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Report to Congressional Requesters

February 1991

CHEMICAL WARFARE

DOD's Successful Effort to Remove U.S. Chemical Weapons From Germany

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United States
General Accounting Office
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National Security and
International Affairs Division

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February 13, 1991

The Honorable Les Aspin
Chairman, Committee on Armed Services
House of Representatives

The Honorable John Conyers, Jr.
Chairman, Committee on Government Operations
House of Representatives

As you requested, we reviewed the Department of Defense's (DOD) plans and efforts for transporting U.S. chemical weapons from the Federal Republic of Germany to Johnston Atoll for storage and eventual disposal.

Specifically, we assessed (1) whether the removal plan was based on minimal technical and operational risk and maximum public safety, (2) the costs associated with the move, (3) the impact of the move on Johnston Atoll, and (4) DOD's efforts to produce an adequate binary chemical weapons stockpile prior to the move.

Background

In May 1986, President Reagan and West German Chancellor Helmut Kohl agreed to the removal of U.S. chemical munitions from West Germany by 1992. However, in March 1989, U.S. Secretary of State James Baker announced that the United States would explore ways of expediting the removal of these munitions, and a removal goal of late 1990 was subsequently established.

When Congress agreed to the accelerated removal date, it stipulated that no fiscal year 1990 funding would be released for the munitions transfer until the Secretary of Defense certified that (1) the removal plan was based on minimal technical and operational risk and maximum public safety and (2) an adequate stockpile of binary chemical weapons would exist before the removal began. In addition, Congress limited fiscal year 1990 funding for this activity to $10 million until the Secretary of Defense certified that the Johnston Atoll Chemical Agent Disposal System was capable of destroying live chemical agents.

Results in Brief

The chemical munitions were removed from their storage site in Germany beginning on July 26, 1990, and arrived at Johnston Atoll on November 6, 1990. Our review showed that

- after extensive preparations, the retrograde transfer was conducted successfully, safely, and in accordance with DOD's overall schedule;
- retrograde costs totaled $53 million—$11 million higher than originally budgeted;
- Johnston Atoll has adequate space to safely store the munitions but not sufficient space to comply with DOD's preferred storage methods for chemical weapons; and
- the Secretary of Defense certified, as required by Congress, that an adequate stockpile of binary chemical weapons would exist before the transfer began but later determined that the planned increase in these weapons was unnecessary.

During our review we made several recommendations to improve the safety and security of the retrograde move. DOD officials were receptive to our comments and corrected or adequately addressed the issues we identified. Thus, we are not making recommendations in this report.

The results of our work are discussed more fully in appendix I.

DOD Minimized Risk During the Transfer

To minimize the risk of an accidental release of chemical agent, DOD enclosed the chemical munitions in three types of steel containers and modified the retrograde ships. DOD assessed the environmental impact of the move and used the most secure and environmentally-preferred sea route for transporting the munitions. During the move the munitions were accompanied by chemical, medical, firefighting, and security personnel and equipment.

Retrograde Preparations Resulted in Cost Overruns and Delays

Difficulties in manufacturing and repairing the steel shipping containers needed to transport the munitions both increased overall retrograde costs and threatened to jeopardize the mission schedule. DOD repaired many retrograde shipping containers to meet United Nations, North Atlantic Treaty Organization, and West German standards. DOD also encountered delays and cost overruns modifying the retrograde ships.

Container and ship modifications and repairs were completed in time for the munitions to depart from West Germany as scheduled, but retrograde costs rose from $41.9 million to $53 million, an increase of about 26 percent. This total does not include at least an additional $7.2 million paid by Germany and $1.4 million paid by DOD for retrograde container production and repair costs that were not charged to the retrograde activity.

DOD Submitted Congressionally Required Certifications

As required by Congress, the Secretary of Defense certified prior to the move that the Johnston Atoll Chemical Agent Disposal System had successfully destroyed live chemical agents, that adequate storage space was available on Johnston Atoll to safely store the retrograde munitions, and that an adequate binary chemical weapon stockpile would exist.

Storage space on Johnston Atoll is adequate to permit the safe storage of the retrograde munitions but will not be adequate to comply with DOD's preferred storage method until the Johnston Atoll Chemical Agent Disposal System generates additional storage space. DOD later determined that changing requirements eliminated the need to increase the binary chemical weapon stockpile as planned.

As requested, we did not obtain official agency comments. However, we discussed the results of our review with officials from the Chemical Retrograde Task Force, the Military Sealift Command, the Military Traffic Management Command, the U.S. Coast Guard, and the Office of the Secretary of Defense. We considered their comments as we prepared our report.

Our scope and methodology are described in appendix II.

We are sending copies of this report to the Chairmen of the Senate Committee on Armed Services and the House and Senate Committees on Appropriations; the Secretaries of Defense, the Army, the Navy, and Transportation; and the Administrator of the Environmental Protection Agency. Copies will be made available to others on request.

Please contact me on (202) 275-4141 if you or your staff have questions concerning the report. The major contributors to this report are listed in appendix III.

