers. Such centers address two important functions. The first is assessing people's need for decontamination and medical treatment. Their primary function in this capacity is to monitor for contamination, provide decontamination when needed, and to provide medical assessment and referral. But they may also provide other services, such as guidance about food safety, shelter, temporary housing referrals, or counseling services. Their other function is registering information from victims. This includes information about their exposure (e.g., where they were, what symptoms they experienced), which may be helpful in determining the origin and nature of releases that are not immediately understood. Registration also entails collecting contact information so that victims can receive medical follow-up and the long-term epidemiological consequences of the exposure and treatments can be monitored.

### **Terrorism Practices**

A number of practices were developed specifically to address chemical or radiological terrorism (Type II in Table 3.1), and these warrant general dissemination so that public health and other agencies can consider adopting them. Most of these practices are related to different ways to identify and monitor the release of chemicals and radiation. Unlike accidents, which often involve the release of chemical or radioactive materials originating from a known source, there is no way to predict where or when a chemical or radiological terrorist attack will occur or what agent will be used. Early detection and characterization are thus critical functions for terrorism preparedness.

As a component of a subway safety initiative, one health department is measuring background radiation levels in subways to provide a baseline against which to measure potentially elevated radiation levels that may indicate a release. Another city is deploying a multifaceted Securing the City initiative that includes wide-area (~50 mile radius) radiological detectors intended to detect an advancing plume before it reaches highly populated areas. This initiative also includes victim screening centers. Another monitoring practice used by the police

and fire department in one city entails the regular deployment, to various locations, of radiation monitoring detectors and portals. A related practice in another city is to deploy portable passive radiation and chemical detectors at public gatherings and other special events. A more indirect monitoring effort involves a licensing system that requires notification to emergency responders of the time and location of portable radiography equipment being brought into the city.

To help maintain awareness of any emerging threats that may have public health implications, one public health department has two staff positions assigned full-time to the jurisdiction's intelligence fusion center. In response to the need to respond quickly with antibiotics or other medications in a terrorist attack, one state public health department maintains standardized caches of supplies and keeps a database of medicine stockpiles built by other state agencies, clinics, and pharmacies that could be drawn upon in case of need.

The practices that we identified would be useful in many of the public health functions that might arise in chemical and radiological incidents. Some of them are especially creative in linking public health activities with those of other emergency responders, and all need to be documented and disseminated more broadly.



