Chapter 2
The Army's Chemical Weapons Disposal Program

THE U.S. ARMY'S CHEMICAL WEAPONS STOCKPILE

Geography and Distribution

The chemical weapons (CW) stockpile is located on Army bases at eight continental U.S. sites (see figure 2-1) and at Johnston Island in the Pacific Ocean (717 nautical miles southwest of Hawaii). It is distributed as follows (by percentage of chemical agent):

Site location	Percentage of total
Tooele Army Depot, UT,.	42.3
Pine Bluff Arsenal, AR.	12.0
Umatilla Depot, OR...	11.6
Pueblo Depot, CO.	9.9
Anniston Army Depot, AL..	7.1
Johnston Island, South Pacific	6.6
Aberdeen Proving Ground, MD.	5.0
Newport Army Ammunition Plant, IN......	3.9
Lexington-Blue Grass Army Depot, KY.	1.6

The stockpile includes chemical agents stored in bulk containers without explosives and propellants, as well as rockets, land mines, mortars, cartridges,

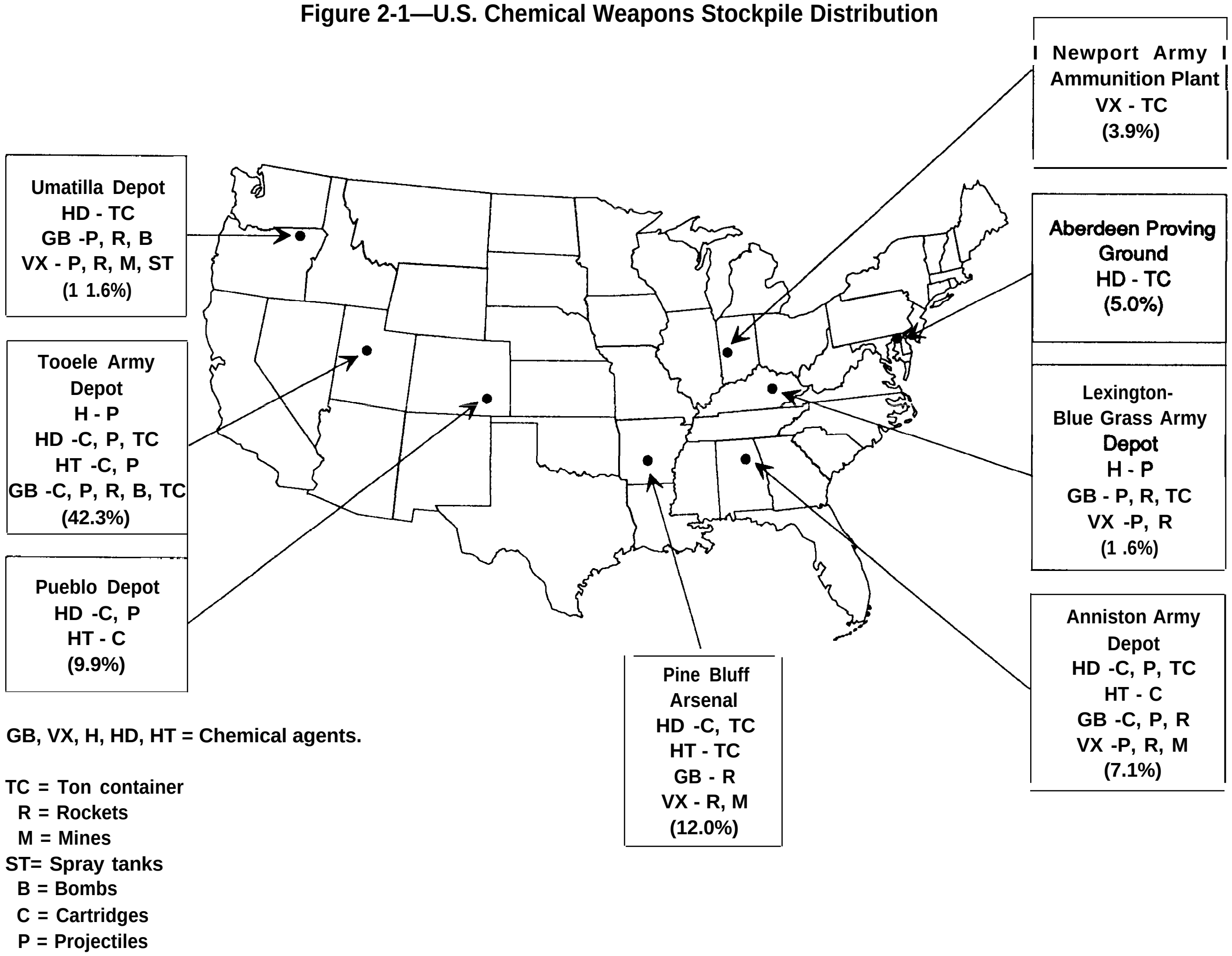


Figure 2-1—U.S. Chemical Weapons Stockpile Distribution

SOURCE: U.S. Department of the Army, "Chemical Stockpile Disposal Program Final Programmatic Environmental Impact Statement," vols. 1,2,3, Office of the Program Manager for Chemical Demilitarization, Aberdeen Proving Ground, MD, 1988.