Richard Davis

Richard Davis
Director, Army Issues

Contents

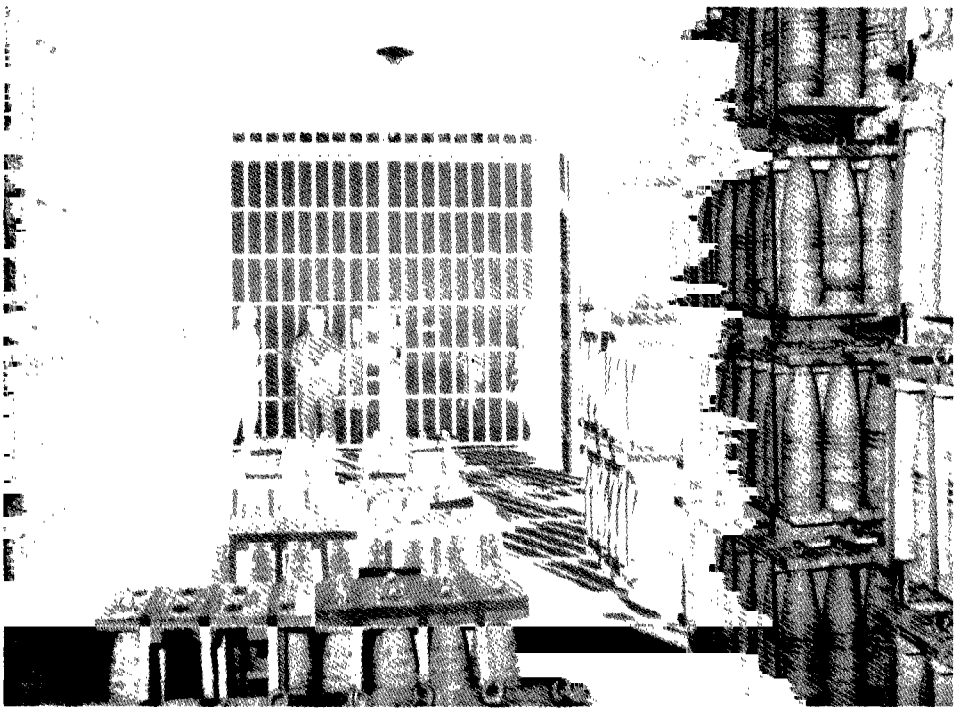
Abbreviations

DOD	Department of Defense
NATO	North Atlantic Treaty Organization

DOD Plans and Efforts for Removing Nerve Agents From Germany

The U.S. chemical weapon stockpile in the Federal Republic of Germany consisted of somewhat more than 100,000 155-millimeter and 8-inch unitary chemical artillery projectiles containing GB and VX nerve agents.[1] As shown in figure I.1, these projectiles were stored at a site near Clausen. The Department of Defense (DOD) planned to transport these projectiles in sealed steel boxes called "secondary steel containers" (see fig. I.2), which in turn were to be loaded into Army ammunition shipping containers called "MILVANs" (see fig. I.3).

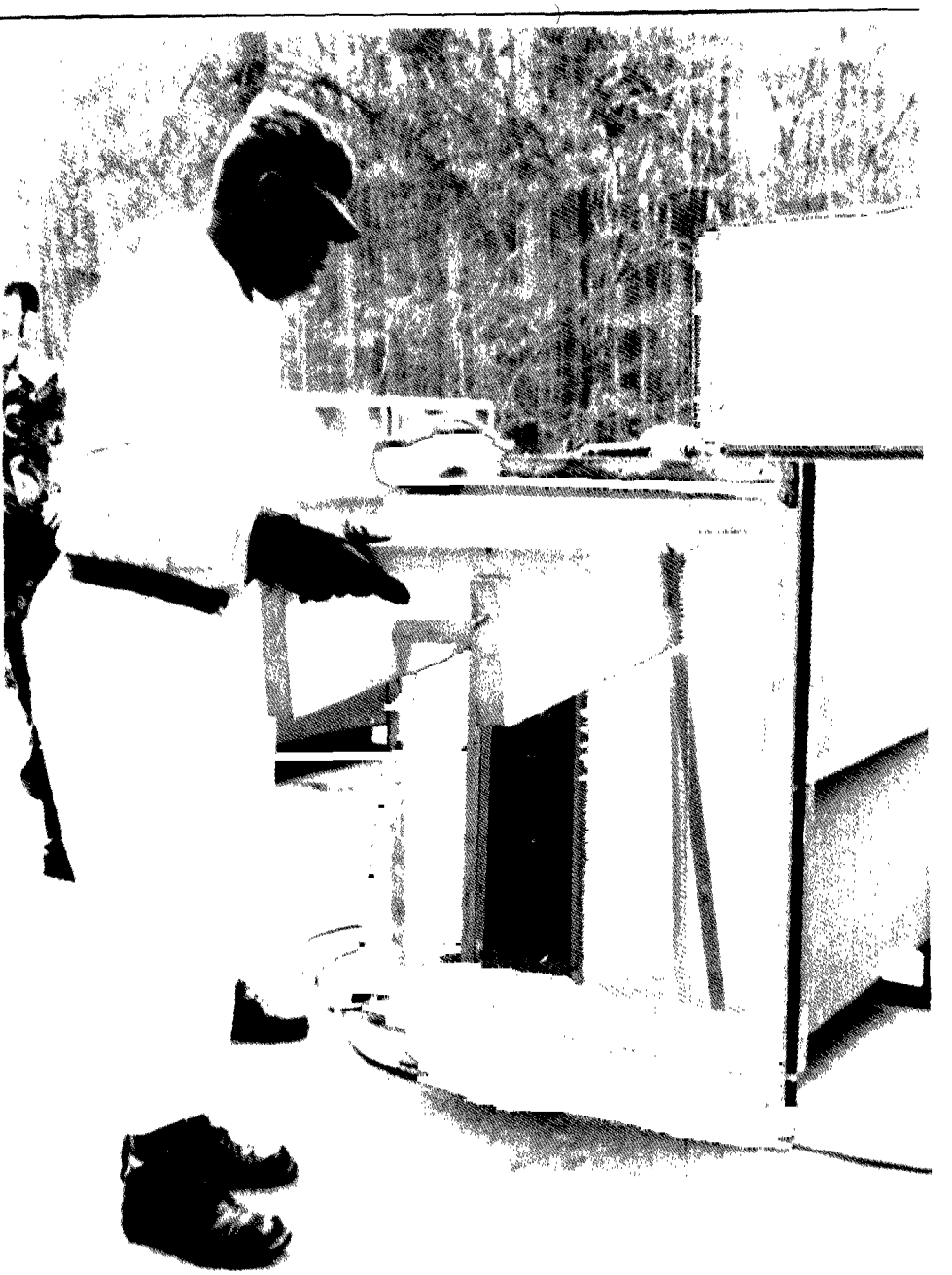
Figure I.1: Chemical Munitions in Storage Near Clausen, West Germany.



Source: U.S. Army.

[1]Both GB and VX are lethal nerve agents that disrupt the nervous system. GB, or sarin, is a volatile non-persistent gaseous nerve agent affecting victims mainly through inhalation. VX is a persistent oily liquid agent affecting victims both through inhalation and skin contact. Unitary chemical munitions are filled with nerve or other chemical agents. Binary chemical munitions contain non-lethal chemicals that mix to form lethal chemical agent only after the munition has been launched and is en route to its target.

Figure I.2: Chemical Artillery Projectiles Being Loaded Into a Secondary Steel Container.



Source: U.S. Army.

Figure I.3: Army Personnel Loading and Bracing Secondary Steel Containers in MILVANs.

Source: U.S. Army.