#### **4. PRACTICES IN THE CONTEXT OF FUNCTIONS AND IMPLICATIONS FOR FUTURE PRACTICE DEVELOPMENT**

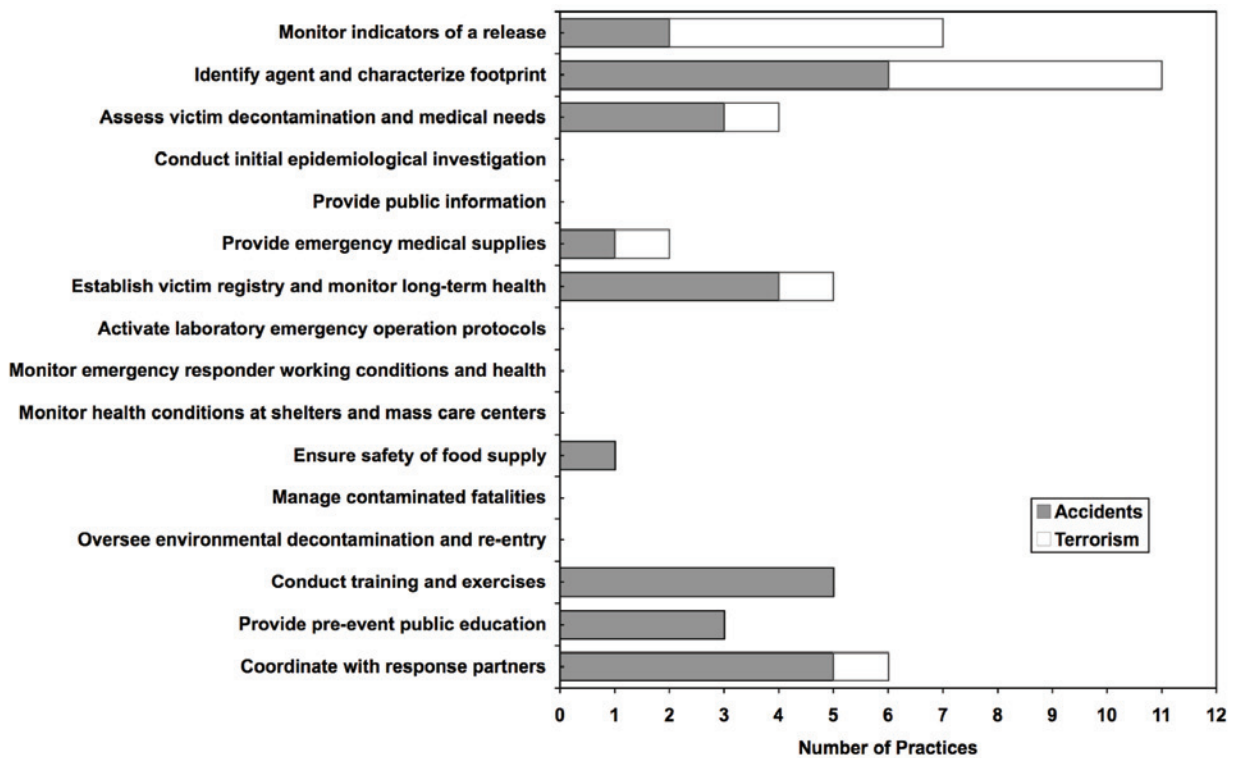
Given a sample of practices used by state and local health departments in which public health departments would be involved in a chemical or radiological incident, we now examine those practices in the context of the functional framework in an effort to identify areas where further practice development may be warranted. One way to prioritize areas for further development would be to target functions for which there are relatively fewer practices. Figure 4.1 shows the number and types of practices identified for each function. The figure shows that the practices cover some function areas better than others. But the number of identified practices alone is not necessarily the best criterion for prioritizing practice development because not all function areas may require practices specifically tailored for chemical or radiological incidents. In addition, our method of collecting practices was necessarily limited to a small number of relevant departments, which may not capture the range of activities undertaken in departments not interviewed. Finally, some function areas are primarily the responsibility of services other than public health, in which case public health may not be the appropriate stakeholder to lead practice development.

Given these considerations, we propose three criteria that can be used to target areas that public health can focus on in terms of developing practices for chemical and radiological preparedness. The most important functions are those for which

- chemical and radiological incidents require specialized practices
- public health is the lead service
- few practices were identified or practices only partially cover the scope of the function.

Some functions may be general enough to be accomplished with existing general emergency preparedness practices. The first criterion thus helps focus attention on those areas where current systems and tools are not sufficient for carrying out the function in chemical or radiological incidents. The second criterion is meant to distinguish functions where public health has the lead responsibility from those where public health would have an important role in supporting some other agency. The third criterion helps draw attention to those areas where more practices may be needed.

**Figure 4.1**  
**Number of Practices Associated with Each Function**



Applying these criteria is not without some uncertainties. The first criterion requires an understanding of when existing practices are inadequate for chemical or radiological incidents. In some cases this is relatively clear (e.g., assessing decontamination needs is quite specialized), but in other cases it is less so. In applying this criterion, we have relied on descriptions of requirements in guidance and research documents as well as our own experience with emergency preparedness and response.

The second criterion is complicated by the fact that the responsibility for most functions is shared among multiple services or agencies and the relative roles and responsibilities among services vary among jurisdictions. Based on references to specific service responsibilities in the planning and response guidance (including the Emergency Support Function and Support annexes of the *National Response Framework* (DHS, 2008)), training materials, and after-action reports reviewed in developing the functional framework, we have identified which of the functions public health could be expected to lead, in at least some jurisdictions.

In applying the third criterion, it is important to restate that the practices we identified in our work represent an incomplete sample of what may be currently in use by state and local health departments. If the distribution of practices among functions we observe in our sample is

representative of all health department practices, then areas where we observe relatively fewer practices are meaningful indicators of areas where there are fewer practices.

Bearing in mind these uncertainties, we present the results of applying these criteria to each of the functions in our framework in Table 4.1. Because our functional framework was developed specifically to highlight public health functions in chemical and radiological incidents, it concentrates on functions specific to chemical and radiological incidents, and all functions but one require specialized practices for such incidents. Public health can be expected to be the lead service in about half of the functions, although the lead for several functions is difficult to establish definitively. Ten of the functional areas have two or fewer practices associated with them.

