Chapter 44

PUBLIC HEALTH PERSPECTIVES RELATED TO TECHNOLOGICAL DISASTERS AND TERRORISM

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INTRODUCTION

Disasters are catastrophic events characterized by urgent requirements for relief resources, technical expertise, and other vital services to assist the stricken population.[1] The public health demands associated with disaster response usually focus on the emergency needs of large populations.[2] Technological disasters are events that result from the unexpected release of hazardous materials, including fuels, chemicals, explosives, nuclear materials, and biological pathogens, during their manufacture, storage, transportation, or distribution. Technological disasters may be characterized by explosions, fires, chemical contamination, toxic plumes, radiation exposure, or infectious disease outbreaks.[3,4] (Table 44-1) Many segments of a community's vital infrastructure, such as transportation routes, communications, and water systems, can be affected. The frequency of such disasters is increasing, particularly as societies with limited experience in occupational safety and emergency medical systems rapidly industrialize.[5,6]

Adverse health effects associated with technological disasters include thermal burns, inhalation injury, blast injury, psychological trauma, and illness and injury due to contamination with chemical, radiological, or biological agents.[4,7–9] Long-term environmental considerations following technological disasters may include contamination of surface water, the water table, the soil, and the food chain.[4,10,11] The resulting biological effects from such environmental exposures may not be apparent until years later, when members of the exposed population present with subtle impairments of the nervous system or immune system.[12–15]

Terrorism has been defined as the use or threat of violence to sow panic in a society, to weaken or overthrow its leaders, and to bring about political change.[16] Although the common forms of terrorist acts, such as bombings, assassinations, and hostage taking, have important political and security implications for a nation, the public health impact of these incidents is usually minimal. They are not covered in this chapter. Unfortunately, new, more lethal technologies have made it possible for terrorists to target larger segments of the population.[17–19] Some authors have used the term weapons of mass destruction to convey the public health impact from chemical, biological, or nuclear weapons designed specifically for the purpose of attacking populations.[20]

From the public health perspective, acts of terrorism

TABLE 44-1

A FEW EXAMPLES OF MAJOR INDUSTRIAL DISASTERS

Date	Place	Event	Result
9/21/1921	Oppau, Germany	Explosion at a nitrate manufacturing plant destroyed plant and nearby village	561 deaths; > 1,500 persons injured
4/16/1947	Texas City, Texas	Explosion in freighter being loaded with ammonium nitrate	561 deaths; much of city destroyed
7/28/1948	Ludwigshafen, Federal Democratic Republic of Germany	Vapor explosion from dimethyl ether	209 deaths
7/10/1976	Seveso, Italy	Chemical reactor explosion released 2,3,7,8-TCDD	100,000 animals killed; 760 people evacuated; 4,450 acres contaminated
2/25/1984	Cubatao, Sao Paulo, Brazil	Gasoline leak from a pipeline exploded and burned nearby shanty town	> 500 deaths
11/19/1984	San Juan Ixtaheupec, Mexico City, Mexico	5,000,000 L of liquefied butane exploded at a storage facility	> 400 deaths; 7,231 persons injured; 700,000 evacuated
12/03/1984	Bhopal, India	Release of methyl isocyanate from pesticide plant	> 2,000 deaths; 100,000 persons injured

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with such agents may be considered "intentional" technological disasters. But whether a disaster results from the accidental disruption of an industrial process or from a calculated terrorist act involving weapons of mass destruction, many of the same emergency public health skills will be required for successful response for the stricken population.[21] A multidisciplinary approach that includes professionals such as toxicologists, chemists, microbiologists, laboratorians, industrial hygienists, health physicists, physicians, and epidemiologists will generally be required to mount an effective response to such hazards. This chapter reviews the public health management of technological disasters, focusing on civilian population needs rather than on those of military personnel, although military personnel are often involved in addressing public health and medical contingencies in civilian populations. Chemical, biological, and radiological warfare and the appropriate medical countermeasures involving military personnel are covered in Chapters 27, Chemical Warfare Agents; 28, Biological Warfare Defense; and 29, Medical Response to Injury from Ionizing Radiation.

