

The Public Health Service Role in the Disposal of Chemical Munitions

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Synopsis

Within the last decade, the Centers for Disease Control (CDC) has increasingly emphasized environmental public health activities. The Center for Environmental Health (CEH), one of nine major units of the CDC, was established as a focus for

assessment and prevention of environmentally related diseases.

Many new, legislatively mandated programs have been delegated to CEH. One such mandated responsibility in Public Laws 91-121 and 91-441 directs the Department of Health and Human Services or its designee to review the Department of Defense (DOD) plans to dispose of or to transport chemical warfare agents.

The Chemical Munitions Demilitarization Program, CEH, reviews DOD plans and makes recommendations to ensure that hazards to public health and safety have been provided for in the plans. In addition, these CEH staffers periodically review approved activities at DOD facilities, assessing their monitoring and evaluation programs. CEH staffers also contact State and local health and environmental agencies to identify and evaluate any concerns of the agencies or the public relating to these activities.

WITHIN THE PUBLIC HEALTH SERVICE, the Centers for Disease Control (CDC) has emphasized preventive activities and health promotion efforts. Most of these activities are well known in the public health community and are also known to the public because of coverage by the mass media. CDC's responsibility to review Department of Defense (DOD) plans to destroy or transport chemical warfare agents is, however, not well known. To ensure greater awareness of this program by the public health community, we describe the basis for this function and the activities undertaken.

Background

Use of infective or toxic weapons in war dates back to ancient times (1). Early biological warfare efforts included contaminating drinking water by placing human or animal corpses in the drinking water supplies. Diseased corpses were deliberately left in areas soon to be occupied by the enemy in an attempt to disable the enemy with infections.

Although chemical and biological warfare has a long history, today's form has a much shorter history.

Modern chemical weapons were first employed during World War I, when they were used by most belligerents (1). Although these weapons were used extensively, they had a relatively minor impact on the war because (a) the agents lacked toxicity, (b) delivery methods were rudimentary, and (c) technology for defense against the agents developed rapidly. Since that time, enormously more potent chemical agents and more effective delivery systems have been developed, produced, and stockpiled.

Modern biological weapons ("germ warfare") were not developed until the early years of World War II. Biological weapons have never been used in warfare; thus, these are unproven weapons with enormous destructive potential.

"Chemical agents" of warfare have been defined as substances employed for their toxic effects (2). "Biological agents" of warfare include those that multiply within the target host and are intended to cause disease. Both types of agents are subclassified as "lethal," "incapacitating," or "harassing," depending upon whether they are intended to kill, to cause prolonged disease or disability, or to rapidly produce a transient disability.

International Agreements

The Geneva Protocol of 1925, to which all major nations are now parties, prohibits the use in war of "asphyxiating, poisonous, or other gases and of all analogous liquids, materials, and devices" as well as "bacteriological methods of warfare" (3). Many nations accept this protocol as absolute in its meaning. Other countries, including the United States, Britain, France, China, and the Soviet Union, interpret the protocol to mean a no-first-use agreement and hold in reserve the right to use such weapons if they are first used by an adversary (4). The United States and France are the only members of the North Atlantic Treaty Organization that have significant military stockpiles of chemical weapons.

The Biological and Toxin Weapons Convention of 1972 bans research, production, and stockpiling of biological agents for use as offensive weapons (5). This convention has been endorsed by many nations, including the United States. As a result, in 1972 this country destroyed its stockpiles of biological weapons and reduced research activities to a limited, defensively oriented program aimed at individual protection, alarms, and antidotes.

Chemical Agent Disposal

Chemical weapons stockpiles in the United States expanded from the mid-1950s to the early 1960s, reflecting chemical warfare policies. These stockpiles were thought to have reached nearly 40,000 tons of chemical agents (6).

During the past two decades, the Army has increasingly emphasized programs to dispose of obsolete or unserviceable chemical agents and agent-filled munitions. Since agent-filled munitions were designed with shelf lives of 20 to 30 years, munitions made in the 1950s and 1960s are becoming obsolete. In addition, weapon delivery systems have changed, rendering older munitions increasingly obsolete.

Storage of chemical agents is expensive because careful physical security must be maintained, storage sites must be monitored for leakage of chemical agents, and containers must be continually maintained. While these agents are stored, they are a potential health hazard for those who work with or near these materials and for populations living or working near such storage sites. With time, corrosion of munitions and containers poses increasing risks of agent leakage, although these risks are thought to be quite small. As a result of all these factors, disposal of chemical agents and munitions has received greater attention and resources during the past decade.

Disposal of chemical munitions evolved from open-pit burning or sea dumping to, more recently, either chemical neutralization or incineration of these agents. In 1969, the Army proposed to dispose of certain obsolete chemical agents and munitions by sea dumping, as had been done numerous times in the past. However, the public expressed significant concern about (a) potential hazards involved in transporting these materials to the designated ports and (b) the potential effects these chemical agents would have if they accidentally leaked into the sea. The Army ceased this disposal activity and asked the National Academy of Sciences to review the disposal plans and recommend alternatives.