Table 2-l-Characteristics of Chemical Agents

Agent	Common name	CAS No.[a]	Chemical name	Chemical formula	Vapor pressure torr (at 25° C)	Liquid density g/cm^3 {at 25o C)	Freezing point (°C)	Color	Mode of action
Nerve									
GA	Tabun	77-81-6	Ethyl-N, N-dimethyl phosphoramidocyani-date	$C_6H_{11}N_2O_2P$	0.07	1.073	-50	Colorless to brown	Nervous system poison
GB	Sarin	107-44-8	Isopropyl methyl phosphonofluoridate	$C_4H_{10}FO_2P$	2.9	1.089	-56	Clear to straw to amber	Nervous system poison
VX		50782-69-9	o-ethyl-S-(2-diisopropylaminoethyl) methyl phosphonothio-late	$C_{11}H_{26}NO_2PS$	0,0007	1.008	<-51	Clear to straw	Nervous system poison
Vesicant									
H, HD	Mustard	505-60-2	Bis(2-chlomethyl)sulfide	$C_4H_8Cl_2S$	0.08[b] (H) 0.11 (HD)	1.27	8-12 (H) 14 (HD)	Amber to dark brown	Blistering of exposed tissue
HT	Mustard		60% HD and 40% T[c]		0.104	1.27	1	Amber to dark brown	Blistering of exposed tissue
L	Lewisite	541-25-3	Dichloro(2-chlorovinyl)arsine	$C_2H_2AsCl_3$	0.58	1.89	-18[d]	Amber to dark brown to black	Blistering of exposed tissue

a Chemical Abstracts Service number.
b Varies with purity of sample.
c Agent T is Bis[2(2-chloroethyl-thio) ethyl]ester; it is CAS No. 63918-89-8.
d Varies ± o.1o C, depending on purity and isomers present.

SOURCE: U.S. Department of the Army, "Chemical Stockpile Disposal Program Final Programmatic Environmental Impact Statement," vols. 1,2,3, Office of the Program Manager for Chemical Demilitarization, Aberdeen Proving Ground, MD, 1988.

and artillery projectiles composed of both chemical agent and various explosive-propellant components.

The total amount of chemical agents contained in the stockpile has been estimated to be 25,000 tons (1, 2), although the exact amount is classified. The chemical weapons contain organophosphorus nerve agents (GA, GB, and VX) or vesicant compounds (mustard and Lewisite) (table 2-l). (See box 2-A on the toxic properties of these compounds.) These chemical agents are "unitary' in that they are directly toxic to humans, as opposed to "binary" agents, which are relatively nontoxic until they are mixed together. Although the exact amount of binary weapons in the U.S. stockpile is classified, it has been described by the House Committee on Appropriations as "negligible" (3).

Most (61 percent) CW agents are not contained in munitions but stored in steel l-ton bulk containers

Box 2-A—Properties of Chemical Weapons Agents

Chemical weapons agents stored at the eight continental U.S. Army sites include both organophosphorus ester nerve agents and mustard blister (vesicant) agents.

Mustards. The sulfur mustards in the U.S. Army stockpile are blister (vesicant) agents H, HD, HT, and Lewisite (table 2-l). Agent H typically contains about 30 percent related impurities (l), but in some cases may contain only 18 percent of the nominal material. The impurity of some of these materials makes monitoring and confirming their destruction by certain proposed technologies, such as chemical neutralization, more difficult (2). HD) and HT are purified by washing or distillation. Lewisite is a more volatile organic arsenic-based vesicant compound (1).

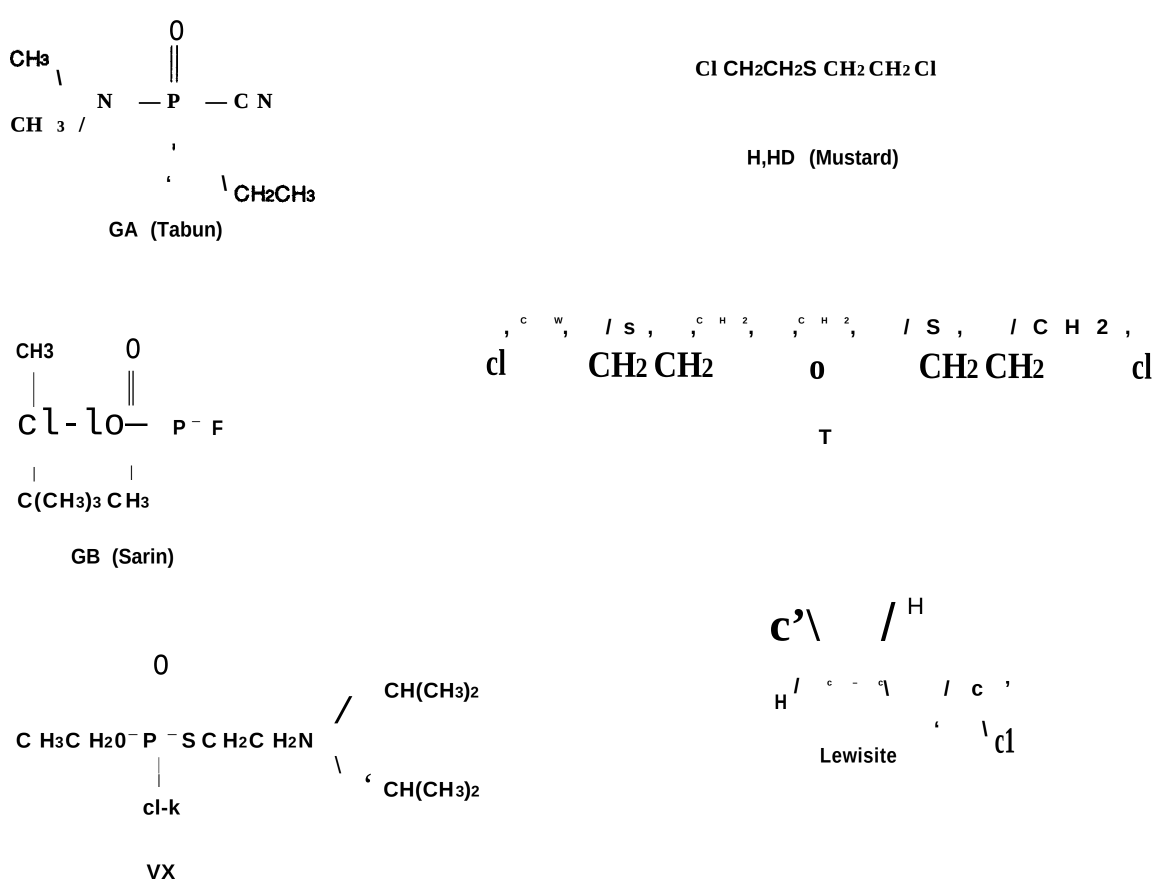
Human exposure to vesicants leads to blistering of exposed tissue and can cause severe skin blisters, injury to the eyes, and damage to the respiratory tract from inhalation of vapors (l). Epidemiological data indicate that agent His a human carcinogenic, and T (in HT) and Lewisite are probably carcinogens (3,4, 5).