The retrograde activity involved transport by truck, train, and ship. DOD planned to transport the loaded MILVANs by truck from the storage site near Clausen to the U.S. Army depot at Miesau, West Germany. From there DOD arranged to ship them by rail to the port of Nordenham, West Germany. Two Military Sealift Command ships were tasked with moving the chemical weapons from Nordenham to Johnston Atoll, in the Pacific Ocean about 700 nautical miles southwest of Hawaii. They were to be stored there as part of the U.S. chemical stockpile awaiting disposal.

Many U.S. government agencies participated in the retrograde activity. The U.S. Army, DOD's primary executive agent for planning the move, established the Chemical Retrograde Task Force to coordinate the move. Headquarters, U.S. Army, Europe planned and carried out the move in Germany, and the U.S. Army Western Command (now renamed the U.S. Army Pacific Command) planned and managed the retrograde activities on Johnston Atoll. The U.S. Navy's Military Sealift Command coordinated the sealift phase of the retrograde activity and worked with the Department of Transportation's Maritime Administration to activate and modify the two Ready Reserve Fleet ships used for the mission.

In addition, the Army's Armament, Munitions and Chemical Command designed the secondary steel containers; the Military Traffic Management Command provided and repaired retrograde MILVANs; the Naval Surface Weapons Center designed personnel protection systems on board the ships; and the Army's Chemical Research, Development and Engineering Center designed chemical agent monitoring systems. Naval escort was provided for the retrograde ships by the U.S. Navy's Atlantic and Pacific Commands.

Retrograde Chemical Munitions Were Transported Safely to Johnston Atoll

The movement of the retrograde chemical munitions from Germany to Johnston Atoll was conducted safely, on schedule, and without incident.

As scheduled, truck convoys moved the chemical munitions from Clausen to the Miesau Army Depot from July 26 to September 1, 1990. Special trains then moved these munitions from Miesau to Nordenham from September 12 through 19, 1990. The ships departed West Germany on September 22, arrived at Johnston Atoll on November 6, and were unloaded by November 18, 1990.

U.S. armed forces personnel, civilian contractors, and West German police and military personnel provided security, chemical agent monitoring, and medical and firefighting equipment and services for the truck and rail movements. Army personnel provided security on board the retrograde ships, and a U.S. Navy guided missile cruiser escorted these ships at sea. No significant security incidents occurred during the move.

The ships sailed non-stop from Nordenham to Johnston Atoll by the Cape Horn route around South America. The ships were refueled at sea three times during the voyage. Army officials told us that no chemical agents leaked during the move.

Special Containers Improved Retrograde Safety but Increased Costs

DOD, in producing the secondary steel containers, encountered several problems that increased costs by at least $7.2 million and threatened to jeopardize the mission schedule until the West German government agreed to pay these costs. An additional $1.4 million was required to repair retrograde MILVANs so they would meet minimum international safety and serviceability standards.

Special Containers Improve Retrograde Safety

The Army used three types of steel containers for removing its chemical munitions from Germany. Pallets of chemical artillery projectiles were first loaded into the specially designed vapor-proof secondary steel containers, which were then loaded into the MILVANs. Each MILVAN could hold up to 10 secondary steel containers, and both types of containers were equipped with monitoring ports that enabled interior testing for the leakage of chemical agents while keeping the containers closed.

Army officials told us that none of the retrograde projectiles were leaking chemical agent. However, the Army had previously determined that some of the retrograde projectiles were unserviceable and that some of these had potential for leaking. All the unserviceable projectiles were enclosed in steel, vapor-proof single-round containers. These were placed in separate secondary steel containers and MILVANs for the move.

Secondary Steel Containers Encountered Production and Funding Difficulties

The secondary steel containers were designed by the U.S. Army Defense Ammunition Center and School at Savannah, Illinois, but manufactured by a U.S. government-owned, German contractor operation at the U.S. Mainz Army Depot in Mainz, West Germany. The Army contracted for the production of 5,680 containers by May 31, 1990, for a total cost of about $6.7 million.

Army testing of the secondary steel container design appeared thorough and successful. Stringent fire, explosion, drop, rail impact, vertical movement, seaworthiness, and pressurization tests involving secondary steel containers were successfully passed.

The production and funding of secondary steel containers were more problematic. A total of 18 Army design changes, improvements, or modifications resulted in 57 production changes in Germany and various production problems, delays, and increased costs. For example, the original plans called for different materials and thicknesses of steel than were locally available in Germany. Bolts for the secondary steel container doors were not delivered as scheduled, and the rubber gaskets intended for these doors had to be replaced. Substitute gaskets and bolts were installed until suitable ones were received. A misunderstanding between the Army and the contractor regarding door flange specifications also resulted in 1,570 containers failing their acceptance tests and many requiring rework because they might not have been airtight.

A more serious problem occurred when secondary steel container production, already behind schedule, was temporarily terminated in April 1990. The German contractor stopped producing the containers when DOD ran out of funding after paying $6.4 million of the then-estimated $12.4 million cost. DOD was unable to provide the contractor with additional funding because of the congressional limitation on the amount of fiscal year 1990 retrograde funding that could be expended before the Johnston Atoll Chemical Agent Disposal System successfully demonstrated its ability to destroy live chemical agents.

Secondary steel container production resumed during May 1990 when the West German government agreed to fund the work needed to finish the remaining containers. Container delivery was completed on August 22, 1990, 13 days before the last projectiles were scheduled to leave Clausen and 28 days before the retrograde ships were scheduled to leave Germany. Throughout the production period, design changes and modifications, currency fluctuations, and increased labor and material costs increased the total cost of the secondary steel containers to $13.6 million, twice the original estimate of $6.8 million.

Army MILVANs Required Extensive Repairs

The Army planned to identify and use 600 of its best MILVANs for the retrograde activity. However, most of the Army's MILVAN fleet did not meet minimum international safety standards. As a result, DOD decided to repair retrograde MILVANs as needed to meet international standards, thus incurring additional retrograde costs.

The International Maritime Organization, a United Nations organization composed of member nation representatives, sets international maritime standards and addresses international maritime issues. This organization established the International Maritime Dangerous Goods Code, which sets safety and serviceability standards for maritime freight containers used to ship dangerous goods such as munitions. The North Atlantic Treaty Organization (NATO) has adopted safety standards affecting the use of munitions containers in host countries identical to those in the code, and West German law also requires that maritime containers used there meet these standards.

