



Responding to a Changing World

Public Health, Law, and Local Control: Destruction of the US Chemical Weapons Stockpile

Michael R. Greenberg, PhD

Destruction of US chemical weapons has begun at one of the 8 sites in the continental United States, was completed on Johnston Island in the Pacific Ocean, and is scheduled to begin in at least 3 other locations during the upcoming year. About 25% of the stockpile and 38% of the munitions had been destroyed as of December 31, 2002.

However, the program has become controversial with regard to choice of technology, emergency management, and cost. This controversy is in large part due to efforts by some state and local governments and activist groups to play a more central role in a decisionmaking process that was once fully controlled by the US Army.

IN 1985, PUBLIC LAW 99-145 directed the United States Army to dispose of its aging stockpile of chemical warfare agents within a decade as a result of fears that portions of the stockpile could self-ignite or be detonated by an accident, thus posing a danger to soldiers, workers at stockpile sites, and nearby residents.¹ In light of the growing concern in the United States regarding weapons of mass destruction and the difficult political control issues involved in destroying the

US stockpile, this program has become controversial.

CHEMICAL WARFARE AGENTS AS A PUBLIC HEALTH HAZARD

The US stockpile consists primarily of organophosphorous nerve agents and vesicants, mainly blistering agents (Table 1).²⁻⁵ The 31 500-metric-ton stockpile has been stored at 8 continental US sites and on Johnston Island in the Pacific Ocean (Table 2). Degree of risk varies according to site. One factor is the number of weapons housed at a given site. The Tooele (Utah) site houses 13 600 metric tons, as compared with only 523 metric tons at the Lexington–Blue Grass (Kentucky) site. Amount of weaponry does not always translate to risk, however. About 60% of the stockpile has been stored in bulk containers (called “ton” containers), similar to tanks used for storing propane. These containers house no explosive devices or fuel assemblies, and so they are the least dangerous part of the stockpile.

About 40% of the weapons consist of more dangerous artillery projectiles, cartridges,

bombs, land mines, mortar rounds, and spray tanks. Explosive elements and fuel assemblies are attached to some of these weapons, and hence they could be detonated either accidentally or deliberately. Much but not all

of the aging stockpile is stored in earth-covered bunkers called “igloos.” These igloos are not impregnable and could, in certain scenarios, be breached.

Risk depends not only on inherent hazard, amount and type

TABLE 1—Major Chemical Warfare Agents

Type of Agent	Symptoms and Health Effects
Respiratory agent: Phosgene	Difficulty breathing, tearing of eyes, damage to and flooding of lungs, suffocating, death; timing is immediate to 3 hours
Nerve agents	Potent cholinesterase inhibitor; difficulty breathing, sweating, drooling, convulsions, dimming of vision; incapacitates at low concentrations, kills at sufficient dosage; timing for vapors is seconds to minutes; skin effects at 2–18 hours
GA (tabun)	
GB (sarin)	
GD (soman)	
GF (cyclosarin)	
VX	
Vesicant agents	Blisters develop in hours to days; eyes and lungs affected more rapidly; timing for vapors is 4 to 6 hours; skin effects at 2–48 hours
H (mustard with impurities)	
HD (mustard)	
HN (nitrogen mustard)	
Lewisite	
Blood agents	Rapid breathing, convulsions, and coma; kills at sufficient doses; nonpersistent, inhalation hazard, immediate effects
AC (hydrogen cyanide)	
CK (cyanogen chloride)	
CN (salts of sodium, potassium, calcium)	

Note. Data were derived from references 2–5. GA (tabun) = N,N-dimethyl phosphoramidocyanidate; GB (sarin) = methylphosphonofluoridate isopropyl ester; GD = pinacolyl methyl phosphonofluoridate; H/HD (mustard) = Bis (2-chloroethyl)sulfide; HT (mustard) = Bis 2(2-chloroethylthio)ethyl ether; VX = S(diisopropylaminoethyl)methylphosphonothiolate o-ethyl ester.