RISK FACTORS FOR TECHNOLOGICAL DISASTERS

In civilian populations, people from lower socioeconomic levels may be at greater risk from technological disasters because of their more limited access to emergency services and because of the frequency with which hazardous industrial sites are located near low-income residential areas.[22,23] The lack of effective urban zoning regulations and enforcement policies designed to maintain geographic separation between residential communities and industrial sites contributes to this problem.[24] Developing countries are at particular risk for technological disasters. This is largely due to industrial safety problems, including the inability to ensure the proper use of new technology, the underdevelopment of occupational health and the general public health infrastructure, the lack of prehospital emergency medical services, and, in some cases, civil unrest.[25] Nonmedical occupational groups at risk during the emergency response to technological disasters include plant workers, emergency responders, media representatives, and law enforcement officials.

PLANNING FOR TECHNOLOGICAL DISASTERS IN A CIVILIAN ENVIRONMENT

One of history's worst technological disasters involved a nighttime chemical release in the city of Bhopal, India, on 3 December 1984. The toxic agent was methyl isocyanate (MIC) vapor, which was vented into the atmosphere because of a combination of operator error and malfunctioning safety systems within a local chemical plant.[6] MIC is an intermediate product in the manufacture of carbamate pesticides. The toxic plume of MIC covered an area of 40 km^2 and extended 8 km beyond the factory.[26] Because proper warning and evacuation guidance were delayed, many victims first became aware of the disaster as they were overcome by MIC. More than 2,500 people in the adjacent community may have died, and 200,000 people were affected by the chemical release.[8,27] Thousands of victims sought urgent medical assistance, overwhelming local medical services.

The magnitude of the Bhopal disaster exposed a number of vulnerabilities associated with the release of a hazardous agent within a minimally prepared civilian population. In particular, basic disaster management strategies, such as informing the community of the types and quantities of the chemicals stored on the site and ensuring the emergency notification of the nearby population, were incomplete.[8,26] Consequently, many medical personnel and public health officials were unaware of the appropriate treatment options during the initial phase of the emergency response. In addition, poor initial documentation of patients' clinical status, inadequate laboratory sampling, and incomplete epidemiologic studies further limited longer-term relief initiatives and exposure studies.[27,28] Unfortunately, such deficiencies in emergency response activities for technological disasters are widespread in both developed and less-developed countries.[21]

An effective response to disasters such as Bhopal requires the development of a comprehensive and effective local strategy to manage the risk of disasters. It is a collaborative process that requires cooperation between government agencies, private organizations, and the community. Key objectives of disaster planning include the clarification of the capabilities, roles, and responsibilities of the agencies involved and the strengthening of emergency networks. Public health response considerations should be incorporated into local, regional, state, and national disaster plans to ensure the health of populations at risk. For technological disasters, such considerations will include rapid assessment, community notification, mass decontamination, mass vaccination or other medical management, evacuation procedures, and public health surveillance. Disaster plans, including the public health components, should be tested regularly in exercises to evaluate their effectiveness, train personnel, and improve the overall emergency response. Activities to assess and mitigate local risks should be integrated into a program of ongoing disaster management.

During domestic disasters, the US military provides important support as part of the National Disaster Medical System (see Chapter 46, Domestic Disaster Response: FEMA and Other Governmental Organizations).[29] The United States has a well-developed Federal Disaster Response Plan, in which public health professionals play a key role. This system is supported by the involvement of 26 federal agencies, including the Department of Defense, the Department of Veterans Affairs, the Federal Emergency Management Agency, and the Department of Health and Human Services. Unfortunately, many developing countries lack these resources for national disaster response. Within the United Nations system, a number of agencies and organizations may be able to assist such countries following a technological disaster by providing important technical information and services. Some of these agencies are listed in Exhibit 44-1. Military medical officers may need to coordinate relief operations with these organizations within contingency situations involving civilian populations.