The U.S. Coast Guard is responsible for ensuring the safety of maritime cargo containers used in the United States and for administering compliance with related international standards. However, the Coast Guard has exempted DOD from the international ammunition container standards for MILVANs since 1977. A Coast Guard official told us these

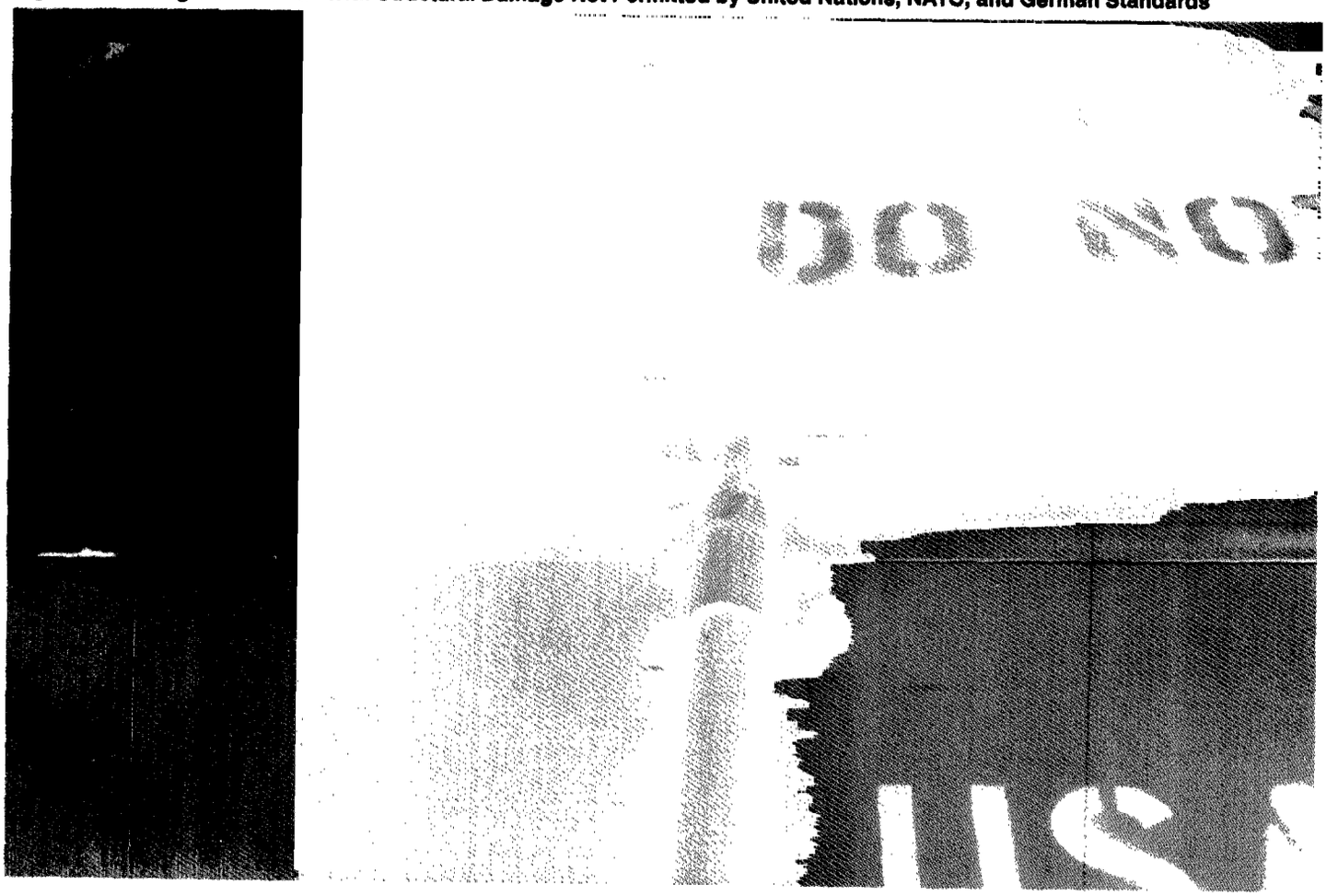
exemptions were granted because DOD had a standardized container inspection program, ammunition MILVANs were structurally stronger than commercial containers, and the Coast Guard had decided to allow DOD time to refurbish aging MILVANs or purchase new ones.

By early 1990, at least 80 percent of the Army's fleet of about 4,200 ammunition MILVANs either had structural defects or had been repaired in ways that prevented them from meeting the international standards set by the code. Only about 250 ammunition MILVANs were relatively new. The others had been in service since the early 1970s and, according to a Coast Guard official, were nearing the end of their service life.

In October 1989, the Coast Guard informed DOD of its concern over the use of these MILVANs for the removal of chemical weapons from Germany, as well as of its intention to reconsider any MILVAN exemptions from the code. A Coast Guard official told us that this action was the result of concerns regarding the use of MILVANs for the retrograde activity and the little effort by DOD to upgrade the MILVAN fleet since exemptions were first allowed in 1977. DOD responded in early February 1990 with a request that MILVANs continue to be exempted until 1998 to allow time for refurbishment and the purchase of new MILVANs.