Nerve ***Agents. The three*** nerve agents in the U.S. Army CW Stockpile are GA (Tabun), GB (Sarin), and VX (figure 2-2). They are normally liquids at room temperature but are highly toxic both as liquids or following vaporization (see table 2-l). Structurally related organophosphorus ester compounds having less acute human toxicity are used as insecticides. These compounds are potent inhibitors of acetylcholinesterase (AChE), an enzyme that normally breaks down the neurotransmitter acetylcholine. With AChE inhibited, acetylcholine builds up to abnormal levels, causing a continuous, uncontrolled stimulation of nerves that use this neurotransmitter. Among other characteristic poisoning symptoms from AChE inhibition are convulsions, with death in mammals caused by respiratory failure. Death from these nerve agents can occur within 10 minutes of exposure (l). None of the nerve agents is apparently carcinogenic, mutagenic, or teratogenic. In one review, nerve degeneration was considered an unlikely outcome from either acute or chronic exposure to these nerve agents (5).

References

1. U.S. Department of the Army, "Chemical Stockpile Disposal Program Final Programmatic Environmental Impact Statement," vols. 1,2,3, Office of the Program Manager for chemical Demilitarization, Aberdeen Proving Ground, MD, 1988.
2. Whelen, R.P., Engineering and Technology Division, briefing at the Office of the Program Manager for Chemical Demilitarization, Aberdeen, MD, Oct. 29, 1991.
3. U.S. Department of Health and Human Services, National Toxicology Program, Fourth Annual Report on Carcinogens, NTP 85-002, Washington, DC, 1985.
4. International Agency for Research on Cancer, Monograph 9, pp. 181-192, Geneva, Switzerland, 1975.
5. Journal of the American Medical Association, "Recommendations for Protecting Human Health Against Potential Adverse Effects of Long-term Exposure to Low Doses of Chemical Warfare Agents," ***Jourrnal of the American Medical Association, 259(10):1453, 1459,*** Mar. 11, ***1988.***

Figure 2-2-Structures of Chemical Weapons Nerve (Organophosphorus) and Blister (Mustard) Agents



SOURCE: U.S. Department of the Army, "Chemical Stockpile Disposal Program Final Programmatic Environmental Impact Statement," vols. 1,2,3, Office of the Program Manager for Chemical Demilitarization, Aberdeen Proving Ground, MD, 1988.

Table 2-2—Physical Characteristics of Chemical Munitions

Munitions type[a]	— Physical data—			— Agent —		Explosive/energetic components		
Rocket	Length (in)	Diameter	Weight (lb)[b]	Type	Weight (lb)[b]	Burster	Propellant	Fuze
M55	78.0	115 mm	57	GB	10.7	Yes	Yes	Yes
M55	78.0	115 mm	56	Vx	10.0	Yes	Yes	Yes
Land mine								
M23	5.0	13.5 in	23	VX	10.5	Yes	No	Yes[c]
155-mm projectile								
M104	26.8	155 mm	95	HD	11.7	Yes[d]	No	No
M11O	26.8	155 mm	99	H	11.7	Yes[d]	No	No
M11O	26.8	155 mm	99	HD	11.7	Yes[d]	No	No
M121, M121A1 , M122	26.7	155 mm	100	GB	6.5	Yes[d]	No	No
M121A1	26.7	155 mm	100	VX	6.0	Yes[d]	No	No
105-mm projectile								
M60	21.0	105 mm	32	HD	3.0	Yes[d]	Yes[e]	Yes[c]
M360	16.0	105 mm	32	GB	1.6	Yes[d]	Yes”	Yesc
8-in projectile								
M426	35.1	8 in	199	GB or VX	14.5	Yes[d]	No	No
4.2-in mortar								
M2, M2A1	21.0	4.2 in	25	HT	5.8	Yes	Yes	Yes
M2, M2A1	21.0	4.2 in	25	HD	6.0	Yes	Yes	Yes
500-lb bomb								
MK-94-O	60	11 in	441	GB	108	No	No	No
750-lb bomb								
MC-1	50	16 in	725	GB	220	No	No	No
M4teye bomb								
MC-1	86	14 in	525	GB	347	No	No	No
Spray tank								
TMU-28/B	185	22.5 in	1.935	VX	1,356	No	No	No
Ton container	81.5	30.1 in	3,100	H, HD, HT, or L	1,700	No	No	No
	81.5	30.1 in	N/A[f]	GA	N/A[f]	No	No	No
	81.5	30.1 in	2,900	GB	1,500	No	No	No
	81.5	30.1 in	3,000	Vx	1,600	No	No	No