EXHIBIT 44-1

UNITED NATIONS ORGANIZATIONS OR PROGRAMS THAT MAY PROVIDE ASSISTANCE FOLLOWING TECHNOLOGICAL DISASTERS

Food and Agricultural Organization

Industrial Development Organization

International Labour Organization

International Programme for Chemical Safety

United Nations Environment Programme

World Health Organization

World Meteorological Organization

As part of their responsibility to protect populations from the effects of industrial disasters, public health professionals should facilitate communication between local clinical services (eg, hospitals, ambulance services), occupational health professionals at the industrial site, and members of the surrounding community.[30] Other technological disaster mitigation activities for public health officials and preventive medicine officers may include the following: (*a*) establishing warning systems to alert nearby communities of a toxic agent release, (*b*) determining minimal threshold concentrations of toxic chemicals, biological agents, or radiation that would require the community to evacuate in the event of a release, (*c*) coordinating evacuation activities following a hazardous release, (*d*) coordinating medical care and appropriate referral destinations for patients exposed to hazardous materials, and (*e*) ensuring the appropriate collection and laboratory analysis of specimens.[6,8]

ASSESSMENTS OF PUBLIC HEALTH AFTER A TECHNOLOGICAL DISASTER

Following the release of a chemical or radiological agent, the adverse health effects associated with that agent may appear rapidly within the population, focusing early attention by health authorities on the task of identifying the responsible toxin or toxins. Public health mitigation procedures, such as evacuation, sheltering in place, and decontamination, can often be initiated quickly, in some cases even without precise knowledge of the hazard. The health effects of other technological disasters, however, may present more insidiously. For example, an infectious disease outbreak secondary to the accidental or deliberate release of a biological agent may be detected only after an unusual infection or clinical presentation has been diagnosed by a physician or identified by routine surveillance activities or an epidemiologic investigation.[4,31]

At other times, it may be unclear if a disease outbreak is due to a chemical or a biological agent. For example, a 1996 disease outbreak in Haiti characterized by fever and renal failure in children was initially believed to be caused by an infectious agent.[32] However, the cause of these deaths was ultimately determined to be poisoning by di-ethylene glycol–contaminated paracetamol, which had been used to control fever in children.[33] The final diagnosis and subsequent public health interventions may have been delayed because of the lack of consideration of a toxic agent. The important lesson learned was the need to consider from the outset the possibility that a chemical or other toxic agent may be responsible for any unusual epidemic. Public health personnel use assessment tools to evaluate the situation and gain the knowledge they will need to make appropriate decisions.

In an emergency, public health assessments of the affected population are used to determine the nature and magnitude of the emergency, the extent or risk of injury to the population, the availability of local resources, and the need for external resources to mitigate the adverse health effects. Several methods of data collection are used during the rapid assessment, including a review of data available through local and government sources, a visual inspection of the affected area, interviews with key informants, and, occasionally, rapid surveys. Results of a well-conducted rapid assessment can be used to formulate public health recommendations and to determine appropriate patient care, such as evacuation, mass decontamination, and administration of antidotes. Established epidemiologic methods used to investigate public health emergencies in a community can be adapted to provide rapid assessment of populations exposed to nuclear, chemical, and biological agents.[34,35] Key operational assessment issues follow.

Obtaining an Accurate History

During the emergency response to a population affected by a technological disaster, the need to rapidly obtain an accurate history of the unfolding disaster cannot be overemphasized. This information should include a review of the type of agent or agents released; clinical presentations; existing laboratory data (eg, human, animal, environmental); and how chemical, biological, or radiological agents were detected or confirmed in the community. These data assist greatly in quickly determining the need for emergency public health interventions, such as evacuation, sheltering in place, pharmacological prophylaxis, or treatment. Often, a basic estimate, such as the number of people killed or ill, is sufficient basis on which public health officials can estimate the magnitude of the event, organize the initial assessments, and determine emergency response options. This information may also alert responders of the need to deploy specialized laboratory equipment and technical teams and to coordinate the transfer of hazardous samples to reference laboratories. After the initial assessment, regular surveillance measures should be instituted and are discussed later in this chapter.