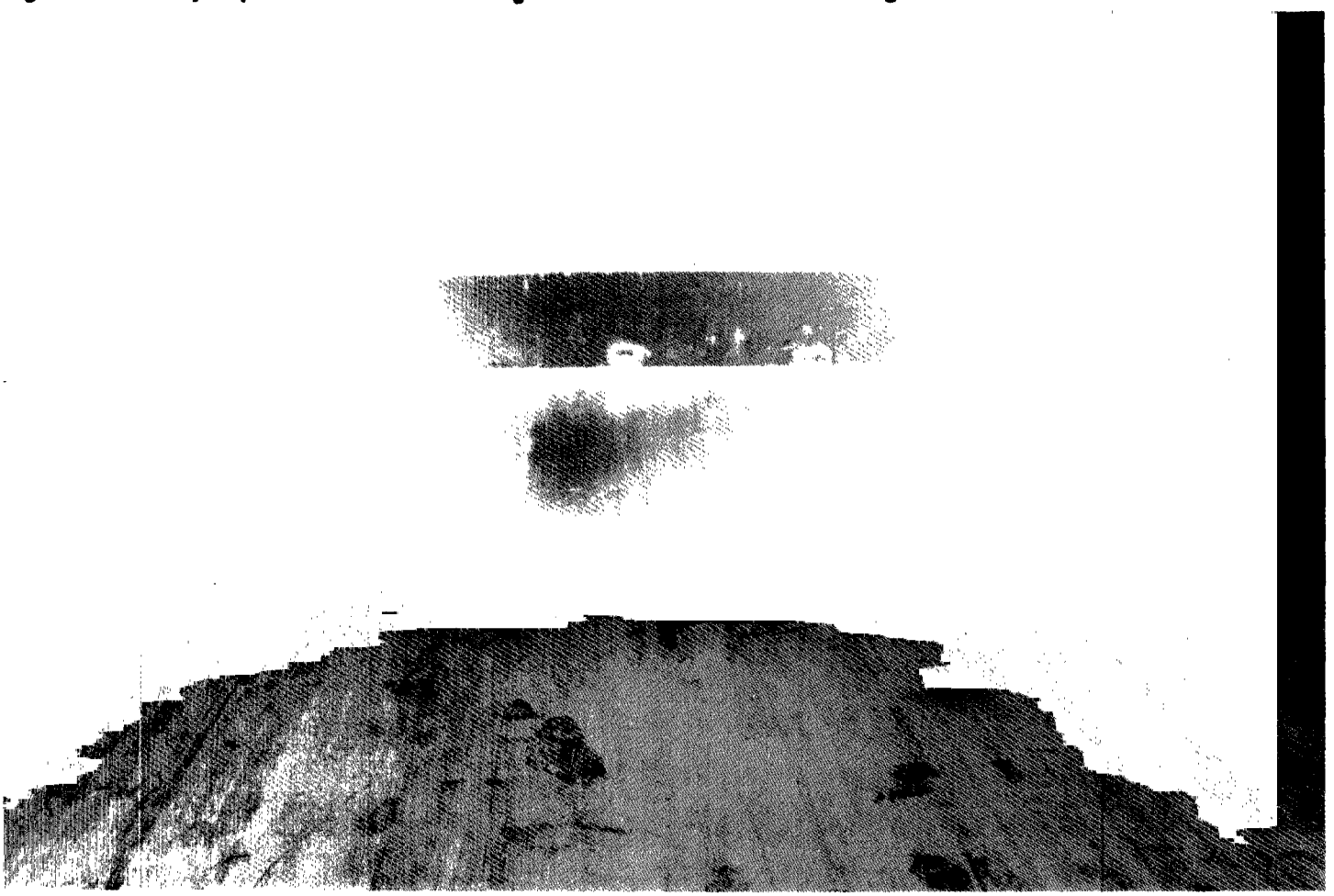
During our visit to the Military Ocean Terminal at Sunny Point, North Carolina, in late January 1990, Army officials told us that while MILVANs were inspected according to DOD standards and considered safe for munitions shipments, 90 percent of them did not meet the international standards set by the International Maritime Dangerous Goods Code. We observed that many of the retrograde MILVANs had considerable exterior damage and rust and that the roof of one MILVAN that had recently passed Army inspection and certification had rusted through and was leaking rainwater on the container floor (see figs. I.4 and I.5). This occurred because Army MILVAN inspection procedures for certification at Sunny Point included interior visual inspection, but not exterior visual inspection, of MILVAN roofs. Exterior roof inspection would have revealed rust spots on the verge of rusting through. Army MILVAN inspection and certification procedures we observed in Germany also did not include adequate roof inspection. We subsequently recommended that the Army modify these procedures to include exterior roof inspection. Army officials revised the procedures shortly thereafter.

Figure I.4: Retrograde MILVAN With Structural Damage Not Permitted by United Nations, NATO, and German Standards



Source: U.S. Army.

Figure I.5: Recently Inspected and Certified Retrograde MILVAN With Rainwater Leakage From Holes in Its Roof



Source: U.S. Army.

We subsequently informed retrograde task force officials of our concerns regarding the discrepancy between DOD and international standards. We noted that while MILVANs conformed to DOD and Coast Guard requirements, they failed to conform to the International Maritime Dangerous Goods Code, NATO standards, and West German law for not only hazardous chemical munitions but for all types of conventional munitions shipments.

DOD decided later in February 1990 that MILVANs used for the retrograde move would meet the international standards. Six Army facilities in West Germany subsequently refurbished 315 retrograde MILVANs.

These repairs cost a total of $1.4 million, an average of approximately $4,400 per MILVAN repaired. New MILVANs cost approximately $10,800 each.

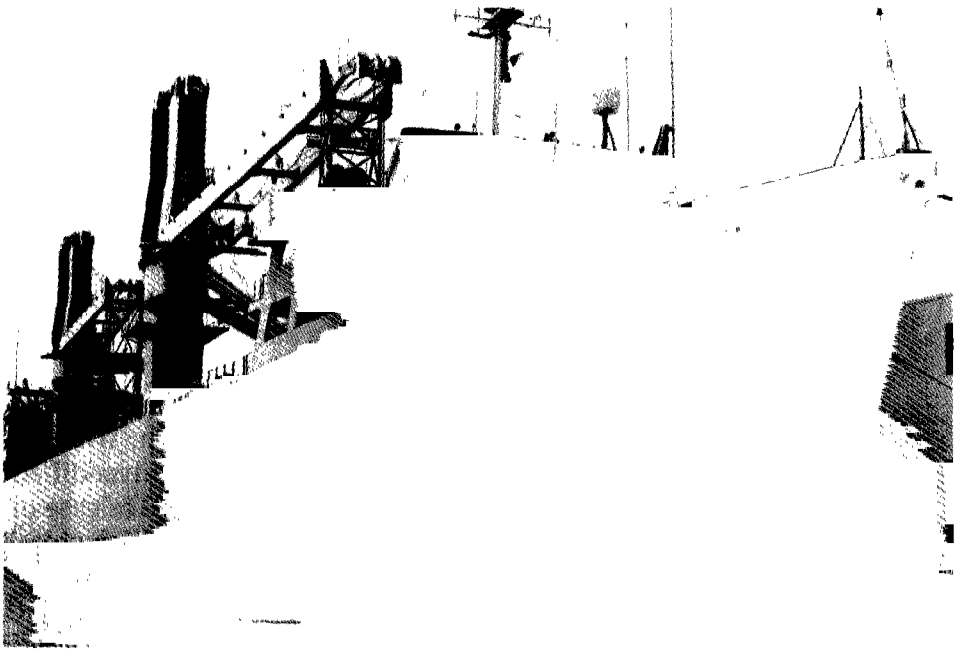
The Coast Guard notified DOD in April 1990 that MILVANs would not be exempted from the standards for transporting hazardous munitions such as chemical weapons after August 1, 1990. However, the Coast Guard again extended MILVAN exemptions from the standards for other types of munitions until 1995. The Coast Guard also noted that these exemptions had only domestic authority and might not be acceptable in other countries.

