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TECHNICAL  
R E P O R T

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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

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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.