Determining Appropriate Levels of Personal Protective Equipment

Regardless of the cause of the disaster, responders working in a contaminated area, or "hot zone," will require personal protective equipment to protect their skin, eyes, and airways. In most developed countries, occupational guidelines exist to protect workers in stable workplaces from environmental and infectious exposures. When faced with a rapidly unfolding emergency caused by an unknown chemical, biological, or radiological hazard, it is necessary to ensure that responders have the appropriate protective equipment and training.[36] Limitations of physical performance and sensory input due to this equipment can be extreme and require consideration during the planning and coordination process of any assessment mission. Emergency personnel required to wear protection equipment may also be at risk of certain physical and psychological stresses, including dehydration, heat exhaustion, and claustrophobia.

Assessing Clinical Presentations

Some clinical syndromes associated with human exposure to certain biological, chemical, and radiological agents may suggest a specific etiology long before confirmatory laboratory tests are completed. A case definition describing the key clinical and other diagnostic features of an environmental illness or injury should be established early. It may be modified later as more information becomes available. Confirming an increase in the incidence or prevalence or both of a disease or environmental illness may be problematic without baseline public health surveillance information. Some events (eg, an outbreak of pulmonary anthrax, or a case of smallpox) are so unusual, however, as to overwhelmingly suggest the presence of a nonnatural event, such as biological terrorism.

Laboratory Evaluation of the Affected Population

Biological specimens from victims (eg, blood, hair, urine, skin) may be required to determine the type of environmental exposure. Portable monitoring and analytical instruments may assist with the identification and quantification of human exposure from environmental hazards under field conditions. Coordination of the safe and efficient transfer of human samples from the field to appropriate reference laboratories is a key component of the emergency response activities following a technological disaster. This may require cold chain technology to maintain refrigeration or consideration of chain of custody issues as part of an ongoing criminal investigation.

Laboratory Evaluation of the Environment

Specimens of air, water, soil, and munitions should be taken for laboratory analysis. In addition to the identity of the agent, the following information will be important for the public health assessment and response: the quantity of the agent released, the method of its release, the time and location of its release, whether the release is continuing, the prevailing weather conditions, and the location of citizens at risk.[37] In the setting of a chemical, infectious, or nuclear plume, such information can be combined with information from other databases (eg, regional maps, population census) to provide a computer model of the likely path of the plume and an estimate of the population at risk.[38]

Analyzing Data

Data collected from field investigations should be rapidly analyzed to provide information on affected persons and the characteristics of their illnesses. Clinical and laboratory data may be used to refine case definitions further. Information related to the timing of the onset of illness helps investigators detect trends in incidence or prevalence rates. In dealing with the exposure of the population to an unidentified environmental or infectious agent, it may be useful to plot epidemic curves, to compare attack rates in cases and controls, or to represent cases graphically on maps. The information derived from these exercises may help determine a possible etiological agent, other risk factors for the illness, the source of exposure, and the mechanism of exposure. Timely and accurate analysis of the data may help in the rapid development of rational public health and clinical recommendations. Regular surveillance should be instituted as soon as possible to provide reliable information about the changing situation and the effectiveness of interventions.