Ready Reserve Fleet Ships Were Specially Modified for Retrograde Activities

For the sea portion of the transfer, DOD selected two ships from the Ready Reserve Fleet and modified them to ensure crew safety, reduce the risk of an accidental release of chemical agent, and otherwise facilitate the movement of the chemical munitions to Johnston Atoll.

DOD used two container ships for the retrograde activity, the S.S. Gopher State and the S.S. Flickertail State (see fig. I.6). DOD chose these ships primarily because they (1) had self-supporting cranes that would enable them to unload their cargo at Johnston Atoll, (2) had sufficient cargo space below deck to accommodate the munitions and separate them by type of nerve agent, and (3) could be modified to accommodate other safety and operational equipment identified as needed for the transfer.

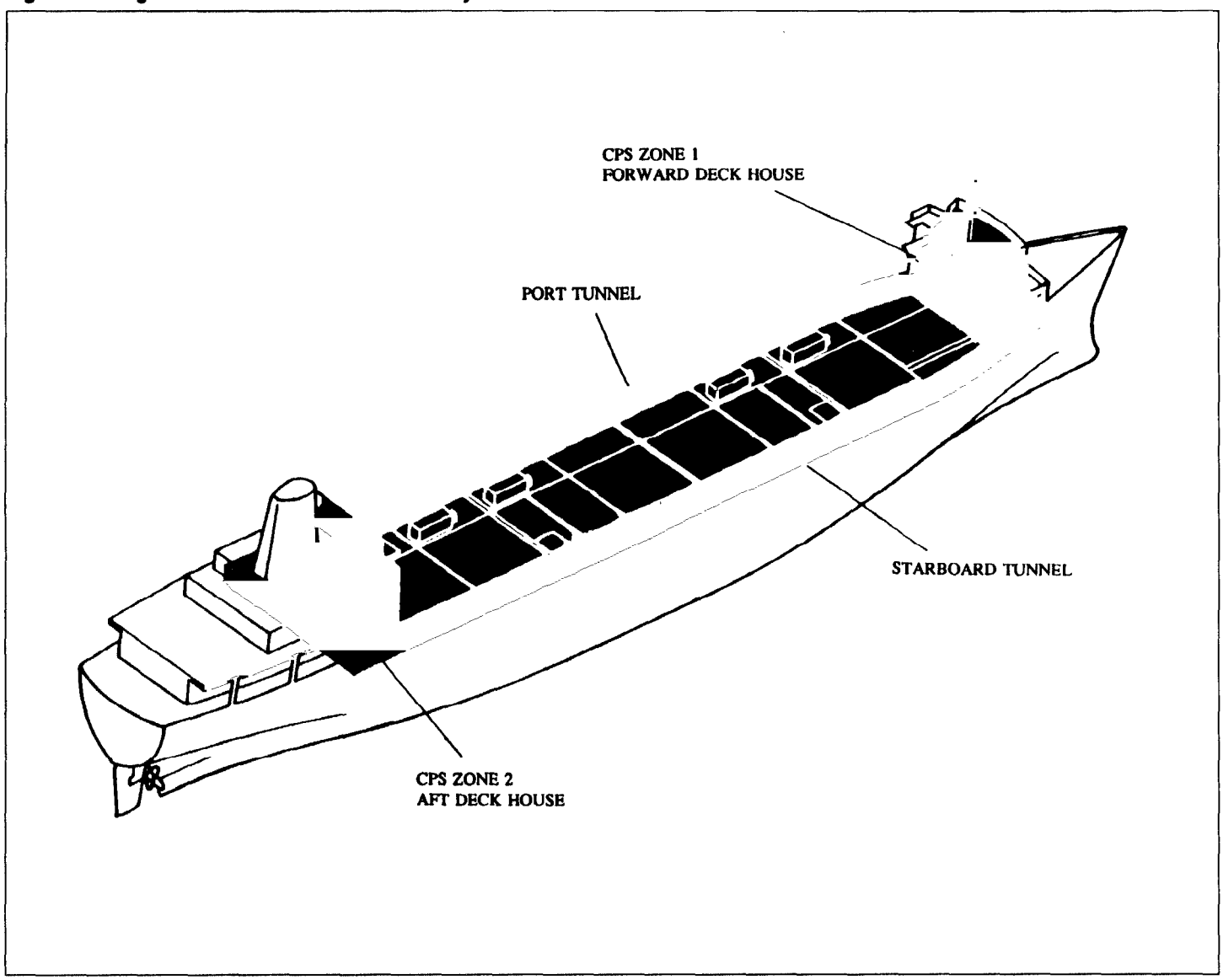
Figure I.6: S.S. Flickertail State



To monitor the cargo, the ships were equipped with three different systems for testing the atmosphere for the presence of chemical agents. These systems used special ventilation equipment, various air sampling devices, and on-board laboratories for sample analysis. The ship holds and hatch covers were modified to be airtight. Empty containers were loaded along the sides of the cargo holds, thus providing a buffer zone to protect the cargo in the event of a collision and to prevent the cargo from shifting during rough seas.

The ships were also outfitted with collective protection systems that provided a constant flow of clean filtered air to the crew accommodations and most working areas (see fig. I.7). This protected these areas from contamination in the event of an accidental release of chemical agents. Other safety modifications included decontamination stations and upgrades to the ships' medical facilities and firefighting/damage control systems.

Figure I.7: Diagram of the Collective Protection System



Operational modifications included upgraded communications equipment and facilities and the installation of fueling stations. The fueling stations enabled the two ships to refuel at sea and thus sail non-stop from Germany to Johnston Atoll. Their ability to stay at sea both eliminated security problems that would have accompanied the need to stop

at ports en route and removed the potential for exposing densely populated areas to harmful nerve agents in the event of an accident or terrorist incident. The additional communications equipment permitted secure and non-secure radio communication between the retrograde ships, the escort vessel, and various DOD commands in Washington, D.C., and at other locations.