TABLE 2—Distribution of Unitary Chemical Weapon Stockpile, by Storage Location

Site	Metric Tons of Original Stockpile (1000s)	Chemical Agent(s)	Form of Munition	Destruction Technology	Percentage of Agent Destroyed as of December 31, 2002	Status of Construction of Destruction Facility
Tooele, Utah	13.6	H/HD/HT, GB, VX	C, P, TC, R, B, M, ST	Incineration	44	Operational
Pine Bluff, Ark	3.9	HT/HD, GB, VX	TC, R, M	Incineration	0	98%
Umatilla, Ore	3.7	HD, GB, VX	TC, P, R, B, M, ST	Incineration	0	100%
Pueblo, Colo	2.6	HT/HD	C, P	Hydrolysis/biotreatment	0	0%
Anniston, Ala	2.3	HT/HD, GB, VX	C, P, TC, R, M	Incineration	0	100%
Johnston Atoll	2.0	HD, GB, VX	C, P, M, TC	Incineration	100	Operational
Aberdeen, Md	1.6	HD	TC	Hydrolysis	0	85%
Newport, Ind	1.3	VX	TC	Hydrolysis	0	28%
Blue Grass, Ky	0.5	HD, GB, VX	P, R	Hydrolysis/supercritical water oxidation	0	0%
Total	31.5	25	...

Note. See Table 1 for description of warfare agents. TC = ton containers; R = rockets; M = mines; ST = spray tanks; B = bombs; C = cartridges, mortars; P = projectiles. Data were derived from reference 2 and the author's files.

Another concern was that the United States would not be able to prevent other countries from demanding inspections, during which industrial espionage was possible.⁸⁻¹¹ An alternative proposal was for the United States to destroy its own weapons, which it was already beginning to do, or sign a treaty with the Soviet Union, which it did in 1990. According to this treaty, stockpiles were to be reduced by more than 80%, production of weapons was to cease, and information on disposal methods and technology was to be shared.

The UN treaty required that the 1% of the most dangerous weapons be destroyed by April 29, 2000. In fact, 15% of the US stockpile had been destroyed by that date, whereas Russia, which has a stockpile of approximately 40 000 metric tons, did not meet the year 2000 deadline owing to a lack of funds.¹² Nevertheless, by signing the international treaty in 1997, the United States obligated itself to destroying the entire stockpile by April 2007, with the possibility of a 5-year extension.

The final critical legal requirement is for Congress to monitor progress toward destruction of the stockpile. However, technical oversight is also legally mandated, and the organizations involved in this oversight include the National Research Council, the US Department of Health and Human Services, the Centers for Disease Control and Prevention (CDC), the Environmental Protection Agency (EPA), the Council on Environmental Quality, the Occupational Safety and

of munition, and protection of stored weapons but also on fate and the transport characteristics of the agents and their degradation products. Protocols and guidelines seek to minimize occupational and environmental health exposures. For example, with regard to workers, air inside the destruction facility, outdoor air quality, stack exhaust, decontamination solution, fuels, use of protective suits, and equipment all must be tracked and managed.^{4,5}

The population at risk is another key element in the risk equation. Most of the weapons are stored in remote locations. For example, all of the occupants of Johnston Island were military personnel or worked on the island. Tooele has a large share of the weapons, and some farms and homes are within 10 miles (16 km) of the site, but the nearest population center is Salt Lake

City, more than 50 mi away. The riskiest situation involves the Pine Bluff (Ark) site, where homes are within a mile of the site. Phase 1 risk assessments at each site point to storage risk as superseding the risk of destroying the weapons. For example, estimates indicated a probability of one or more public fatalities in 20 years of continued storage at the Pine Bluff site at 1 in 33, as compared with 1 in 20 000 in the case of incineration of the weapons.^{6,7} These risk estimates are based on conservative assumptions that may not materialize, but they underscore the desire of some, including myself, to destroy the weapons as soon as possible.

TREATIES, LAWS, AND POLICIES

Congressional action to destroy the weapons in 1986 was

sparked by the concern that the probabilities of leaking and of a serious accident increase as the stockpile ages. Furthermore, risk analyses show that external events, such as earthquakes, lightning strikes, and, recently, terrorism, have become credible concerns. In addition, the United States has been involved in international negotiations regarding chemical weapons for more than 75 years, signing the Geneva protocol of 1925 and the 1972 chemical weapons agreement. Neither addressed verification of weapon destruction, but a 1993 United Nations convention did include such verification. The United States signed the UN treaty in January 1993, but the Senate did not ratify it until 1997, and then only after considerable debate. Rogue nations, it was feared, would not sign or would sign and violate the treaty.