SURVEILLANCE

Public health surveillance has been described as the ongoing, systematic collection, analysis, and interpretation of important health data.[39] In general, these data are used in planning, implementing, and evaluating public health programs. Following a technological disaster, however, surveillance data can be used to estimate the magnitude of adverse health outcomes, identify groups at increased risk of adverse outcomes, detect epidemics or smaller outbreaks, evaluate public health interventions, and identify research needs.[40]

Surveillance activities usually begin as soon as immediate life-threatening conditions (eg, fire, explosions, chemical spills, plumes) are controlled and after contaminated patients have received appropriate emergency care.[41] In an infectious disease emergency, increased surveillance may be a component of the initial operational public health response to the epidemic. Appropriate surveillance following a technological disaster requires active pursuit of important public health information, such as the collection of clinical data from workers, emergency responders, and community members; the abstraction of information from treatment facilities; the evaluation of medical examiner reports for cause-of-death information; and a review of laboratory results from clinical and technical facilities.[42–44]

Surveillance tasks for health officers also include the institution of disease and injury registries to follow exposed individuals for the appearance of illness or injury over time. Such registries facilitate the recognition of adverse health effects within an exposed population and will suggest directions for long-term population-based studies.[45] For example, victims exposed to radiation may require follow-up for many years to detect complications such as thyroid cancer.[46,47] Individuals from populations sustaining chemical exposures may not present with clinical illness for many years. Table 44-2 lists a number of chemicals that have known late-presenting health effects.[48] In addition to medical illness, psychological complications such as post-traumatic stress disorder, depression, anxiety, somatization, and alcohol abuse have been documented following technological disasters.[8,22,49] Mental health surveillance and outreach programs may be useful in identifying psychological trauma among survivors of and emergency responders to technological disasters.[49] As the situation unfolds and more surveillance data become available, more extensive epidemiologic studies may be undertaken; some of the methods commonly used are discussed below.

TABLE 44-2

EXAMPLES OF LONG-TERM MEDICAL CONSEQUENCES AFTER EXPOSURE TO SELECTED CHEMICALS

Category	Example	Agent
Carcinogenic	Liver cancer	Vinyl chloride
Teratogenic	Cerebral palsy syndrome	Organic mercury
Immunological	Abnormal lymphocyte function	Polybrominated biphenyls
Neurological	Distal motor neuropathy	Triorthocresyl phosphate
Pulmonary	Parenchymal damage	Methyl isocyanate
Hepatic	Porphyria cutanea tarda	Hexochlorobenzene
Dermatological	Chloracne	Polychlorinated biphenyls

Sources: (1) Baxter PJ. Review of major chemical incidents and their medical management. In: Murray V, ed. *Major Chemical Disasters—Medical Aspects of Management*. International Congress and Symposium Series No. 155. London: Royal Society of Medicine Services Limited, 1990: 7–20. (2) Douidar SM, Shaver CS, Snodgrass WR. Hepatotoxicity from hazardous chemicals. In: Sullivan JB, Krieger GR, eds. *Hazardous Materials Toxicology, Clinical Principles of Environmental Health*. Baltimore: Williams & Wilkins, 1992: 109–123. (3) Shields PG, Whysner JA, Chase KH. Polychlorinated biphenyls and other polyhalogenated aromatic hydrocarbons. In: Sullivan JB, Krieger GR, eds. *Hazardous Materials Toxicology, Clinical Principles of Environmental Health*. Baltimore: Williams & Wilkins, 1992: 748–755.

EPIDEMIOLOGIC STUDIES

It is estimated that a complete hazard assessment is available for less than 7% of the most widely used chemical substances,[48] but well-conducted environmental epidemiologic studies can help elucidate adverse health effects following exposures. Case-control studies are useful when the disease or injury is rare. Finding appropriate controls may be difficult, though, when years have passed since the exposure or when confounding influences, such as smoking and increasing age, are present. Case series reports are also useful if there is a limited number of patients but may not be as representative of the effect being studied as better designed studies. In addition, exposure levels may be difficult or impossible to estimate in both case-control and case series studies. Consequently, such studies may not present convincing evidence that a specific chemical exposure is associated with a particular adverse health outcome. Cross-sectional studies may provide an estimate of disease prevalence, but the incidence of a medical condition following an environmental exposure cannot be determined. Cohort studies, while limited in their value when the adverse health outcome under investigation is relatively rare, may be extremely helpful when focusing on high-risk populations such as victims or emergency responders.[50]