a Military designation numbers are shown below the munitions type.
b For conversion of the U.S. military standard sizes to metric units, 1 in -2.54 cm and 1 lb - 0.454 kg.
c Land mines and fuzes are stored together but are not assembled.
d Not all projectiles have been put into explosive configurations.
e The 105-mm projectile is configured both with and without bursters, fuzes, and cartridge cases containing propellant.
f Information is not available.

SOURCE: U.S. Department of the Army, “Chemical Stockpile Disposal Program Final Programmatic Environmental Impact Statement,” vols. 1,2,3, Office of the Program Manager for Chemical Demilitarization, Aberdeen Proving Ground, MD, 19SS.

(4). However, most of the individual items to be destroyed in the stockpile are the various munitions described in table 2-2.

History of Chemical Weapons Disposal

The Army has an ongoing need for disposal of surplus and obsolete chemical weapons. Attempts to manage the problems of CW disposal have a long history involving a variety of destruction techniques. Prior to 1969, the Army disposed of chemical weapons by open-pit burning, evaporative “atmospheric dilution,’ burial, and placement of munitions in concrete coffins for ocean dumping (5, 6). During the decades of experience with CW disposal, although Army personnel have been exposed to CW agents, no casualties have resulted (7).

In 1969 at the request of the U.S. Department of Defense (DOD), the National Research Council (NRC) reviewed the issue of CW disposal and recommended chemical neutralization via alkaline hydrolysis for the nerve agent GB and incineration for the mustard agents H and HD (6). After research and development work by the Army in the 1970s on these technologies, the Army concluded that incineration was the preferred method for the destruction of all classes of chemical weapons.

The Army indicated that the decision to abandon chemical neutralization in favor of incineration (officially in 1982) resulted from problems encountered with the chemical neutralization process (6). The Army's early chemical neutralization program actually applied only to destruction of the chemical agent itself. Incineration was used to decontaminate metal parts centaining residual chemical agent that came from disassembled CW munitions and storage containers. Since incineration was introduced as a necessary component of all early CW disposal schemes, the fact that it became the basis of the Army's CW disposal program was probably inevitable. The 1987 report by the Army about its experience with CW destruction refers to the "widespread acceptance of incineration as an effective, safe, and environmentally sound method of disposal of hazardous materials' (6). Now, 5 years later, the suggestion of widespread acceptance of incineration seems insupportable in light of the strong and effective opposition to most applications of incineration for waste disposal.

In 1984 the incineration decision was supported by another NRC review. The NRC based its endorsement on a review of existing data supplied almost entirely by Army research. In 1988 the Army published a Final Programmatic Environmental Impact Statement (PEIS) designating on-site disposal consisting of disassembly followed by incineration as the preferred method of CW destruction (4).

On-Site Destruction vs. Relocation of the CW Stockpile for Off-Site Destruction

In **the** 1988 PEIS for its on-site CW disassembly and incineration program, the Army compared several alternatives, including partial or complete relocation of the CW stockpile to regional or national sites for destruction. The comparative risk of the entire CW disposal program associated with on-site versus regional disposal was evaluated as not statistically distinguishable according to an analysis contracted by the Army (7). The Army argued that this apparent risk equivalence was misleading because the analysis failed to consider the location in terms of corresponding mitigation of possible accidents. That is, an accident on an existing Army base would be easier to mitigate than an accident occurring at some unknown point along a transportation corridor. A qualitative consideration of this difference led to the conclusion that *any* option involving CW transportation off-site was more risky (7). The current Army program specifies that chemical weapons will remain on-site, at the eight continental U.S. bases and Johnston Island where they are now located, for destruction by disassembly and incineration.

Condition of the CW Stockpile—Potential of Increased Risk From CW Deterioration

In 1992, chemical weapons containing unitary agents stored in the continental United States will be from 24 to 47 years old (8). Low-level leaks of agents have been detected in some of the munitions, although the risk from such leaks has been suggested to be low. The M55 rockets (box l-C) filled with GB agent are the greatest source of leaks. All other types of munitions and storage containers in the CW stockpile have substantially fewer leakages and are in stable condition (4, 5, 9, 10). The relative instability of the M55 rocket is probably due to its unique construction, which includes a thin aluminum warhead filled with GB chemical agent (7, 10, 11). The other agent-filled munitions are constructed of much heavier gauge aluminum plate or steel that is more resistant to corrosion and leakage. Most of the leaking M55 rockets, first discovered in 1966, come from one manufacturing source of GB agent, and there appears to be a correlation between acid content and frequency of leakage through the aluminum walls (7, 10, 11, 12).

Primarily because of leakage problems, the M55 rockets constitute a major portion of the total risk of CW handling and storage at the five continental U.S. sites where they are located (12). The CW monitoring program directs Army personnel to conduct ongoing surveillance of the stockpile. The Army has established a continuous monitoring program to rapidly identify new leaking munitions (4). As leaking munitions are discovered, they are sealed in protective steel tubes ("overpacks") to contain further leakage. Although M55 rockets containing agent GB were first found to be leaking in 1966(11, 12), there has been no trend toward an increased rate of leakers detected (9).

