

GAO

Report to the Chairman, Subcommittee
on Environment, Energy, and Natural
Resources, Committee on Government
Operations, House of Representatives

December 1994

CHEMICAL WEAPONS

Stability of the U.S. Stockpile



**National Security and
International Affairs Division**

B-259506

December 22, 1994

The Honorable Mike Synar
Chairman, Subcommittee on Environment,
Energy, and Natural Resources
Committee on Government Operations
House of Representatives

Dear Mr. Chairman:

Since 1985, the U.S. Army has been working to implement congressional direction to dispose of the U.S. stockpile of unitary¹ chemical weapons and agents—a process the Army currently estimates will cost \$8.5 billion. Because the Army continues to experience delays in implementing its disposal program and may have to store the stockpile longer than planned, you asked us to review the Army's (1) prediction of how long chemical weapons can be stored safely and (2) contingency plans for disposing of chemical weapons that become dangerous.

Background

In November 1985, Congress passed Public Law 99-145 directing the Department of Defense (DOD) to destroy its stockpile of unitary chemical agents and weapons by September 30, 1994. The weapons are stored at eight sites in the continental United States and on Johnston Atoll in the Pacific Ocean. (See app. I for the stockpile munitions and storage locations.)

To comply with the congressional direction, the Army, DOD's lead service in chemical matters, developed a plan to burn the stockpile on-site in specially designed high-temperature incinerators. However, because of technical problems and strong citizen opposition to incineration, the program was delayed. To date, two of nine planned incinerators have been built and only one of the two is operational. In October 1992, Congress extended the completion date to December 31, 2004.

The Fiscal Year 1993 Defense Authorization Act required the Army to report on the physical and chemical integrity of the stockpile. This report,² submitted in July 1993, reviewed available inspection data, laboratory data, and historical stockpile assessment reports and determined that the

¹A unitary chemical munition is a munition containing a single, lethal, chemical agent.

²Physical and Chemical Integrity of the Chemical Weapon Stockpile, Department of the Army, July 1993.

chemical weapons stockpile is safe for continued storage for the near and midterm and uncertain for the long term (beyond 2004).

Threats to safe storage of the stockpile include external events such as earthquakes, airplane crashes, and tornadoes, and internal events such as leakage of chemical agents from the warhead, accidents during normal handling and maintenance activities, and autoignition of propellant. An accident involving one munition could potentially affect many munitions. For example, Army tests have shown that the ignition of a single M55 rocket within a storage igloo could involve many of the 4,000 rockets that are typically stored together. The effect of an accidental release on a nearby community would depend on such things as the type and amount of agent released, meteorological conditions, and the community's proximity to the storage installation. Through its Chemical Stockpile Emergency Preparedness Program, the Army is working to help communities near storage sites improve their emergency response capabilities.

Results in Brief

The Army's assessment that the chemical weapons stockpile can be safely stored until 2004 is subject to question based on the nature of the supporting data. According to Sandia National Laboratories,³ which reviewed the Army report at our request, the data on which the Army based its assessment were old and may no longer be representative of munitions in actual field storage. Also, the assessment did not include an analysis of leaking munitions. Sandia recommended that the Army immediately expand its stockpile monitoring activities to include propellant samples from non-leaking and leaking munitions at each storage location. The Army has established a working group to review its assessment and received \$4.5 million in fiscal year 1995 to expand its stockpile monitoring activities. However, the expanded monitoring activities will not resolve all questions about the stability of the stockpile.

A contingency plan for emergency disposal of the M55 rocket is needed because it is the only munition in the stockpile that cannot readily be reconfigured to remove its explosive components. However, the Army has not prepared a plan. It is studying several courses of action, but additional information on the specific hazards is needed before a plan can be finalized.

³Sandia National Laboratories has knowledgeable experts responsible for ensuring the integrity of nuclear weapons. The aging problems in nuclear weapon systems are similar to those that have been and will be encountered in the chemical weapon stockpile.