**Table 4.1**  
**Application of Criteria for Prioritizing Functions for Practice Development**

<b>Chemical or Radiological Incident Function</b>	<b>Specialized Practices Needed</b>	<b>Public Health Lead</b>	<b>Insufficient or Inadequate Practices</b>
Monitor indicators of a release	•		
Identify agent and characterize footprint	•		
Assess victim decontamination and medical needs	•	•	
Conduct initial epidemiological investigation	•	•	•
Provide public information	•	•	•
Provide emergency medical supplies	•	•	(1)
Establish a victim registry and monitor long-term health	•	•	• (2)
Activate laboratory emergency operation protocols		•	•
Monitor emergency responder working conditions and health	•		•
Monitor health conditions at shelters and mass care centers	•	•	•
Ensure safety of food supply	•		•
Manage contaminated fatalities	•		•
Oversee environmental decontamination and reentry	•		•
Conduct training and exercises	•		
Provide pre-event public education	•	•	
Coordinate with response partners	•		

- (1) Although few practices in this function were identified, the federal CHEMPACK program provides rapid dispensation of medical supplies for chemical incidents.
- (2) Although the practices involving victim screening or processing centers typically include creating victim registries, none address long-term health monitoring. Hence this is a case in which practices do not address the entire function.

Four of the functions satisfy all three criteria for areas that warrant priority for practice development:

- Conduct initial epidemiological investigation.
- Provide public information.

- Establish a victim registry and monitor long-term health.
- Monitor health conditions at shelters and mass care centers.

Based on our analysis, these are functional areas that (a) are essential for chemical or radiological incidents; (b) would likely be led by public health departments, so the public health service must take charge of developing plans, policies, and practices; and (c) do not appear to be adequately supported by current practices. Improving the nation's emergency preparedness and response for chemical or radiological incidents therefore depends on public health agencies investing in efforts to increase capabilities in these functions.

We conclude with a brief discussion of topics for future work in each of these areas. Based on the specific needs anticipated for chemical or radiological incidents, we highlight areas for additional research, guidance, and decisionmaking that can inform further practice development.

## **INITIAL EPIDEMIOLOGICAL INVESTIGATION**

Some small- to moderate-scale radiological releases have initially gone undetected and were first identified through diagnosis of victim symptoms (e.g., IAEA, 1988, 2004). In addition, there have been numerous occurrences of unintentional and intentional chemical contamination in food products (Schier et al., 2006). Although it is less likely that large-scale radiological or chemical accidents would occur undetected, it is possible that terrorists would deliberately mount such a covert attack. As cases emerge, the location(s), timing, and nature of the release would need to be deduced using epidemiological methods. While some of the same investigation principles for infectious diseases apply to chemical or radiological illnesses, the details differ and epidemiology staff familiar with infectious diseases may not have ready access to procedures and references for identifying and characterizing a chemical or radiological release. Limited research has addressed the recognition and characterization of covert chemical or radiological releases (Patel et al., 2006; Schier et al., 2006; Bakhshi, 1997). This research highlights obstacles to recognizing covert chemical releases and discusses clues and strategies to enhance recognition. The CDC has published case definitions for a number of chemical agents that cover clinical descriptions, laboratory criteria for diagnosis, and case classifications (Belson et al., 2005).

There is a need to integrate the existing research and case definitions into guidance and tools to help health departments be able to conduct epidemiological investigations into unexplained chemical or radiological illnesses. A promising example of such an effort is the Michigan Department of Community Health's (2007) step-by-step guidance for investigation of suspected chemical exposure-related illnesses. This guidance discusses clues that may indicate chemical exposure, provides epidemiological and environmental health investigation steps, and summarizes available laboratory resources. It also includes a flowchart to guide investigators

through the process. This example may provide a good model or starting point for federal guidance.

## **PROVIDING PUBLIC INFORMATION**

Providing useful and accurate information will be particularly important in the case of a chemical or radiological incident because of the public's unfamiliarity with chemical and radiological materials and their effects. The characteristics of these health effects, particularly the potential for exposures to cause latent adverse health outcomes and for health hazards to persist in the environment, also instill fear in many people.<sup>14</sup> Past incidents provide good examples of the impact of these concerns. After an accidental radiological release in Goiânia, Brazil in 1987, nearly three-fourths of the 112,000 people who were monitored for contamination had spontaneously gone to be monitored for fear of radiation, but only 249 had any measurable contamination from the incident (IAEA, 1988). Similarly, in the 1995 sarin attack on the Tokyo subway, of the 5,500 victims who sought medical treatment, some 4,000 "seemingly had nothing wrong with them" (Sidell, 1996).