In a partial answer to questions about the urgency of CW disposal, the NRC committee in its 1984 report stated that data are insufficient to project the

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near- or long-term storage life of CW agent containers. However, in the face of this uncertainty, available information indicates that the frequency of leaks for most munitions at all eight U.S. sites, except for the M55 rockets, did not increase substantially in the years prior to (5) or after 1984 at at least the Lexington-Blue Grass Army Depot in Kentucky (9). A 1985 study by the Army specifically on the condition of the M55 rockets concluded that the occurrence of a catastrophic event in the near future is "highly unlikely" (11, 12). However, in view of the critical importance of this issue, this study could be updated.

DISPOSAL OF THE ARMY'S CW STOCKPILE

The Army's Demonstration Projects

The Army's current program requires a series of pilot demonstration CW disposal facilities. Some of these demonstrations have been required by Congress. The Chemical Agent Munitions Disposal System (CAMDS) (Tooele, Utah) was initiated by the Army to test and evaluate equipment and processes to be used in CW disposal facilities. Although CAMDS is authorized to dispose of chemical weapons, its primary purpose is data collection and test evaluation of the process equipment (13).

The Johnston Atoll Chemical Agent Disposal System (JACADS) is currently undergoing operational verification and testing for the destruction of M55 rockets. The Army anticipates that JACADS will eventually demonstrate the destruction of all types of CW munitions and storage containers. This system is actually not one but four separate incinerator systems, each designed to handle a distinct component from the CW disassembly waste stream. Public Law 100-456 (the National Defense Authorization Act of Fiscal Year 1989) requires the Army to complete operational verification of its technology at JACADS before proceeding with equipment tests at Tooele, Utah, and other U.S. sites (14). Based in part on the CAMDS experience, this "new generation' of CW incinerators is intended to demonstrate compliance with current Toxic Substances Control Act (TSCA) and Resource Conservation and Recovery Act (RCRA) standards. TSCA compliance is required because the tube containers for M55 rockets contain small amounts of polychlorinated biphenyls (PCBs). RCRA compliance is similar for any new incinerator and involves demonstrating acceptable emission rates of metals in ash, particulate loading, hydrogen chloride and hydrogen fluoride stack emissions, etc. (See box 2-B on regulatory hurdles for CW incineration facilities.) Results from this technology demonstration design facility are intended for use as a basis for the design and construction of the eight proposed continental U.S. on-site incinerators, although construction at Tooele, Utah has already begun.

Four evaluations of the JACADS operation by the Mitre Corp. have been planned for completion by 1993. The frost report was released in June 1991 (14). A final evaluation directed to Congress, followed by congressional certification of JACADS, is anticipated in February 1993 (15).

DIFFICULTIES ENCOUNTERED BY THE CURRENT CW DISPOSAL PROGRAM

Local and National Opposition

Several national and local organizations are opposed to the Army's present CW disposal program. Citizens at the Lexington-Blue Grass Army Depot (Kentucky) have mounted the most effective resistance. The opposition to the Army's CW destruction program in Kentucky may be able to block or seriously delay its completion. (See box 1-B for a description of Kentucky State authority for regulating hazardous waste facilities.)

Currently, less opposition exists at other continental U.S. sites (16). However, other States might follow Kentucky's lead. The Utah State legislature has implemented some restrictive requirements for CW disposal facilities proposed for the Tooele site. Specifically, it has required a series of additional and time-consuming test burns. Citizen groups that oppose the Armys current CW destruction plan also exist in every one of the eight states with CW stockpiles.

Although the public was not informed of the Army's plans to build a CW destruction facility at the Lexington-Blue Grass Army Depot until January 1984, citizen concerns about the CW storage had been developing for decades. Although the Army moved chemical weapons into the Lexington-Blue Grass Army Depot during the 1950s, local residents were not informed of this fact until 10 years later.

Box 2-B—Some Regulatory Hurdles for CW Destruction

The Army must secure environmental permits for its CW incineration facilities in the same manner as civilian projects. The Army's Johnston Atoll Chemical Agent Disposal System (JACADS) demonstration facility, located on Johnston Island, however, is exempt from obtaining certain environmental permits that will be required for CW destruction facilities planned for the continental United States. Although Executive Order 12088 provides for waivers of these laws in cases of national emergency, the Army has not yet requested such a waiver for the storage and handling of chemical weapons. A range of Federal, State, and local permits required prior to the start of construction include:

1. A review by the Department of Health and Human Services of public health and safety issues and the environmental impact of the Army's CW destruction program (l).
2. Resource Conservation and Recovery Act (RCRA) permits for construction and for operation of incinerator facilities. Full-scale incinerator operations cannot begin until trial burns are satisfactorily completed, following construction approval, in accordance with final RCRA permitting requirement. The U.S. Environmental Protection Agency (EPA) has delegated RCRA authority to all of the eight States in which incinerators are planned.
3. Toxic Substances Control Act approval before operation of incinerators with M55 rockets, because of the presence of PCBs in rocket-firing tubes.
4. Air emissions source permits under the Clean Air Act and State or local air quality regulations. Clean air permits must be obtained from each relevant State authority.
5. Other environmentally oriented regulations including the Endangered Species Act (Public Law 93-205), Floodplain Management Executive Order 11988, and Protection of Wetlands Executive Order 11990.
6. For transportation off-site, approval from the U.S. Department of Transportation, the Environmental Protection Agency, and other relevant Federal and State authorities.