The Army Lacks Data to Conclusively Predict Stability

After reviewing supporting documents for the Army's report, Sandia identified concerns about the Army's assessment and recommended that the Army expand and continue its surveillance activities until the stockpile is destroyed. The Army has partially complied and is reviewing the validity of its prediction, but questions may still remain about the stability of the stockpile.

Better Data Could Improve the Army's Predictive Assessment

The Army's assessment that chemical munitions are safe for continued storage until 2004 is based on Army data on M55 rocket propellant. Propellant samples are used to assess chemical munition stability because propellant is an inherently unstable compound that must be stabilized to prevent reactions that could lead to a spontaneous ignition. Propellant manufacturers add small amounts of stabilizing compounds that deteriorate over time, and storage life is determined by monitoring remaining stabilizer content in the propellant samples. All munitions stored with propellant, except the M55 rocket, are having propellant removed from the munition.⁴ Reconfiguration of the munitions should be completed by 1998.

The Army's assessment is based on M55 rocket propellant samples from the time of manufacture (1959-65) and from a limited number of field samples taken from the stockpile in 1980, 1985, and 1989. No field samples have been taken since 1989. In some cases, the Army has only one or two samples from a particular lot. In addition, changes in stabilizer content cannot be verified because different collection and analysis procedures were used for the original and more recent analyses. Sandia's analysis questions how representative the samples are, compared to actual propellant stored with M55 rockets at the five storage locations. The samples are stored at a central location and are reanalyzed every year. However, storage conditions and climatic conditions such as temperature and humidity vary by location and these differences can affect the rate of propellant degradation.

As a result of these concerns and similar concerns raised by the National Research Council, the Army convened a working group in July 1994 to review its safe storage assessment. The panel is expected to release its report in January 1995. According to Army officials, this report is currently in draft but concludes that there is high confidence that none of the non-leaking rockets in the stockpile will undergo autoignition prior to 2004.

⁴The design of the M55 rocket makes separation of the propellant from the chemical warhead difficult.

Additionally, the Army requested and received \$4.5 million in fiscal year 1995 to expand its stockpile monitoring activities. However, the expanded monitoring activities may still not resolve all questions about the stockpile's stability because the Army plans to select additional propellant samples only from rockets stored at Tooele Army Depot, Utah. The samples will be selected at the Tooele depot because it is the only storage site that currently has a suitable explosive and agent containment facility. Thus, questions about variances among storage sites will go unanswered.

Leaking Munitions May Pose a Significant Safety Hazard

According to the Army's report, over time, nerve agents—particularly the nerve agent GB—become acidic and can corrode the metal warheads of rockets, mortars, and projectiles. In some cases, the corrosion can eat small holes in the metal warheads that allow the agent or agent vapors to escape. These leaks can be either external or internal to the munition.

External leaks allow an agent to escape outside the weapon or storage container and are quickly detected by monitoring. When detected, such leaks are controlled by placing the leaking munition in a special airtight container and segregating it. Army reports showed that from 1983 through 1993, 1,824 chemical munitions, mostly nerve agent-filled (GB) M55 rockets, developed external leaks. Leaking munitions have been found at all six storage sites that store munitions.⁵ In 1992, the last year data were available, 0.252 percent of M55 rockets in the total stockpile had external leaks and 0.022 percent of other munitions in the total stockpile had external leaks.

Internal agent leaks cannot be detected without disassembling the munition. When a munition leaks internally, an agent can come in contact with its explosive components. Such contact, according to Army reports, could increase the risk of unanticipated ignitions or explosions during handling, movement, and disassembling prior to final destruction. Possible problems that could result from internal leaks include accelerated aging of the propellant stabilizer, formation of sensitive explosive metal salts from reaction of the agent on burster explosives, corrosion of metallic parts in fuses, and formation of hazardous metallic salts in the fuse assembly. Again, internal agent leaks are most acute with M55 rockets. In a 1985 assessment of M55 rockets, the Army estimated that 1 to 3 percent had internal leaks. However, the limited sample size makes this estimate uncertain.

⁵Aberdeen Proving Ground, Maryland and Newport Army Ammunition Plant, Indiana, store only bulk agent.