The Academy's ad hoc advisory committee noted in its 1969 report (7):

It should be assumed that all such agents and munitions will require eventual disposal and that dumping at sea should be avoided. Therefore, a systematic study of optimal methods of disposal on appropriate military installations, involving no hazards to the general population and no pollution of the environment, should be undertaken. Appropriately, large disposal facilities should be required counterpart to existing stocks and planned manufacturing operations. As the first step in this direction, we suggest the construction of facilities for gradual demilitarization and detoxification

Also in 1969, a report was published of an epidemic in Skull Valley, Utah, that affected more than 6,000 sheep and caused the death of about 4,500 sheep (8). Illness in these animals was traced to organophosphate contamination of their forage. Just before this epidemic illness, routine open-air testing of a chemical warfare agent had occurred at the Dugway Proving Ground, about 40 miles from the affected sheep herds. The investigators postulated that unusual meteorological conditions may have spread this chemical agent to the Skull Valley site.

Legislation and Responsibility

The National Academy of Sciences' recommendations and the public's concern about open-air testing, transportation, and disposal of chemical warfare agents led Congress, in 1969, to modify the military procurement appropriations acts. Public Law (PL) 91-121, later amended by PL 91-441, directed the Secretary of Defense to alert the Secretary of Health, Education, and Welfare (now Health and Human Services) whenever transportation, testing, or disposal of biological agents or lethal chemical agents is necessary for national security. Before any such actions by the Army, the Secretary of HHS, or a designee, must review the plans with

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respect to any potential hazards to public health and safety that such transportation, testing, or disposal may pose. The Secretary of HHS or a designee must recommend precautionary measures needed to protect the public health and safety and must transmit these recommendations to the Secretary of Defense or a designee.

Within HHS, responsibility for this review process was delegated to the Surgeon General of the Public Health Service and subsequently, by the Surgeon General's Office, to the Centers for Disease Control's Center for Environmental Health. CEH has been responsible for the program since September 1983.

Chemical Agent Transportation and Disposal

Since PL 91-121 and PL 91-441 were passed, HHS has reviewed all DOD plans to transport or dispose of chemical warfare agents. These programs are also reviewed periodically to ensure that they continue to be operated in a safe manner.

Since 1970, five chemical agent transportation activities have been completed by the Army without incident. By far the most significant of these was moving bombs containing nerve agent from Colorado to Utah. In 1973, the DOD decided to remove chemical warfare materials stored at Rocky Mountain Arsenal, located on the outskirts of Denver. By 1978, the only such materials remaining at Rocky Mountain Arsenal were the chemical-agent-filled "Weteye" bombs. In this project, about 900 bombs were transported in 1981 from Rocky Mountain Arsenal to Tooele Army Depot, Tooele, Utah, for continued storage. Transportation modes included truck convoys from the arsenal to Stapleton International Airport; C-141 air cargo planes from Stapleton to Michael Army Airfield, Dugway Proving Ground, Utah; and finally truck convoys to Tooele Army Depot. Before the project was approved by HHS and the States affected by the

transportation, it received considerable public attention.

Lethal chemical agent disposal facilities operated at the Rocky Mountain Arsenal between 1970 and 1976. In these operations, 4.2 million pounds of nerve agent contained in munitions were destroyed and an additional quantity of 4 million pounds of bulk nerve agent was destroyed (9). Mustard agent was also destroyed at this arsenal. After these disposal efforts, remaining munitions were transported to Tooele, leading to closure of this chemical agent storage site.

Two chemical munition disposal facilities are currently operated by the Army. A highly sophisticated facility, the Chemical Agent Munitions Disposal System (CAMDS), is located at Tooele Army Depot (10). The plant is an industrial-scale prototype facility designed for development and demonstration of advanced procedures and equipment for large-scale disposal of lethal chemical agents and munitions. Prototype disposal equipment, monitoring devices, and containment facilities are initially tested at this plant, modified, and retested to make them more suited to future operations. In addition to this operational research activity, the plant is also intended for the disposal of unserviceable chemical agent munitions stored at the Tooele Army Depot.

Since 1978, different types of munitions have been destroyed at the CAMDS facility, and bulk quantities of chemical agents have been rendered harmless there (table 1). In the past, the nerve agent GB was destroyed by chemical neutralization at this facility. Various destruction options, however, have been evaluated for their suitability. Research and development experiences suggest that the current method of choice for destroying agents is incineration, because the agents are destroyed rapidly and irreversibly (11). Accordingly, the CAMDS facility has been modified so that agents are now destroyed by incineration without insult to the environment or hazard to human health.