DOD and the Maritime Administration activated and modified the ships largely as planned. Congressional funding restrictions prevented the Maritime Administration from awarding the ships' activation contracts according to plan and contributed to compressed shipyard work schedules. This and unanticipated maintenance and repairs to the ships' engines, hardware, and other mechanical equipment resulted in increased costs. Despite funding problems and various shipyard delays, shipyard modifications and other preparations were essentially completed in time for the ships' operational tests in mid-August 1990.

Retrograde ship personnel were required to attend special training in firefighting, damage control, chemical response, and refueling at sea. The training was specifically designed to prepare these personnel for the retrograde operation.

We observed the operational testing at sea and evaluated DOD's preparations for this part of the mission. We found that the retrograde ships and personnel were generally well prepared for the move. However, we noted several problems that needed to be addressed prior to the ships' departure from Germany. For example, the air-monitoring and collective protection systems were not fully operative during the tests because of improper equipment installation and other problems. The ships' mechanical equipment also experienced some problems. However, according to Military Sealift Command officials and the ships' engineering officers, these problems were no more extensive than those normally expected for a recently reactivated Ready Reserve Fleet vessel. In addition, some important medical, damage control, and communications equipment had not yet been placed aboard the ships.

Underway refueling was practiced during these tests until the crews on both ships developed proficiency at this task. However, the drills revealed design problems with the roller device installed on these ships to hoist and guide the fuel hose on deck. The rollers tended to bind and seize the fuel hose as it was being winched on deck (see figs. I.8 and I.9).

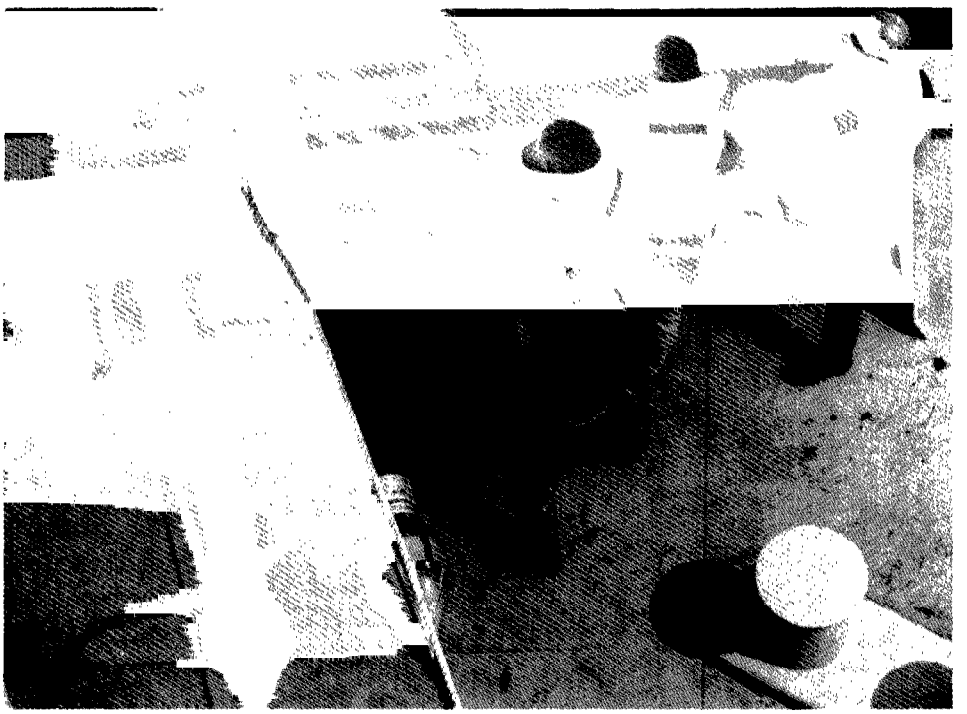


Figure I.8: S.S. Flickertail State Crew Hoisting Refueling Hose Aboard During Training at Sea

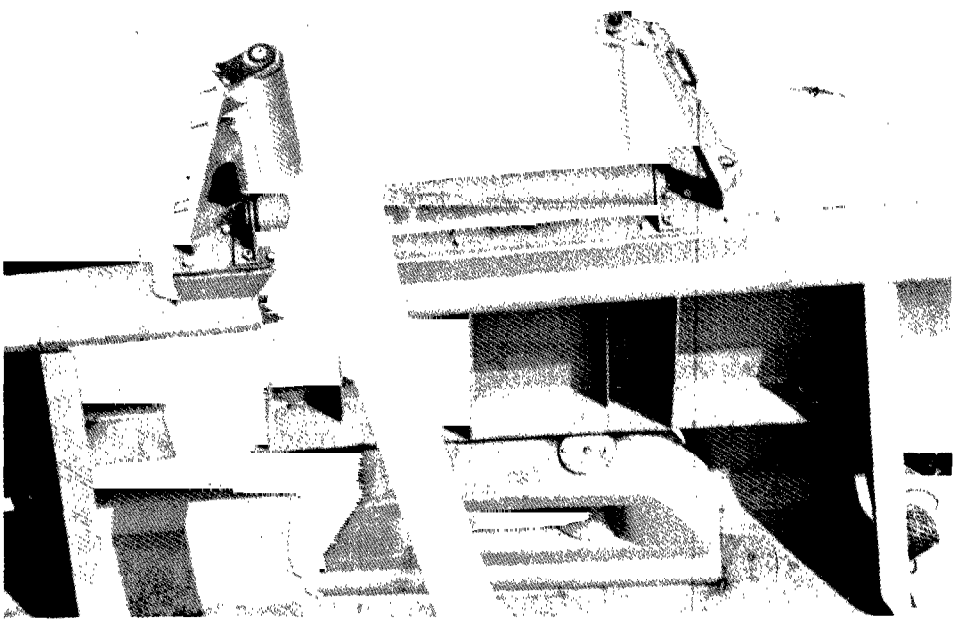


Figure I.9: Roller Bar Assembly Binding a Fuel Hose During Operational Tests

We briefed DOD officials regarding our observations and suggestions at the conclusion of the operational tests. DOD had already begun to address many of the problems we noted and assured us that the remainder would be addressed.

Prior to the ships' departure from Norfolk we confirmed that all the problems we identified during the operational tests were corrected or adequately addressed, with the exception of the air-monitoring system and some missing damage control equipment and uncompleted exercises. DOD officials told us that all these problems, except some of the missing damage control equipment, were corrected prior to the ships' departure from Germany.