The extent of the hazard posed by internal leaks is unknown. The Army has never sampled leaking munitions because it considers them dangerous. Consequently, the Army has not resolved the questions about the specific hazards posed by leaking munitions. Sandia concluded that “(w)e can not emphasize enough the importance of evaluating leaking systems because of the questions generated and the lack of data to validate possible problems associated with these systems.” Further, Sandia pointed out that current Army procedures for handling leaking munitions (e.g., placing them in a containment vessel that allows an agent to remain in contact with the various components for long storage periods) could make problems worse.

Army officials report that the probability of an agent reaching a propellant is considered low, but nonetheless they plan to initiate laboratory tests to investigate the sensitivity of an agent-contaminated propellant. These tests should start in early 1995. However, due to the risks involved in the selection and handling of agent-contaminated propellant samples, the Army has no plans to analyze actual field samples because it does not have a laboratory capable of handling such materials. Army officials acknowledge that, depending on the outcome of the laboratory tests, they may have to develop a capability to select, analyze, and monitor the condition of actual agent-contaminated propellant samples.

In addition to uncertainties about problems caused by the interaction of agent and propellant, a 1985 Army report speculated that agent contacting fuses and bursters could also be a mechanism for unanticipated explosive detonation, especially during munition handling and movement. While Army officials believe the risks are minimal, they told us additional analyses may be necessary if the Army is required to store the chemical weapons beyond 2004.

The Army Is Not Prepared to Deal With Hazardous Munitions

To resolve concerns about propellant stability in M55 rockets, the Army hired a contractor to study and prepare a report on various alternatives to allow continued safe storage or disposal of unstable rockets. However, the Army has not yet decided which alternative to develop. The report, issued in February 1993, identified two possibilities: refrigeration of the rocket storage facilities to prevent stabilizer deterioration; and separation of the rocket warhead from the propellant-containing rocket motor by unscrewing the two components at their juncture. Theoretically, cooling would reduce the rate at which the propellant stabilizer is used, thus lengthening the time a rocket could be stored; but, this has not been

scientifically demonstrated. Separating rocket components would mitigate the effect of a spontaneous ignition, but because of the hazards involved, the Army would likely have to design and construct remotely operated, explosion proof, agent containment facilities at each storage site. The two rocket sections could then be stored separately.

Recommendations

We recommend that the Secretary of Defense direct the Secretary of the Army to expand the Army's monitoring program to resolve questions about the stockpile's stability and develop a contingency plan for emergency disposal of M55 rockets. The expanded program should include an analysis and implementation of the processes that would be necessary to safely take field samples from all storage sites and from leaking munitions, and include milestones and required resources. The plan should also identify specific methodologies to be used, and specific milestones and resources.

Scope and Methodology

To address our objectives, we reviewed Army documents on the chemical and physical integrity of the chemical weapons stockpile and options for dealing with M55 rockets that become unstable. We also discussed stockpile stability with the Army's contractor for the stability study and with Army officials at the Army Materiel Command; the Armament, Munition and Chemical Command; and the Armament Research, Development and Engineering Center.

Because of the technical complexity of assessing munition stability, we also asked the Department of Energy's Sandia National Laboratories to review the Army's report to Congress on stockpile stability along with its supporting documentation. We asked Sandia to review key documents used in the Army's stockpile stability report⁶ and (1) provide a critique on the methods used and inconsistencies (if any) within and between reports and (2) discuss any other potential hazards that exist or might exist that were not given appropriate attention in the studies. Sandia's report was shared with Army officials responsible for the stockpile.

⁶(1) Physical and Chemical Integrity of the Chemical Weapons Stockpile: Assessment of the U.S. Chemical Weapons Stockpile: Integrity and Risk Analysis, The MITRE Corporation, July 1993;

(2) Experimental Propellant Degradation Kinetics via Transient Spectroscopy, U.S. Army Armament Research, Development and Engineering Center and Hercules Aerospace Company, July 1990;

(3) Independent Evaluation/Assessment of Rocket, 115mm: Chemical Agent (GB or VX), M55, Army Materiel Systems Analysis Activity, October 1985; and (4) Technical Memorandum ORDBB-DR4-41, Compatibility of GB and VX Agents with RDX, Tetryl, Composition B and 70/30 Tetrytol, Artillery, Ammunition and Rocket Development Laboratory, April 1961.