Reference

1. U.S. Department of the Army, "Chemical stockpile DisposalProgram Fina.1 Programmatic Environmental Impact Statement," vols. 1,2,3, Office of the Program Manager for Chemical Demilitarization, Aberdeen Proving Ground, MD, 1988.

This led to the impression that the Army had "sneaked' chemical weapons into the area without any regard for the safety of citizens who lived nearby (17). Although the amount of chemical weapons stored at the Kentucky depot is proportionally small (1.6 percent of the total U.S. stockpile), local residents are aware that Kentucky's share includes a higher proportion of the most dangerous types, especially the M55 rockets (69,500 rockets out of a total of 478,000, or 14.5 percent in the total M55 rocket stockpile) (9, 11, 12).

At present, organized opposition to the Army's CW incineration program in Kentucky comes from members of the State legislature; civic leaders; academics; and key political, citizen, and national groups that together comprise a highly organized and potentially very effective opposition (17). In 1988 (when the Army's PEIS was published), the Governor of the State of Kentucky stated that the chemical weapons at the Lexington-Blue Grass Army Depot should be moved to another site for destruction (18).

Based on conversations with representatives from three Kentucky citizen groups (the Kentucky Environmental Foundation, Concerned Citizens of Madison County, and Common Ground), opposition is based on several issues, and there is no consensus on which concerns are most important. Issues of public concern include the possible health risks associated with effluents from incineration, as well as the possibility that the planned CW destruction facilities will be used to incinerate other types of waste once the weapons disposal program is complete. The latter concern is founded partially on reports that specifically direct the Army to consider using the incinerator facilities, after the completion of CW destruction, for the disposal of hazardous waste generated by DOD; Federal, State, or local governments; and private industry (3, 5, 19). A general concern is that the Army may have not adequately addressed unique aspects of the Kentucky Blue

Grass facility, such as its proximity to major population centers.[1] Another often repeated issue is the perceived risk to citizens in communities surrounding CW stockpiles during munitions transport from storage igloos to the central on-site incinerator facility.

As a result of this last concern, Kentucky citizen groups continue to express a strong preference for the option of removing the chemical weapons from Kentucky to some other site for storage or destruction using a transport container that would prevent leakage in case of an accident. They refer to the 1987 Mitre report concluding that there is no significant difference in risk between on-site incineration and moving the stockpile to a less populated area (1,12). They also cite the Army's successful movement of CWs stored in Germany to Johnston Island in the summer of 1990 (17, 20). Many of the communities that surround the Lexington-Blue Grass Army Depot have indicated a reluctance to have chemical weapons transported through their own communities. Similarly, the Army's counter argument is that the Mitre risk assessment failed to consider the geographic location and the potential for adequate response to accidents occurring on-site versus those occurring during transportation off-site (7).

Projected Program Schedule— Revised Deadlines

The Army's current proposed schedule for its CW destruction program is shown in table 2-3. This schedule has been revised more than once since the 1988 PEIS, and unforeseen events may prompt further revisions. The schedule shown in this table was presented to Congress on April 1, 1992 (21).

Cost Estimates-Cost Overruns

The *Amy's* cost estimates for the CW destruction program have been continually revised upward. In 1985 the Army's life-cycle cost estimate for completion of destruction of the CW stockpile at the eight continental U.S. storage sites and Johnston Island was $1.7 billion. In 1988 the Army revised the total program cost to $3.4 billion (19). Recent reports indicate that the Army is revising its cost estimates for CW destruction upward to $6.5 billion (3, 17) or as high as $7.9 billion (21). The largest portion of the cost is for existing and projected operating expenses (while the incineration facilities are operational). Facility construction is a small fraction of the total cost (17).