Another disposal facility is a mobile, self-contained system called the Drill and Transfer System (DATS) (12). DATS is a small-scale mobile field system designed to be moved from one Army depot to another and to process small quantities of defective chemical agent munitions. In the DATS operation, the nerve agent is not destroyed. Instead, the chemical agent is merely separated from the explosive of the munition by drilling holes in the round and then draining or transferring the chemical agent into a holding container. The munition can then be safely detonated while the agent is stored until it can be destroyed by either incineration or neutralization. The main component of this system is a large

Table 1. Chemical agent disposal activity at CAMDS,¹ Tooele, Utah, 1979–84

Munitions or containers	Number disposed of	Amount of chemical agent destroyed (pounds)	
		By neutralization	By incineration
M55 rockets GB	13,951	127,940	...
Projectiles GB	19,631	54,000	17,570
Bulk agent GB			11,204
Bulk agent VX			6,661

¹ Chemical Agent Munitions Disposal System.

glove box designed to prevent leakage of the chemical agent into the environment by use of differential pressure and filter systems. Equipment to drill the munition and transfer the agent is fixed within the glove box; after the munition is manually placed and aligned, these steps are carried out by remote control. The DATS also includes chemical analysis and monitoring facilities, a control room, and other support services.

DATS has been installed and operated at five sites and is scheduled to visit three other depots during the next 2 years (table 2). More than 500 chemical agent bombs, rockets, projectiles, and land mines that were leaking or corroded have been destroyed. Since DATS processing occurs immediately adjacent to storage areas, potential hazard from movement of these deteriorated munitions is minimized.

CDC Activities

Before any chemical agents are transported or disposed of, the Department of the Army submits an operational plan specifying the procedures, equipment, and personnel to be used and the types of agents and munitions involved. The Centers for Disease Control reviews this written document and, if necessary, calls on experts from the Public Health Service or elsewhere. In addition, CDC staff conduct site visits to survey the layout of the facility, its proximity to human populations, and monitoring stations to detect potential escape of chemical agents. The past performance of the chemical analytical laboratory is reviewed, and its ability to rapidly detect any agent release is assessed. Medical care provisions on and off base are evaluated. Disaster plans for the surrounding area are reviewed to ensure that civil defense plans and military facility plans are integrated, including provisions for movement of and care for potential casualties.

After its review, CDC submits a memorandum to the Department of the Army conveying its recom-

Table 2. Chemical agent munitions processed by Drill and Transfer System (DATS), 1978–present

Site	Period	Number of munitions
Dugway, UT (pilot site)	February 1978–October 1979	57
Pine Bluff, AR	March 1981–August 1981	39
Anniston, AL	October 1981–August 1982	200
Lexington, KY	November 1982–August 1983	163
Umatilla, OR	Fall 1983–present	197
Pueblo, CO	Planned for late 1985	
Edgewood, MD ..	Date unknown	
Dugway, UT (repeat visit) ...	Date unknown	

mendations to protect human health. After these recommendations are incorporated into the final plans, the Army notifies Congress of the plans and of HHS concurrence. When transportation of chemical agents is planned, the governors of States through which such agents will move are notified.

CDC, as part of its continuous oversight activities, is notified of any changes in the planned disposal operations. Thus, for example, when plans are modified, reflecting the need to dispose of chemical agents or munition types other than those specified in the approved plan, CDC is notified. CDC recommends to the Army any additional measures necessary to ensure public health and environmental safety, and these measures are incorporated into the modified plans before operations are renewed.

If an agent monitoring system is activated during disposal operations, operations are automatically stopped and CDC is notified. CDC then evaluates this event to identify its cause. After any problems are resolved, operations resume.

To help protect the public's health, CDC personnel meet with State and local health and environmental officials to review the oversight program, solicit input, and coordinate related activities. Pertinent health literature and public health data are identified, reviewed, and summarized. Public meetings and other forums are sought to clarify CDC's

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functions and to review relevant activities undertaken.

Other Legislation

In addition to its responsibilities under PL 91-121 and PL 91-441, CDC reviews environmental impact statements (EIS) prepared under PL 91-190, the National Environmental Policies Act. Under this law, EIS documents are prepared for all new construction projects receiving major Federal funding. CDC reviews under this law focus on human health concerns arising from the construction activities or operation of the project itself. The originating agency is provided comments and prepares a final EIS, incorporating changes, reflecting these comments, that mitigate adverse effects on human health. Thus, new facilities planned by the Army for chemical agent disposal are reviewed under three separate public laws.

Discussion

Within the Public Health Service, the CDC has major responsibility for health promotion and prevention activities. Recently, these activities have expanded to encompass responsibilities to review plans for disposal, transport, or open-air testing of chemical and biological warfare agents. Since no biological warfare agents remain in the United States, the scope of this responsibility is now limited to chemical warfare agents. Furthermore, no open-air testing of chemical warfare agents has been performed since PL 91-121 and PL 91-441 were passed. Thus, the CDC responsibility is now focused on plans to transport or dispose of lethal chemical agents.

Activities under these public laws led to the disposal of more than 8.5 million pounds of lethal chemical agents and destruction of the biological warfare agent stockpile without loss of life or per-

manent injury. Anticipated future disposal activities will destroy a further 5 million pounds of lethal chemical agents. CDC will continue to evaluate these plans for their provisions for worker and public safety and for environmental protection as it may affect human health. In addition, the systems developed to review these disposal projects periodically will ensure, insofar as possible, that they continue to operate in a safe manner.

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