To obtain information on the Army's plans for dealing with large numbers of deteriorated chemical munitions, we held discussions and obtained information from officials at the Army Materiel Command and the contractor for the contingency study.

We conducted our work from January 1993 to December 1994 in accordance with generally accepted government auditing standards.

As requested, we did not obtain official agency comments on this report. However, we did discuss our findings with agency officials, who generally agreed. Their views are included where appropriate.

As arranged with your staff, unless you announce its contents earlier, we plan no further distribution of this report until 30 days from its issue date. At that time, we will send copies of this report to the Secretaries of Defense and the Army and the Director, Office of Management and Budget. Copies will also be made available to others on request.

Please contact me on (202) 512-8412 if you or your staff have any questions concerning this report. Major contributors to this report are listed in appendix II.

Sincerely yours,



Donna M. Heivilin
Director, Defense Management
and NASA

Contents

| | |
|--|----|
| Letter | 1 |
| Appendix I Chemical Stockpile Munitions and Locations | 10 |
| Appendix II Storage Configuration for Some Munitions | 11 |
| Appendix III Major Contributors to This Report | 12 |

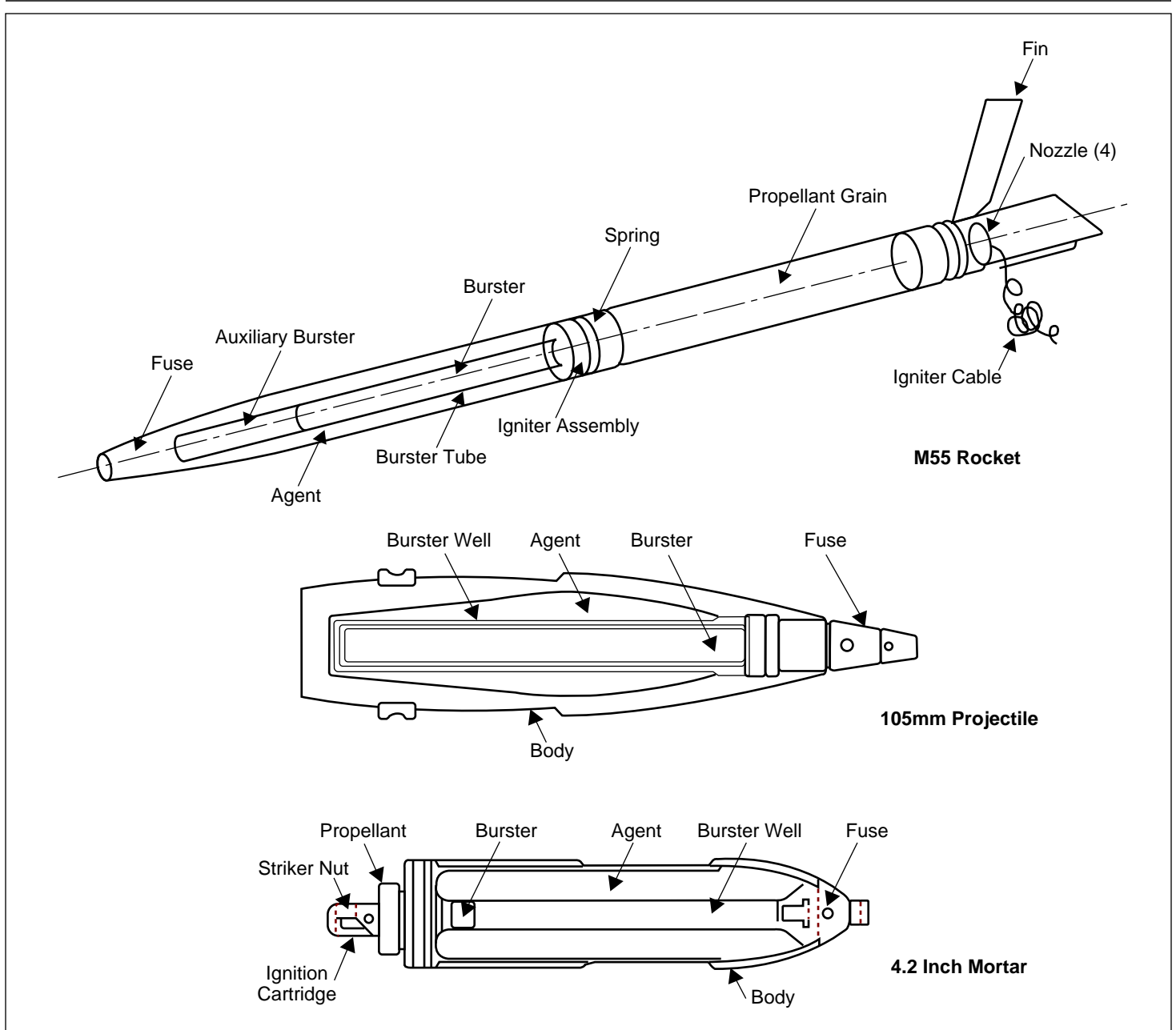
Abbreviations

DOD Department of Defense

Chemical Stockpile Munitions and Locations

| Storage site | Weapons and agents stored |
|------------------------------|--|
| Aberdeen Proving Ground, MD | Ton container (H) |
| Anniston Army Depot, AL | Projectiles & cartridges (H,GB,VX) M23 mine (VX) Ton container (H,GB) M55 rocket (GB,VX) |
| Blue Grass Army Depot, KY | Projectiles & cartridges (H,VX) Ton container (H,GB) M55 rocket (GB,VX) |
| Johnston Atoll | Projectiles & cartridges (H,GB,VX) M-23 mine (VX) Ton container (H,GB,VX) M55 rocket (GB) Bomb (GB) |