One of the major challenges of epidemiologic studies following a technological disaster is quantifying levels of exposure within the population and the environment. Postdeployment epidemiologic investigations of US service members following the Persian Gulf War were hampered by the fact that investigators were often unable to determine preexposure levels of certain toxins or chemicals within the deployed populations. In addition, during the investigation of "agent smoke," the general name given to the byproducts of the burning oil wells in Kuwait that may have contributed to illness among service members, many of the potentially offending chemicals under investigation were volatile organic compounds that are rapidly eliminated from the body. Therefore, any blood samples used to determine serum levels of these compounds would primarily reflect exposure from the preceding day. Exposures at other times may have been significantly higher or lower and would not have been documented by such a sampling methodology.[51]

The difficulties in establishing accurate exposure histories highlight the potential benefit of early involvement of laboratory and epidemiologic services with specialized environmental or toxicological capabilities in protecting service members' health. Baseline toxicological exposure information, such as that derived from physical examinations, serological tests, and mental health screening among those deployed to areas where serious environmental exposures might be encountered, is now being collected on a trial basis during selected deployments. Factors to consider when attempting to quantify a person's or population's level of exposure following a technological disaster include the onset of exposure, the duration of exposure, the route of exposure (eg, inhalation, ingestion, contact with the skin), and in some cases the distance from the source of the release.[52,53]

PUBLIC HEALTH RESPONSE TO TERRORISM

Recent events have demonstrated that in addition to conventional weapons, terrorists now have access to chemical, biological, and, perhaps, radiological materials.[17,18,31,54–57] The sarin vapor release on March 29, 1995, in Tokyo highlighted the insidious nature of terrorism in an urban center using a weapon of mass destruction capable of harming tens of thousands of citizens. Members of the Aum Shinrikyo religious sect coordinated multiple releases of the nerve agent within the city's subway system.[17] The US medical delegation dispatched to Tokyo from the Centers for Disease Control and Prevention (CDC) determined that more than 5,000 people were affected, 12 of whom ultimately died.[58] Although the overall response by the Japanese emergency services was commendable, a number of deficiencies were recognized. These related to assessment issues, the use of personal protective equipment by prehospital and hospital personnel, and therapeutic strategies. Areas identified as needing better planning for the mitigation of the health consequences of such terrorist chemical releases are listed in Exhibit 44-2. Many of these points parallel those from disaster management recommendations for dealing with other, more common hazardous materials.

Consequence management in the health sector refers to those activities designed to control and mitigate the harmful health effects of terrorism on the population. Public health approaches to emergency management, such as evacuation and mass vaccination, become increasingly important when terrorists use the technology of destruction to threaten whole communities. Preparedness for terrorist attacks using weapons of mass destruction has become an important focus for both health professionals and security forces.[31,55,56]

Operational tasks for preventive medicine officers after a chemical, biological, or radiological release include instituting measures to reduce exposures within the population and measures to mitigate the effects of known exposures. Measures to reduce exposure include the use of a public warning and information system to inform the community about the nature of the problem and the actions they can take to protect themselves (eg, retreat to sealed rooms, evacuate, use gas masks).[38,54] Potential means of notifying the public include sirens, loud speakers, radio, television, and door-to-door home visits. Potential mitigation procedures include mass decontamination, vaccination, medical prophylaxis, distribution and use of antidotes, and development of medical treatment strategies.[17,18,38]

During some disasters, the deployment of specialized medical or laboratory teams in operational support of civilian populations may be required. Although the Ebola hemorrhagic fever outbreak in Zaire in 1994 is thought not to have been the result of terrorism, the event exposed some of the limitations in the civilian medical sector's ability to respond to technological disasters involving biological agents. Such limitations included difficulties in fielding a proper containment laboratory, coordinating medical logistics, and evacuating relief workers who contract the virus. Interagency cooperation between the CDC and components of the Department of Defense (eg, the US Army Medical Research Institute of Infectious Diseases) mitigated some of these