The fundamentals of crisis and emergency risk communication (e.g., HHS, 2002, 2007; CDC, 2002, 2004) are well known and have been widely adopted. These fundamentals apply to any incident, including chemical or radiological incidents. Guidance specifically addressing public information in radiological incidents is also available (NCRP, 2001; IAEA, 2006, 2007; FEMA, 2007; EPA, 2007).<sup>15</sup> This specific guidance is built upon the fundamentals and includes basic facts about radiation, sample scenarios, and conflicting concerns that may arise in terrorist incidents.

An important aspect of public risk communication that requires special attention in chemical and radiological incidents is advising people about recommendations for protective action. These recommendations may include such steps as sheltering, evacuation, administration of medical countermeasures, decontamination, relocation, shielding, limiting time spent in potentially contaminated areas, and avoiding certain foods (EPA, 1992; NCRP, 2001; IAEA, 2007). These actions are very different from those recommended for more common emergencies, such as infectious disease outbreaks or natural disasters. Our research suggests that there is a need for guidance to public health departments and other agencies charged with public communication describing these recommendations and how to convey them. Guidance could address how the recommendations will be developed, including who will have responsibility for

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<sup>14</sup> NCRP (2001) contains a review of literature related to the psychosocial effects of radiological terrorism.

<sup>15</sup> We are aware of no communication guidance addressing chemical incidents.

providing the technical expertise and what information they will use. It would also be beneficial to understand the details of what the recommended actions would entail and to anticipate problems associated with implementing them. Some recommendations, for example, may conflict with peoples' inclinations. Lasker (2004) emphasized this point when she found that only three-fifths of survey respondents said they would follow instructions to stay inside an undamaged building other than their home after a dirty bomb explosion.

## **VICTIM REGISTRATION AND LONG-TERM HEALTH MONITORING**

Exposure to contaminants from chemical or radiological incidents has the potential to cause extended illnesses or latent adverse health effects. It is therefore important to monitor the health of victims for an extended duration after an incident to detect changes in their health status. The importance of collecting information from potentially exposed victims and monitoring their long-term health is discussed in numerous guidance documents (IAEA, 2006, 2007; CDC, 2001, 2007; HHS, 2007). However, while these documents emphasize the importance of this function, they provide little guidance about how to go about doing it. The limited information that is available describes establishing a victim registry and does not address long-term health monitoring or how such monitoring data could be used to inform treatment protocols and to develop strategies for protecting people and mitigating adverse health effects in the future.

There is therefore a need for guidance to health departments about establishing a registry and designing a program for long-term health monitoring. Such guidance could draw upon experience from state cancer registries and past chemical and radiological incidents. The World Trade Center Medical Monitoring and Treatment Program represents one example of long-term health monitoring after a disaster.<sup>16</sup> This program is for workers or volunteers involved in rescue, recovery, cleanup, or restoration of essential services at the site of the 9/11 terrorist attacks at the World Trade Center. The program consists of free yearly medical examinations, free medical treatment for incident-related health outcomes, and assistance with receiving workers' compensation and disability benefits. In addition to directly benefiting affected responders, the program has provided data for numerous scientific research studies intended to improve our understanding of the health effects of the hazards produced in the attacks.<sup>17</sup> A large multinational registry was established for the victims of the Chernobyl nuclear reactor accident in 1986 (Ivanov et al., 1999), but we are not aware of long-term health monitoring programs for

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<sup>16</sup> See <http://www.wtcexams.org/>

<sup>17</sup> See <http://www.wtcexams.org/healthfindings.html>

any large chemical incidents such as the Tokyo subway sarin attack in 1995 or the Bhopal, India chemical plant accident in 1984.

## **MONITORING HEALTH CONDITIONS AT SHELTERS AND MASS CARE CENTERS**

In any disaster situation in which large numbers of people are displaced into shelters or mass care facilities, there is an increased risk of infectious disease outbreaks (CDC, undated b). In addition, many displaced people will arrive with preexisting medical conditions, often exacerbated by lack of access to prescription medications or regular health care providers (Vest and Valadez, 2006). Of additional concern in a chemical or radiological incident is the possibility that shelters and other facilities could become contaminated from the arrival of contaminated people. While the issue of secondary contamination in medical treatment facilities has been recognized (e.g., Horton et al., 2003; OSHA, 2005), we identified no research, guidance, or practices addressing the concern of contamination in shelters. There is therefore a need for research about the avenues for contamination, the risks to shelter residents and staff, and approaches for mitigating these risks. This research would then need to be translated into guidance that could be made available to health departments, which could ultimately use it to inform shelter planning. There may be opportunities to leverage and integrate existing research on surveillance and epidemiology for infectious diseases in shelters (e.g., Toprani et al., 2006) with practices related to preventing and monitoring contamination (e.g., IAEA, 2006).