| Newport Ammunition Plant, IN | Ton container (VX) |
| Pine Bluff Arsenal, AR | M23 mine (VX) Ton container (H) M55 rocket (GB,VX) |
| Pueblo Army Depot, CO | Projectiles & cartridges (H) Ton container (H) |
| Tooele Army Depot, UT | Projectiles & cartridges (H,GB,VX) M23 mine (VX) Bomb (GB) Spray tank (VX) Ton container (H,GB,VX) M55 rocket (GB,VX) |
| Umatilla Depot Activity, OR | Projectiles & cartridges (GB,VX) M23 mine (VX) Bomb (GB) Spray tank (VX) Ton container (H,GB,VX) M55 rocket (GB,VX) |

Storage Configuration for Some Munitions



Major Contributors to This Report

**National Security and
International Affairs
Division, Washington,
D.C.**

David Warren
Tom Howard
Glenn Furbish

**Philadelphia Regional
Office**

Frederick K. German
Glenn Knoepfle
Richard Behal
Harry Shanis
Margaret Klucsarits
Travis Thomson
Mark Tremba

Ordering Information

The first copy of each GAO report and testimony is free. Additional copies are \$2 each. Orders should be sent to the following address, accompanied by a check or money order made out to the Superintendent of Documents, when necessary. Orders for 100 or more copies to be mailed to a single address are discounted 25 percent.

Orders by mail:

U.S. General Accounting Office
P.O. Box 6015
Gaithersburg, MD 20884-6015

or visit:

Room 1100
700 4th St. NW (corner of 4th and G Sts. NW)
U.S. General Accounting Office
Washington, DC

Orders may also be placed by calling (202) 512-6000 or by using fax number (301) 258-4066, or TDD (301) 413-0006.

Each day, GAO issues a list of newly available reports and testimony. To receive facsimile copies of the daily list or any list from the past 30 days, please call (301) 258-4097 using a touchtone phone. A recorded menu will provide information on how to obtain these lists.

**United States
General Accounting Office
Washington, D.C. 20548-0001**

**Bulk Mail
Postage & Fees Paid
GAO
Permit No. G100**

**Official Business
Penalty for Private Use \$300**

Address Correction Requested