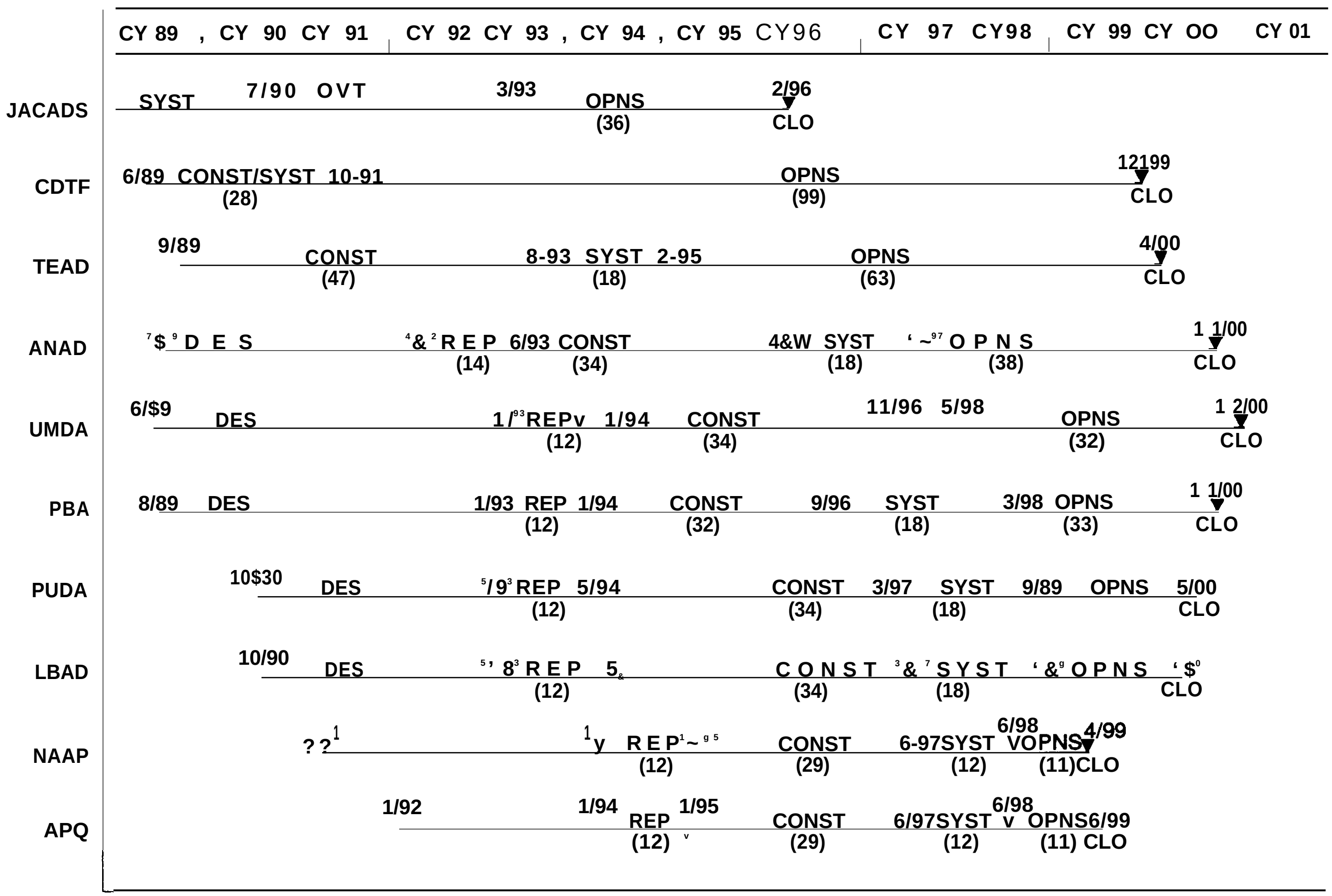
INTERNATIONAL IMPLICATIONS OF A SUCCESSFUL PROGRAM

The United States and former Soviet Union signed a bilateral agreement in June 1990 to destroy their CW stockpiles, although acceptable verification and destruction technologies were not resolved (3, 22). The agreement timetable specified that destruction should begin by December 1992; that 50 percent stockpile would be destroyed by December 1999, followed by all but 5,000 metric tons destroyed by May 2002. Although the agreement was not ratified by either country, some of its provisions were adopted. Both nations have declared an end to CW production and in May 1991 president Bush forswore U.S. use of chemical weapons and pledged to destroy all U.S. chemical weapons within 10 years of the Geneva global chemical weapons convention (CWC) negotiations (a multilateral effort now in its 24th year) coming into effect. This renunciation was very positively received by the participants of the convention and was widely seen as a significant impetus for the CWC negotiations (3). If ratification of the bilateral agreement continues to be delayed, then the CWC may be concluded and allowed to supersede the U.S./Soviet bilateral agreement on CW destruction (3).

Negotiations over the bilateral agreement were prolonged primarily by the Soviet Union's inability to develop a workable plan for the destruction of its chemical weapons. U.S. officials now believe that the agreement deadlines will have to be extended because of the lack of CW destruction facilities in the independent republics. The agreement allowed for postponement of deadlines should either side encounter delays in the construction of facilities.

[1] The Kentucky Lexington-Blue Grass Army Depot, which stores chemical weapons and is the proposed site of the Army's chemical weapons destruction facility, is 1/2 mile from an elementary school, in an area with approximately 55,000 inhabitants. Several schools are within a 5-mile radius of the depot (1, 17). A related problem is the apparently poor credibility of the Army in the eyes of many of the citizens in the affected area. For example, late in 1991 an incident in which a small amount of leaked mustard agent was detected by the Army inside one of the munitions storage igloos at the Lexington-Blue Grass depot was revealed to the general public indirectly via a "leak" to a local school newspaper. Public reaction to this apparently minor incident was one of outrage and expressed the general feeling that the Army was neither sincere in its efforts to protect the public nor credible in keeping the public informed of potential hazards.

Table 2-3-U.S. Chemical Weapons Disposal Program Implementation Schedule



JACADS = Johnston Atoll Chemical Agent Disposal Facility
CDTF = Chemical Demilitarization
TEAD = Tooele Army Depot
ANAD = Anniston Army Depot
UMDA = Umatilla Depot Activity
PBA = Pine Bluff Arsenal
LBAD = Lexington-Bluegrass Army Depot
NAAP = Newport Army Ammunition Plant
APQ = Aberdeen Proving Ground

DES = Design
SYST = Systemization
CONST = Construction
OPNS = Operations
CLO = ClOSUre
OVT = Operational Verification Testing
RFP = Issue and Evaluate Request for Propose

V. start activity first of month
T = complete activity end of month

SOURCE: Livingstone, S., Assistant Secretary of the Army (Installations, Logistics and Environment), testimony before the House Committee on Appropriations, Subcommittee on Defense, April 1, 1992, Second Session, 102nd Congress.