EXHIBIT 44-2

IMPORTANT EMERGENCY RESPONSE PLANNING ISSUES THAT WERE IDENTIFIED FOLLOWING THE SARIN VAPOR RELEASE IN TOKYO, 1995

Chemical agent detection

Toxicological information dissemination

Environmental epidemiology

Personal protective equipment training

Decontamination procedures training

Emergency medical services enhancement

Source: Lillibridge SR. Sarin vapor attack on the Japanese subway system: Report of the US Medical Delegation to Japan. Atlanta: Centers for Disease Control and Prevention; April 1995. Trip Report.

TABLE 44-3

ASSESSMENT UNITS COLLOCATED AT THE SCIENCE AND TECHNOLOGY CENTER, ATLANTA, GEORGIA, DURING THE 1996 OLYMPICS

Type of Assessment	Assessment Unit
Biological Assessment	Centers for Disease Control and Prevention*
	Environmental Protection Agency*
	Food and Drug Administration*
	Navy Medical Research Institute
Chemical Assessment	Agency for Toxic Substances and Disease Registry*
	Centers for Disease Control and Prevention*
	Environmental Protection Agency*
	US Army Research and Materiel Command Treaty Verification Laboratory
	US Coast Guard Atlantic Strike Force
Radiological Assessment	Centers for Disease Control and Prevention*
	Environmental Protection Agency*
	Food and Drug Administration*

*Selected technical staff, or laboratories, or both

deficiencies and contributed to successful management of the emergency public health issues associated with the Ebola outbreak. In addition, US military health personnel were successfully integrated into the World Health Organization and the CDC outbreak investigation teams, providing important epidemiologic, laboratory, and technical support.

During the 1996 Olympics in Atlanta, the multidisciplinary Science and Technology Center was established to manage the public health consequences of an act of terrorism involving weapons of mass destruction.[59] The Center, which was located at the CDC, was charged with coordinating rapid assessment and public guidance in the event of a terrorist attack with a nuclear, chemical, or biological agent. Multiple federal agencies and components of the Department of Defense were collocated at the Science and Technology Center (Table 44-3). Personnel and assets from other federal agencies, such as the Department of Energy, the US Marine Corps Chemical Biological Incident Response Force (CBIRF), the US Army Medical Research Institute of Infectious Diseases, the US Army Medical Research Institute for Chemical Disease, and the US Army Technical Escort Unit, were staged throughout Atlanta to support the overall federal emergency response to a terrorist incident. Coordination of all federal assets was organized through the Federal Bureau of Investigation as the lead US agency in combating terrorism. Military medical personnel provided the critical liaison between the civilian medical community and the military tactical response units that had been deployed in support of health consequence management.

The experience in Atlanta demonstrated that an all-hazards approach to rapid assessment involving chemical, biological, or radiological terrorism and to the development of public health recommendations requires significant planning and interagency coordination. Activities that required daily review included appropriate collection of samples, procedures for alerting the civilian population, appropriate routing of specimens to reference laboratories, rapid development of public health advice following an event, and development of the method by which agencies would report their results to an appropriate coordination point of the lead agency.

SUMMARY

Technological disasters, whether caused by accidents or terrorism, are becoming increasingly common,[5,60] and the environmental or infectious consequences of these events may not stop at the borders of the nation immediately affected.[47] Urgent preventive medicine responsibilities associated with technological disasters include rapidly assessing and quantifying chemical and radiological exposure levels and, given the new developments related to the potential for biological terrorism, detecting infectious disease outbreaks within the population.[4] These investigations may require skills from many allied health fields, such as pathology, laboratory science, toxicology, and environmental and occupational health. No single civilian institution or military unit offers the range of skills and equipment required to mitigate the adverse health effects in service members, as well as in civilian populations. Recent events have shown that the need for organizational collaboration will likely increase, if not become indispensable, as new and complex technical threats are identified.

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