Health Administration, the Office of the Secretary of the Defense, and state and local government agencies.

Moreover, section 172 of Public Law 102-484 (October 23, 1992) and subsequent amendments require the establishment of citizen advisory commissions, the role of which is to report state and public concerns about disposal to the Army and promote public involvement, at each of the 8 continental US sites.¹³ Each of these groups comprises 9 members, including prominent citizens, activists, and scientists, appointed by the state governor. The groups include 7 members from the site region, and they are required to meet at least twice yearly. On the basis of my observations of these commissions, they meet far more often than required, and members openly express their concerns and viewpoints. All of the organizations just mentioned have played a growing role in policy decisions.

PROGRAM CONTROVERSY

The destruction program has become controversial, which I attribute to loss of centralized control by the US Army in favor of a much more participatory decisionmaking process that includes the states, local governments, and special interest groups as well as other federal departments and agencies. Space limitations preclude a full discussion of all of the issues involved; however, I provide an illustration by way of focusing on the areas of technology, emergency planning, and cost.

Technology

Up until the 1970s, the Army disposed of its obsolete munitions by burning them in open pits, by burying them, or through ocean dumping. During the 1970s, however, the Army began to investigate incineration and neutralization as means of destroying weapons. In 1990 incinerators were built on Johnston Island, a military facility located in the Pacific Ocean about 750 mi from Hawaii, and then at Tooele, Utah. Incineration has been supported by EPA, the National Academy of Sciences stockpile disposal committee, CDC, and others. These organizations believe that incineration is the safest technology because it has been used many times and can be implemented in a relatively rapid manner (approximately 5 years are required for construction and permits). In my opinion, incineration was the Army's technology of choice when it controlled the decision-making process.

Incineration has been criticized by certain local citizens groups, certain national activist groups (most notably the Chemical Weapons Working Group), and certain elected officials. They assert that incinerators could malfunction, leading to discharge of a lethal agent; that they produce toxic by-products; and that leaks have occurred at the stockpile sites. Whistleblowers have asserted that the Army has covered up mistakes and mismanaged the program, and the Chemical Weapons Working Group, in conjunction with other organizations, filed an

environmental justice complaint with the EPA asserting that the Army was not fulfilling its mandate by opting for incineration.

Opponents of incineration have argued for alternative technology. In 1993, Congress asked the Army to investigate alternative technologies. Subsequent reports published by the National Research Council suggested that most of the alternative technologies were at least as risky as incineration but that neutralization (notably hydrolysis) could be used, especially at the sites (Newport, Ind, and Aberdeen, Md) where the stockpile was housed in ton containers.^{14,15} After considerable debate, incineration was chosen as the main technology at the 5 sites with the most stockpile and the greatest variety of ordnance; hydrolysis, supported by other technologies, will be used to destroy the residual materials at the other 4 sites (Table 2).

Emergency Planning and Management

While the struggle over technology unfolded, emergency planning and management became a second area of dispute over control. Congress directed the Army and the Federal Emergency Management Agency (FEMA) to create a chemical stockpile emergency preparedness program to assist states in developing emergency response capacity at the weapons sites. While the program is under Army oversight, FEMA plays a critical role in working with the states, which in turn work with counties. This was intended to be

a simple management process, but it has been anything but. The program has been jeopardized at sites where FEMA, the state government, and local governments have been unable to work together; Anniston (Alabama) is the most prominent example.

In 1996, at the request of Alabama Representative Glen Browder, the General Accounting Office (GAO) investigated the readiness of the Anniston region for an emergency event. GAO reported that the site was not prepared, that two thirds of the money already allocated had not been spent, and that the Army, FEMA, and the state and local governments were in disagreement regarding fund amounts and allocation.¹⁶ Two subsequent GAO reports published in 1997 and 2001 continued to detail problems, especially at Anniston.^{17,18} The emergency management control debate has economic and possibly serious public health consequences. The \$1 billion Anniston incinerator is complete. However, Governor Siegelman of Alabama asserted that he would not grant a final state permit to operate the site until emergency preparedness issues had been resolved.¹⁹ Although these issues have, in fact, been temporarily resolved, I believe that disputes related to both emergency management and technology will continue in the areas of control and cost.