According to the June 1990 bilateral agreement, destruction technologies were to be shared. However, it appears that Soviet CW destruction capabilities are currently nonexistent. The entire CW stockpile is located in Russia (23), which may be requesting U.S. assistance in building CW destruction facilities. The political disarray caused by the breakup of the Soviet Union into independent republics has made this more difficult.

The U.S. CW destruction program has also been delayed, as described earlier in this paper. Recently, on the recommendation of the House Committee on Appropriations, the FY 1992 DOD appropriations bill as passed by the House prohibited obligation of $151.9 million in procurement funds for the CW destruction facilities planned at Anniston, Umatilla, and Pine Bluff until the following events occurred: Operational testing at Johnston Island is certified complete and a report submitted to Congress; the Johnston Island plant design has been verified; and appropriate environmental permits for the three new facilities have been secured. The restriction for obligation of procurement funds for Anniston is tied to the start of the third phase of Operational Verification Testing of JACADS (OVT 3) (24).

In developing their current disposal programs, the United States and Russia are setting the stage for general and worldwide weapons disposal. The control and prevention of the proliferation of chemical weapons is a problem paralleling that of nuclear weapons: They have in common similar problems of the verification of manufacture or destruction, and the potential for illegal use. A United Nations special commission is currently investigating possible methods for the destruction of Iraq's CW stockpile. Iraq has acknowledged having a variety of chemical weapons containing nerve and blister agents that will be destroyed under this program (25). As many as 18 countries in addition to the United States and the Commonwealth of Independent States (C. I. S.) may possess chemical weapons. In testimony before the House Committee on Armed Services in 1991, Rear Admiral Thomas Brooks, Chief of Naval Intelligence, estimated that the following 14 non-NATO or non-Warsaw Pact countries probably have chemical weapons: Burma (Myanmar), China, Egypt, India, Iran, Iraq, Israel, Libya, North Korea, Pakistan, South Korea, Syria, Taiwan, and Vietnam (3). Indonesia, Saudi Arabia, South Africa, and Thailand were also identified as possibly having chemical weapons. As international proliferation of chemical weapons expands, the need for an appropriate and acceptable CW disposal program becomes increasingly critical.

The C.I.S. is facing problems surprisingly similar to those of the U.S. Army in establishing a CW destruction program. In 1990 the Soviets unveiled their only CW destruction plant near Chapayevsk in the Ural Mountains, 500 miles southeast of Moscow (1, 20). In contrast to the U.S. Army's program, this facility was designed to use chemical neutralization rather than incineration as the primary means for CW destruction. However, local citizens opposed to the facility for ecological and environmental reasons, and possibly as a reaction to the Chernobyl nuclear accident in 1986, were successful in opposing the facility and it was eventually shut down (l).

ALTERNATIVE SCENARIOS FOR THE ARMY'S BASELINE PROJECT

The current Army program for CW destruction specifies destruction by disassembly and incineration on-site at the eight continental U.S. Army bases and at Johnston Island where they are now located. The Army is required by law to prove the successful demonstration of the Johnston Island chemical Agent Disposal System. Results from this prototype design are intended to be used as a basis for design and construction of the eight proposed continental U.S. facilities. This "new-generation" CW incinerator is designed to show that the technology can meet current TSCA and RCRA standards. The Clean Air Act does not apply to the JACADS facility and therefore the Army is not collecting data to demonstrate compliance with this act. Since all eight continental sites will have to host Clean Air Act standards, operation and tests of the JACADS facility will not provide all the data needed.

The first of four planned evaluations by the Mitre Corp., "Evaluation of the GB Rocket Campaign: Johnston Atoll Chemical Agent Disposal System Operational Verification Testing," was released in June 1991 (14). In September 1991, the NRC released a "Letter Report" review of this first evaluation. In the review, the NRC was optimistic about the eventual success of the JACADS demonstration project and recommended that operational testing be continued. It also made several relevant criticisms that suggested certain shortcomings in the JACADS evaluation strategy:

> Additional performance measurements, which could be made at JACADS, would support future sites by providing higher levels of confidence in the technology. . .[The current program] does not require measurement. . .of PICS. . especially dioxins and furans. . . There is a larger issue than the accuracy of. . .measurements. It is important that the total environmental impact of JACADS be characterized. . . . These data would facilitate permitting and public understanding by providing well documented answers to reasonable, and probably inevitable, questions from concerned citizens as well as regulators.

Although the Army has not had time to respond, these and other criticisms of the JACADS project suggest a series of possible scenarios that may result based strictly on the outcome of the demonstration project.

In one scenario, the Army's demonstration program at Johnston Island could be successfully concluded and the construction of facilities at the continental sites could continue as planned. It would probably be useful to provide local groups and involved States with data from JACADS operations to show safety standards can be met. If citizen groups become convinced that the Army's technology will safely destroy the weapons at each site, and the technology functions as proposed, then the program could proceed without opposition.

In another scenario, the Army's JACADS facility could successfully demonstrate that the technology will perform as expected but the organized opposition would remain unconvinced.

In this case, facilities in individual States might be effectively halted by blocking the issuance of required State permits. In a final scenario, the JACADS incineration technology demonstration project might prove unsuccessful and eventually be abandoned. This, in turn, would probably mean an end to construction at any U.S. site.

The second and third scenarios could result in the need for a CW disposal alternative to incineration, depending on whether opposition was primarily to on-site disposal or to the specific destruction technology. In this event the weapons stockpile would probably be stored and maintained at current sites while an alternative technology and CW destruction program is developed.

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