## **CONCLUSION**

Public health emergencies can arise from a wide variety of incidents and circumstances, including emerging infectious diseases, natural disasters, industrial accidents, and terrorism. Given the capabilities and responsibilities of public health departments, public health emergency preparedness and response efforts have understandably given priority to biologically based threats, such as pandemic influenza and biological terrorism. A comprehensive approach to public health emergency preparedness, however, must consider the full spectrum of threats, including chemical and radiological incidents. Our analysis presents the first overall characterization of the public health service's role in preparing for and responding to chemical and radiological incidents. Our functional framework identifies several areas where public health will have a lead or supporting role in such incidents. Our review of local public health department practices associated with chemical and radiological incidents revealed few relevant practices. By comparing the suite of practices to the functional framework, we were able to identify functional areas in which further practice development may be warranted. Based on available guidance and other materials, we provide suggestions and considerations for future research, guidance, and decisionmaking that can inform further practice development.



**APPENDIX A: AGENCIES INTERVIEWED**

Ledge Light Health District  
New London, Connecticut

Environmental Health Group  
New York City Department of Health and Mental Hygiene

Matagorda County, Texas, Office of Emergency Management

Arkansas Department of Emergency Management  
Office of Emergency Management—Jefferson County

Radiological Emergency Preparedness Program  
Texas Department of State Health Services

Portland, Oregon, Office of Emergency Management

Portland, Oregon, Fire Department

Radiological Emergency Preparedness Program  
Miami–Dade County Department of Emergency Management & Homeland Security

Miami–Dade County Fire Department

Washington, DC, Department of Health

Kansas City, Missouri, Department of Health

Southwest Center for Advanced Public Health Practice  
Tarrant County, Texas, Public Health

Arlington County, Virginia, Public Health Services

Environmental Health  
Nebraska Department of Health & Human Services

Monroe County, Michigan, Health Department

Public Health—Seattle and King County, Washington



## **APPENDIX B: DISCUSSION GUIDE FOR INTERVIEWS WITH DEPARTMENT REPRESENTATIVES**

1. RAND is an independent, non-profit research institution whose mission is to improve policy and decisionmaking through research and analysis. This project is part of RAND's continuing efforts addressing public health emergency preparedness.
2. As our email indicated, we're contacting you as part of a study to identify exemplary practices for public health preparedness and response to emergencies involving chemical and radiological releases. The study is sponsored by US Department of HHS.
3. One way we are identifying practices is by contacting local health and emergency management agencies to find out what practices they may have developed.
4. Our results will be published in a publicly available report. All interview information is being presented on a non-attribution basis—no information will be associated with specific individuals or agencies. We would like to include interviewees' names and affiliations in an appendix to the report.
5. For our study, a practice is any specific program, initiative, or activity that addresses needs or implements guidance related to public health for chemical or radiological incidents. We are interested in systems, methods, or approaches that you have developed or implemented locally.
6. Have you/or your agency experienced or responded to an emergency involving chemical and radiological release?
  - What type of practices did you use in your response?
  - Have you made changes to these practices since the emergency?
7. Do you have any relevant practices that you can describe for us? Relevant practices may cover:
  - Pre-event health risk assessments
  - Monitoring indicators of a release (environmental, syndromic surveillance, other)
  - Coordination with other agencies during response
  - Victim decontamination
  - Map and project footprint and scale of impact
  - Develop medical intervention recommendations
  - Request SNS/CHEMPACK
  - Treat impacted citizens
  - Coordinate sampling and laboratory analysis of samples

- Medical treatment service surge procedures
  - Field investigations and monitoring of people
  - Evaluate health and medical impacts on the public and emergency personnel
  - Assure safe shelters and healthy food and water supplies
  - Public communications
  - Surveillance and epidemiological studies
  - Environmental decontamination, reentry, and recovery of affected areas
  - Establish exposure registry and monitor long-term impacts
8. For each, why do you think it has (or has not) been effective?
9. Please indicate the extent to which each has been
- Demonstrated through experience with actual events, exercises, or other evidence.
  - Permanently implemented and sustained
  - Replicated by other agencies
  - Modeled after some other practice
10. Are there other agencies that we should talk to
- In your local area?
  - Nationwide?
11. Are there any practices or issues that we have not mentioned or you have considered?

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