One week before the ships were scheduled to depart from West Germany, we informed DOD officials of our concern that changes to the escort vessel rules of engagement being considered by DOD had not yet been adopted. DOD adopted the proposed changes shortly before the ships' departure. We also recommended that DOD improve the ability of the retrograde ship security teams to defend against a potential heliborne terrorist attack. DOD officials declined to make these changes, preferring instead to rely almost entirely on the defensive capabilities of the escort vessel to defend against these threats. We recommended other security changes that were considered and adopted by DOD.

Environmental Impact Studies Met Mandated Requirements

As required by law, DOD prepared an environmental impact statement assessing the environmental risks of storing and destroying the retrograde chemical munitions at Johnston Atoll. DOD also prepared a Global Commons Environmental Assessment addressing the environmental impact of the move on territories outside the United States, primarily the bodies of water and land masses in the vicinity of possible sea routes. These statements were challenged in a U.S. district court by environmental groups attempting to halt the chemical retrograde. However, the court found in favor of DOD.

Retrograde Costs Exceeded Budget by 26 Percent

Retrograde activity costs totaled about $53 million, or about 26 percent higher than originally estimated and budgeted. The increases were generally spread over many activities involved with the retrograde mission and did not include some container production and repair costs.

Retrograde expenditures were originally expected to total approximately $41.9 million, including $12.2 million spent in fiscal year 1989, $27.6 million appropriated for fiscal year 1990, and an anticipated

$2.1 million for fiscal year 1991. However, unanticipated requirements and expenditures to ensure the move's safety and security resulted in cost increases of about $11 million. The total cost also did not include an additional $1.4 million paid by the Military Traffic Management Command for MILVAN repairs or $7.2 million paid by the Federal Republic of Germany to expedite and complete the production of secondary steel containers.

Chemical Munitions Storage at Johnston Atoll Is Safe but Does Not Meet the Army's Preferred Guidelines

The Secretary of Defense certified in July 1990 that adequate space was available on Johnston Atoll to safely store the retrograde munitions. While DOD has determined that the Army's plans for storing these munitions are safe, there is inadequate storage space on Johnston Atoll at the present time to store them in accordance with DOD's preferred standards.

The U.S. Army Defense Ammunition Center and School issues guidance on the preferred methods for storing munitions. According to Army officials, while this constitutes the Army's guidance for how munitions should be stored, it is not a regulation and therefore does not require compliance by Army facilities storing munitions. However, these facilities are inspected by the Army Safety Office and the DOD Explosives Safety Board to ensure that the storage methods used are acceptable and safe.

The Army planned to store all the retrograde munitions on Johnston Atoll in igloo-type chemical munitions storage magazines. Although Johnston Atoll normally stores munitions according to the preferred standards, it planned to store the retrograde chemical munitions in closely packed configurations that did not provide for the easy access, visual inspection, and lot separation recommended by the preferred standards.

The Army planned to store the munitions in this fashion because most of the Johnston Atoll igloos were already filled with obsolete chemical munitions awaiting destruction, thus leaving inadequate igloo space to store the retrograde munitions in accordance with the preferred standards. The Army planned to reconfigure the storage patterns to be more in accordance with the standards as the Johnston Atoll Chemical Agent Disposal System made more igloo space available through disposal of the obsolete chemical munitions. Both the Army Safety Office and the DOD Explosives Safety Board determined that planned methods for storing the retrograde munitions at Johnston Atoll were safe.

We reviewed the Army's storage plans and suggested changes that would allow an earlier, improved level of compliance with DOD's preferred standards. In refining its storage plans, the Army made changes similar to those we suggested.

Binary Stockpile Requirements Were Reduced

The Secretary of Defense certified that the United States would have an adequate stockpile of binary chemical weapons before the retrograde transfer began. Army officials told us that DOD had determined that the certification was based on the expectation that the production rate of binary chemical artillery rounds would double the number of completed binary rounds by the time of the move. However, several problems with binary round production prevented the expected increase. Army officials then told us that the existing binary chemical weapon stockpile was adequate because of the changing political situation in Europe and expectations of a U.S.-Soviet bilateral treaty agreement on chemical weapons.

Scope and Methodology

We assessed and monitored the status of DOD's preparations for the retrograde movement and monitored the move as it took place. We also monitored the status of the binary chemical weapon stockpile.

To conduct our review, we interviewed officials, reviewed documents, and received briefings during visits to the Army's Chemical Retrograde Task Force, Ft. Belvoir, Virginia; Headquarters, U.S. European Command, Stuttgart, West Germany; Headquarters, U.S. Army, Europe, Heidelberg, West Germany; the 21st Theater Army Area Command, Kaiserslautern, West Germany; Chemical Research, Development, and Engineering Center, Edgewood, Maryland; Office of the Program Manager for Chemical Demilitarization, Edgewood, Maryland; Office of the Program Manager for Binary Munitions, Edgewood, Maryland; and Army Safety Office, Washington, D.C. We conducted telephone interviews with Army chemical weapons storage personnel on Johnston Atoll.

We also performed work at the Military Sealift Command, Washington, D.C.; the Military Traffic Management Command, Falls Church, Virginia, and Bremerhaven, West Germany; the U.S. Navy Atlantic Command, Norfolk, Virginia; the Maritime Administration, Department of Transportation, Washington, D.C.; U.S. Coast Guard Headquarters, Washington, D.C.; and the Environmental Protection Agency, Washington, D.C.

In Europe we reviewed container production and testing at the Mainz Army Depot, Mainz, West Germany, and observed site preparations and training exercises at the chemical munitions storage site near Clausen, the Miesau Army Depot railhead, and at the Midgard shipping terminal in Nordenham, West Germany. In the United States we observed MILVAN operations at the Military Traffic Management Command's Military Ocean Terminal, Sunny Point, North Carolina; ship activation and modification work at the Bethlehem Steel shipyard, Baltimore, Maryland; retrograde ship handling instruction at Marine Safety International, Middletown, Rhode Island; and retrograde firefighting, damage control, and chemical response training in Freehold, New Jersey. We also attended retrograde ship operational readiness inspections during their pre-voyage exercises in the Atlantic Ocean near Norfolk, Virginia.

We performed our work from November 1989 to December 1990 in accordance with generally accepted government auditing standards.

Major Contributors to This Report

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