Cost Management

In 1985, the cost of the chemical weapons disposal program was estimated at \$1.7 billion.²⁰ Having followed the events asso-



ciated with this program for more than a decade, I cannot conceive of the program, as currently planned, costing less than \$20 billion. The typical reasons given for possible increases in cost are management failures (e.g., unclear accountability and lines of authority), lack of coordination, poor record keeping, and inadequate communication.^{16,17} The argument that there have been management problems certainly has some validity, but other issues are involved. For example, some munitions were difficult to disassemble, and there were more leaking weapons than had been anticipated, leading to careful, time-consuming overpacking of weapons before their destruction.

In my opinion, decentralization of decisionmaking, rather than mismanagement, explains the failures of the budget to remain proximate to the original estimate. If the Army had maintained full control of the program (which, as mentioned, it did not), a larger proportion of the weapons would have been destroyed by now. State and local officials continue to ask for and receive more financial support in regard to, for example, issuance of protective gear, including gas masks; overpressurization systems for local schools, which would be used as shelter in case of a release; widening of roads near sites to support evacuation; and even economic impact fees to support strains on education, transportation, sewage, solid waste, parks, housing, welfare, and police and fire departments.

DISCUSSION

In terms of cost-effectiveness, destruction of the US chemical weapons stockpile represents a large expense per dollar invested in the protection of the public's health (similar to the case with many high-consequence, low-probability risk management programs). I believe that the poor management charge aimed at the Department of Defense and FEMA is too simplistic and misses the point of what has taken place with regard to the chemical weapons destruction program. If these organizations are guilty of anything abnormal for government agencies, I believe it is the naive belief that it was possible to centrally control a program designed to destroy lethal weapons without substantial input from the states, local governments, and activist groups.²⁰ The Army and FEMA did not expect the baseline incineration technology to be so aggressively opposed; they did not expect FEMA's programs to be a problem; and they did not expect a request for impact fees and other economic add-ons. Most notably, they did not expect that what they thought was a series of technology decisions would be turned into a clash of values and morality in which they would be portrayed as not doing everything possible to protect the public's health.

Although public input into the decisionmaking process regarding the disposal program may be reduced because of national security concerns, state and local governments and citizen activists

are not going to back off in their criticisms. Technology choices will continue to be scrutinized, and emergency planning will certainly continue to be an issue until the moment at which the last weapon is destroyed. The issue of whether new weapons will be brought to the sites will remain highly controversial, and the issue of site closure, I predict, will become as controversial as any other. The Army has gone on record in stating that it will not pay for the cleanup necessary in making subsequent land use changes.²¹ This decision will raise the ire of local communities that want the former weapons sites turned into new businesses, recreation areas, or housing developments. Communities will argue that the Army has a moral commitment to clean up the sites because of the stigmatizing effect of these weapons stockpiles.

It is still possible that 80% or more of the stockpile will be destroyed by 2007, even with the delays that have occurred, and that the remainder will be destroyed by 2012. Frankly, however, it is time for the struggle for control to be set aside. The parties involved are playing roulette with the public's health. There is no acceptable reason, other than politics, for there not to be a functioning emergency planning program at each site. Nor is it acceptable for the incinerators that have been constructed at 4 of the sites not to be used to destroy those stockpiles, unless they are shown to fail trial tests. Even if they rise to the hundreds of millions, it is

well worth the extra emergency planning and economic impact costs (primarily in relation to personnel and equipment) to rid the United States of this human pesticide scourge while we turn our attention to preventing the same weapons from being used against us by terrorists and rogue nations. ■

About the Author

The author is with the Department of Urban Studies and Community Health, Bloustein School of Planning and Policy, Rutgers University, New Brunswick, NJ.

Requests for reprints should be sent to Michael R. Greenberg, PhD, Department of Urban Studies and Community Health, Bloustein School of Planning and Policy, Rutgers University, 33 Livingston Ave, Suite 100, New Brunswick, NJ 08901-1958 (e-mail: mrg@rci.rutgers.edu).

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